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Theme: Technology, Teaching and Learning: Theory and Practice

July 10-12, 2013
Nairobi, Kenya

Editors

Dr. Adelheid Bwire
Ms. Inviolata Sore
Prof. Joanna Masingila
Prof. Henry Ayot

KENYATTA UNIVERSITY

SYRACUSE UNIVERSITY

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Preface

Kenyatta University and Syracuse University have had an institutional linkage since 2000. This conference is one of the activities sponsored through the Kenyatta University-Syracuse University partnership.

These proceedings are a written record of the research presented at the International Conference on Education held July 10-12, 2013 at the Kenyatta University Conference Center, Nairobi, Kenya. The theme of the conference, *Technology, Teaching and Learning: Theory and Practice*, focuses on an important set of opportunities for technology to be useful in improving teaching and learning. Keynote addresses were given by Prof. Alan Foley and Mr. John Temba.

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EMERGING TRENDS IN ICTS FOR EDUCATION IN AFRICA: CHALLENGES AND OPPORTUNITIES

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Habari! It is an honor to be here for the 3rd International Conference on Education here at Kenyatta University. Before I begin with my comments, I would like to acknowledge and thank Vice Chancellor Mugenda for being here and inaugurating this conference, and the Permanent Secretary. I would also like to thank the conference organising committee for the invitation to give this keynote address.

This is my third visit to Kenya; I had never been to Africa or Kenya before my first trip in June 2012. I'm not sure I can express how transformational these visits have been for me both personally and professionally. I have had the opportunity to meet educators and students who have helped me understand the challenges facing education not just in Africa, but globally. I have had the chance meet new colleagues and develop what I hope are long and fruitful collaborations!

For these opportunities, I would be remiss not to thank Professor Joanna Masingila. She was instrumental in establishing the linkage between SU and KU, and I think it is safe to say without her continuing efforts, we would not be gathered here today. I am honored to consider her a colleague, friend, and mentor. Thank you, Prof!

A bit about me: I am an educational technology generalist. I began my career as a secondary English teacher but became involved in educational technology in the mid 1990s. I was active in web development in the early days of the WWW. I made the switch from analog to digital video editing, developed and refined assistive technology, and have been active in work in emergence of mobile and handheld computing for learning.

I have spent much of my career focusing on issues related to disability and technology accessibility - this is work tied to my personal life having a blind family member. It was work tied to my interest in issues of social justice and equity and it gave me a place to engage in progressive work.

I believe we are at a notable point in history - The potential of technology to connect people and provide access to education has never been greater or more rapidly changing. That said I should offer a blanket disclaimer that technology is not the answer to every problem, that merely placing ICTs in schools will not correct long-standing structural issues - poverty, inequality, political conflict, etc.

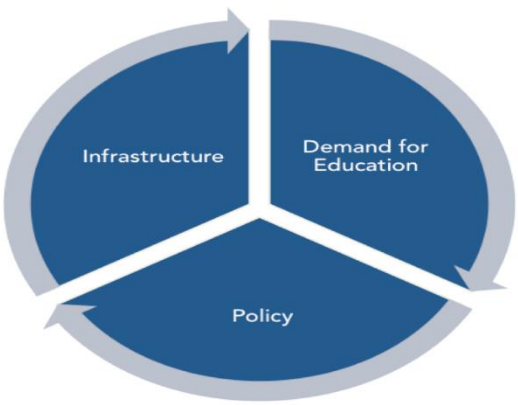
> **"The future is already here — it's just not very evenly distributed."**
> **- William Gibson**

David Attewell (2001) identifies two digital divides. The "first" digital divide is access to technology. The "second" digital divide involves the disparities in technology use across individual and cultural difference - how technology is being used.

The potential of technology to connect people and provide access to education has never been greater or more rapidly changing. Developments in emerging technologies have created possibilities for highly customized digital environments that allow greater access by more people than ever before. Similarly, the processes for developing and distributing new innovations has also been streamlined, resulting in more broadly available innovations and the ability for small developers and individuals to widely distribute their work. These technological innovations create both challenges and opportunities for educators at all levels.

Three Emerging Trends and Three Broad Challenges

I want to discuss three emerging trends in ICTs for Education: mobile and tablet computing, cloud computing, and open content, and situate them within the African context. These are not the only emerging technologies with potential to have impact on ICTs in education (there are others like solar charging, wireless grid, 3D printing, etc.), but these three individually and collectively can impact many of the challenges facing education in Africa.



I want to discuss these emerging technologies in light of several broad challenges in ICT in education that I see — Infrastructure, Demand for Education, Policy. I begin with these challenges to help contextualize mobile and tablet computing, cloud computing, and open content. I will also give examples based on work we have been doing in Kenya — work with faculty in the Department of Educational Communication and Technology at Kenyatta University - workshops and research over the last year, students with visual impairments at KU, and Thika and Kibos Schools for the Blind. These are interrelated at some point as well - infrastructure affects capacity to meet demand, policy affects infrastructure, and demand affects policy (and many other effect combinations).

Demand for Education

Over the past twenty years most countries, particularly developing countries, have seen a large increase in the number of students seeking higher education. This phenomenon has been called the massification of higher education and has occurred globally (Mohamedbhai, 2008). A consequence of this growth is increasing pressure on teaching staff and institutions, usually resulting in, among other effects, increased class size. Large classes of between 300 and 1,000, and even more, at the undergraduate level are not uncommon in a number of countries (Mulryan-Kyne, 2010).

Large classes are often perceived as one of the major obstacles to the attainment of quality education. Biggs (1999) observed that the practical problems faced by students and instructors increase and change in nature as class size increases. Researchers have found that student motivation, perceived learning and teacher sensitivity are factors commonly affected by large classes. Large classes inhibit students' opportunities to receive feedback and interaction with other students and teachers. Carbone and Greenberg (1998) found a general dissatisfaction among students related to large classes. Despite the difficulties associated with teaching and learning in large classes, they remain a reality in many countries affecting learners across all levels of the education system and are often the only perceived option available to meet growing demand for higher education in Sub-Saharan Africa (SSA) (Mohamedbhai, 2008).

The notion of large classes is paradoxical in the context of a networked and "flat" (Friedman, 2007) world because many of the reasons that make sense for large classes in the immediate African context are at odds with an increasingly global job market. This is an industrial model of instruction that is possibly already obsolete in the world economy, and this raises questions such as: Does large class pedagogy (LCP) de-emphasize critical thinking and problem solving that are advocated in models of 21st century skills, and what is the trade-off between the quantity of students served in large class contexts versus the quality of education they receive? At a curricular level, are there points where large classes make more sense than others? In the United States' model of higher education, large classes are typically lower-level undergraduate courses; general education classes and more advanced classes tend to be smaller, providing opportunities for more engaged models of learning.

Hornsby and Osman (2012, personal communication) note that there is increasing pressure in many countries to enroll as many students as possible in tertiary education. This is because of the clear link between tertiary education, health, empowerment and economic development. Bloom et al. (2005) argue that tertiary education can lead to both private and public benefits for a country. Private benefits are seen in the rise in employment prospects, incomes and ability to invest and save money. This leads to improving productivity since tertiary education is tied to overall better health and longer life expectancies.

In a recent paper (Foley & Masingila, 2013), Professor Masingila and I contend that the paradoxes of delivering large classes can be confronted, and in many ways diminished, through the use of current and emerging technologies some of which I will be discussing today.

At the same time, the introduction of free public education in Kenya is increasing demand for teachers, and access to education.

Policy

The policies that drive the selection and implementation of ICTs in schools are both opportunities and challenges. In the lead-up to this year's elections in Kenya, Uhuru Kenyatta promised free laptops to school-going children, beginning next year. Is this a laptop or a tablet? The distinction is increasingly vague.

While politically popular, these types of promises (and this type of rhetoric is not unique to Kenya, or Africa) are often divorced from the practical realities of schools, teachers, and students. In the US, the map is littered with failed projects that placed a number of computers in schools without adequate teacher training, technical and logistic support, and related infrastructure. Is a laptop the best technology to use in this classroom?

Infrastructure

Leveraging technology to facilitate LCP requires instructors comfortable with technology and infrastructure to support the integration of technology into their teaching practice. Physical spaces used for LCP require permanent and reliable infrastructure such as Internet access, projector(s), and audio amplification. Instructors using these spaces need to be trained on the use and troubleshooting of these spaces and need to be able to rely on consistent and easily accessed technology support in case something is not working properly.

We believe it is possible and probably beneficial for educational institutions at all levels in Africa to leapfrog Western institutions by not creating large, complex wired networks and instead focus on developing wireless and mobile capacity on their campuses.

During professional development workshops at Kenyatta University, we discovered that accessing the Internet via mobile data networks using USB modems was much faster than trying to use the campus wired network. We originally planned to set up a wireless router and connect it to the campus network; however, the campus network could not support this.

Another issue we encountered while conducting these workshops was that there was not a ready supply of spare parts and peripherals on hand. One byproduct of increased and sustained technology use is a stockpile of spare parts and other resources – things taken from broken computers or outmoded technology. In many U.S. universities, items such as computer speakers are a commodity. They often come with the computer and when the computer is replaced the speakers are set aside and usually not needed because a new set comes with a new computer.

The challenge we observed at Kenyatta University is that the university is yet to develop technology logistics. In this sense, logistics means the procedures, activities, or organizational systems that make the technology work to meet particular goals and agendas. Many of these technology logistics are fairly bureaucratic – institutional processes for checking in and checking out equipment, and for managing equipment. These processes are important if an institution is going to provide consistent and reliable technology infrastructure. Instructors need to be able to rely on the fact that some technology will be available when they enter a classroom, that it will be functional, and that there is a mechanism for getting assistance when needed.

Another important area is infrastructure to support learners with disabilities. This is the special needs technology room at KU - a very nice setup, and nicer than the one at my home university. There are machines with screen readers installed …

and tools for low-vision users.

However, some of these tools are not the most portable or unobtrusive to use,

which is why mobile is such an innovation.

Mobile and Tablet Computing

Globally, mobile network covers more territory than the electrical grid (Johnson, Smith, Levine, & Haywood, 2010). Approximately half of Africa’s one billion people are not connected to an electrical grid (Zachary, 2009), yet the number of mobile subscriptions is around 644 million (about 11% of the world total).

Source: industry sources, Blycroft estimates c. Blycroft 2012

Global mobile phone penetration is at 85% of the world's population. There are currently 5.98 billion mobile phone subscriptions. Africa has about 644 million subscribers (about 11%). LTE (long-term evolution, or 4G LTE) deployments in Africa are quickly gaining momentum (11 million customers predicted by 2015). Smartphone penetration rates in Africa are now 17 to 19 percent (that's almost 1 in 5!). The rest are split between either "feature" phones or basic "dumb" phones (albeit with SMS capability). Commerce in Africa is dependent on mobile. Micro-entrepreneurship covers some 90 percent of the employment base and about 65 percent of the continental GDP.

Some commentators suggest that Africa will become the first post-PC region of the world. There are currently five major international cables in place providing bandwidth to the African continent; this is a 16% increase overall from 2010-2011. In Kenya, mobile phones are nearly ubiquitous and 92% of Internet usage is via mobile networks (Perry, 2011). As of the second quarter of 2012, 7.7 million users were using mobile data networks to access the Internet – an increase of 19.2% from the same period in 2011 (Communications Commission of Kenya, 2012). Additionally, the number of Internet users overall increased by 19% to 14 million users from 2011. There are roughly 43 million people living in Kenya, and there are roughly 30 million mobile phones being used by Kenyans.

In addition to the increasing availability and relative cost compared to computers, mobile and tablet devices are changing the ways we think about software development and distribution. With the advent of mobile apps, the way we think about software is changing, and whole industries are adjusting to a new world in which sophisticated but simple tools routinely sell for 99 cents. In contrast with the model for desktop applications that stack feature upon feature in a one-size-fits-all approach, mobile apps are small, simple, and elegant. They generally do one thing, or a small list of tightly related things, extraordinarily well. They cost so little, trial versions are unnecessary, and it is simple to outfit a tablet or mobile phone with exactly the feature set you want for far less than you would pay for typical desktop software. Both Apple and Google have developed extensive collections of apps, and adding to your set is as simple as it is inexpensive.

The app software model is clearly working: ABI research shows that over 18 billion apps had been downloaded in the Apple marketplace by October 2011, and over 10 billion in the Android marketplace by December the same year. Those numbers just scratch the surface of the anticipated growth of mobile apps. A recent study by Distimo predicted that

44 billion apps will have been downloaded by 2016 — or, around seven apps per person across the entire population of the earth.

Developments in emerging mobile technologies have created opportunities for providing low cost and easily support assistive technology to students with disabilities. These devices are easier to implement than other forms of assistive technology for visual impairments and enhance access to education for students with visual impairments. The refined and consistent user interface characteristic of iOS devices along with robust, built in access functions make these devices easy to use, flexible, and powerful.

While iOS devices are more costly than other mobile platforms (i.e., Android), these devices are a fraction of the cost of specialized, dedicated assistive technology tools like a screen reader installed on a laptop.

An iPad or iPod can serve as a screen reader, display large or high contrast text, recognize and describe colors, and connect to the Internet via Wi-Fi or mobile networks.

There are also apps that can read money to identify the type of bill.

In June of 2012 our team from Syracuse University worked with four students with visual impairments. The students were provided Apple iPods, a Bluetooth keyboard, and trained to use the devices with the built-in accessibility functions. In January 2013, 10 more students were provided devices - this time iPad minis - and the students from June played a key role in training the new students.

KU colleagues using an iPad as a document camera

In the context of large class pedagogy and as mechanisms for both teaching and learning, all three categories of mLearning have potential. As a teaching tool, mobile devices can provide instructors with access to resources that current infrastructure might not provide. Rather than being dependent on campus network infrastructure, instructors can have a mobile-enabled device connected to the Internet. Increasingly, sophisticated android and iOS tablet devices can effectively be used as presentation devices, running specialized forms versions of slideware (i.e., PowerPoint).

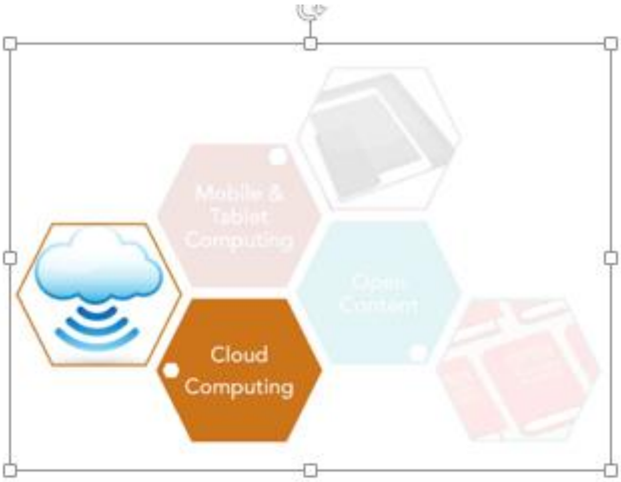
Using mobile for student engagement. One way mobile can be used in LCP is to provide mechanisms for student engagement. An increasingly popular technique for engaging students in large classes is the use of Student Response Systems (SRS). These systems are an evolving technology (Judson & Sawada, 2002) that allows instructors to engage students in real-time polls to gauge comprehension, ask questions, and enhance interaction. Traditionally, student response systems have been proprietary and relied on infrared or radio-frequency systems where students must purchase or rent input devices. Mobile technologies offer possibilities for large class instructors to engage students using Internet-based polling services like Poll Everywhere (http://www.polleverywhere.com) as student response systems.

We observed an interesting distinction in how faculty members at Kenyatta University communicated compared with typical practices in U.S. higher education – text message versus email. KU faculty members have become accustomed to using text messages to communicate instead of emailing. This is a cost effective and easy method of communication, and valuable in the sense that mobile is an area where capacity exists that can be used to support LCP (namely, as a gateway to the Internet); however, texting has drawbacks as an academic and administrative communication method.

Texting does not provide some of the institutional functionality that exists in the procedures of email use that have evolved in other parts of the world. In many Western universities, email is essentially a document delivery system and is considered an official record of communication. Email sent to students' university-provided email accounts is considered as official as paper documents sent via mail. These official emails serve as an institutional record – notes of conversations, documentation of communication with students, and administrative tools for scheduling meetings, etc. Email browsers and web-based services, like Gmail, allow users to sort, search, and archive email. Email distribution lists and LISTSERVs are easy to set up and maintain, and many learning management systems offer integrated class email functionality.

While in many ways the use of SMS text by university faculty members is a more sophisticated use of mobile technology than one might see in a U.S. university, it does not scale well as a LCP practice. As a means of communicating with several hundred students, texting could potentially be a viable broadcast mechanism, where an instructor sends a mass message; however, the cost and logistics (SMS charges, collecting and managing phone numbers) of this would be significant. There are tools that mass broadcast SMS messages, but these require additional material and personnel support from the institution. All faculty members we worked with had email accounts both through the university and from free services, such as Yahoo and Gmail. These services essentially provide unlimited email storage space at no cost. The active use of SMS by university faculty, and the near ubiquity of mobile devices we observed among faculty and students at Kenyatta University suggest other opportunities to enhance LCP.

Cloud Computing

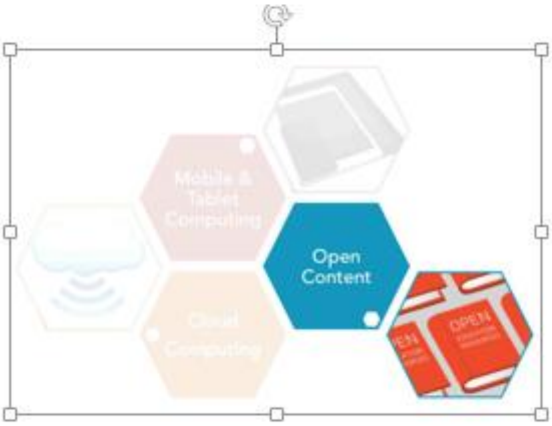


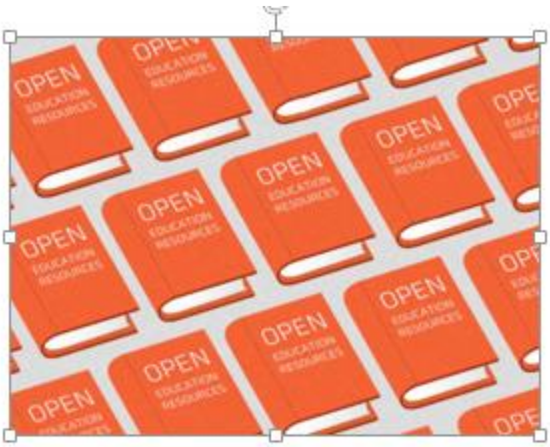
The "cloud" is a term used to describe the vast collections of networked computers, typically housed in data centers that comprise the Internet. The National Institute of Standards and Technology (NIST) defines cloud computing as follows: Cloud computing is a model for enabling convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction.

Google Docs and Microsoft Office 365 are examples of cloud-based software. These tools do not require the installation of software on a computer; however, they do require a connection (at least initially) to the Internet.

The mobile version of Dragon Dictation is also an example of cloud technology. The Dication app is installed on a device, but all of the language libraries the app uses to convert spoken word into text are online. This is in contrast to the standalone, desktop version of Dragon, which requires the user to train the software and build their local language library. The standalone version of the software provides many more features (i.e. ability to control the computer via voice, editing, text selection) and is very accurate, but the mobile version is remarkably accurate – and free.

Open Content





Open content is focused on creating collections of sharable resources and on devising licenses and metadata schemes to organize and distribute those resources. The movement toward open content reflects a growing shift in the way academics in many parts of the world are conceptualizing education to a view that is more about the process of learning than the information conveyed in their courses. Information is everywhere; the challenge is to make effective use of it. Open content embraces not only the sharing of information, but the sharing of instructional practice and experiences as well.

The role of open content producers has evolved as well, away from the idea of authoritative repositories of content and towards the broader notion of content being both free and ubiquitous. While universities ultimately paved the way for open content as an instrumental classroom tool, its recent entrance in the K-12 sector is partly rooted in the financial benefits. For example, Siyavula, launched in South Africa, serves disadvantaged schools by providing royalty-free, open source books written by volunteer experts.

Not-for-profit providers Curriki and Wikibooks are building ever-growing platforms filled with free, open source textbooks that are easy to find. As more faculty and administrators become aware of and experience open content, its comparative benefits and challenges vis-à-vis traditional learning resources are becoming better understood. Open resources are generally, though not always, electronic. They are easier to update than print materials. Because they are digital in nature, open learning materials can incorporate activities to support multiple modes of study (e.g., reading, listening).

Sharable materials reduce teacher workloads as they do not need to be recreated from scratch. The same set of materials, once placed online and made sharable via the appropriate licensing, can also inform a wide variety of learning modalities, not the least of which is learning for the sheer joy of discovery. Additionally, the use of open content promotes a set of skills that are critical in maintaining currency in any area of study — the ability to find, evaluate, and put new information to use. The same cannot be said for many textbooks, which can be cumbersome, unchanging, and costly.

Thika School for the Blind

People with print disabilities (e.g., blindness, low vision, dyslexia) have limited access to books. The World Blind Union (WBU) estimates that blind people in developed countries have access to less than 5% of the world's published material in an accessible format, and that people in developing countries have access to less than 1% of published material in an accessible format (Sullivan, 2007). Blindness civil society groups refer to this problem as a “book famine” (European Blind Union, 2011).

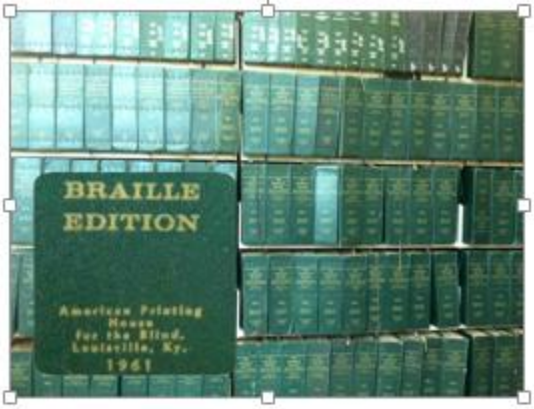
The term “famine” is appropriate in that this is a problem of severe scarcity of an essential resource, but it is inaccurate to the extent that it connotes that access to published material is a recent problem. Unfortunately it has always been true that blind people have had limited access to books; however, groups such as the World Blind Union advocate for print-disabled people to have access to the same books – on the same day and at the same cost - as their fellow citizens, on the same day and at the same price.

Though this is an old problem, the reasons for this limited access have evolved, and currently have more to do with ideological and legal barriers than technological limitations. Copyright laws present barriers to access for blind people in two ways: (1) by not adequately allowing for limitations and exceptions for people who need formats other than those produced by publishers, and (2) by motivating publishers to use technology that prevents access to ebooks.

Copyright law has added additional barriers to the production of accessible books. America copyright laws limit access to books in specialized accessible formats when they do not include limitations and exceptions provisions that allow non-copyright holders to produce them. A work in an accessible format such as Braille is considered a derivative of the original work in text format, and carries copyright protection. Some countries have written limitations and exceptions into their domestic copyright laws to allow for the creation of accessible formats, but this is the case in less than half of the world’s countries. In some countries the use of technology to create accessible formats is illegal. In the US, states lack clear guidelines about how domestic laws overlap when it comes to import and export of works in accessible formats. Because of the complexities of copyright laws, international library lending of books in specialized accessible formats is limited.

The implementation of copyright limitations and exceptions has become more complex over time due to changing technological capabilities coupled with greater complexity in international and domestic copyright laws (and mechanisms for their enforcement). For example, when Braille books were only shared by shipping a physical book in analog format, leakage risks were low. Now BRF files for Braille printing make it possible to share Braille books online, presenting new leakage risks because they could be translated back to print and read by sighted users.

The international governance arena where this problem is being discussed is the World Intellectual Property Organization (WIPO) Standing Committee on Copyright and Related Rights (SCCR). The solution to this problem lies in balancing the interests of the book publishing industry and print-disabled members of the book reading public who want better access to their products. In WIPO only nation-states get to vote or participate in dialogue, so both the publishing industry and civil society groups attempt to press policy levers by convincing representatives of states to articulate their positions.



Groups such as the WBU refer to books in accessible formats as books in specialized disability-specific formats, not intended for use by the general public. This is an artifact of the not so recent past when this was the only type of accessible format there was. When books existed only in analog formats, the catalog of accessible books was short primarily due to the limitations inherent to a fixed format. Books printed in the default manner (text printed on paper), did not accommodate the way people with print disabilities were able to access information. Those readers needed specialized accessible formats (e.g., Braille, large print, audio recordings). Due to low demand, which was made smaller by societal norms that limited opportunities for people with disabilities - production and distribution of specialized formats was time-consuming and expensive. For example, a Braille copy of the Bible costs over $700. This is still the case. Non-profit and government organizations serving people with print disabilities (e.g., Learning Ally, formerly Reading for the Blind and the Dyslexic) assumed the role of creating accessible formats that were not profitable for commercial publishers to produce.

Accessing content

Absence of copyright limitations and exceptions that allow the creation of specialized, disability-specific formats is just one of the ways copyright gets in the way of book accessibility (and, I contend, is increasingly the least significant copyright barrier). Now that books exist in digital formats, there is no innate technological reason that blind and sighted people can't read the same books. An accessible format need not be a specialized format different from formats used by everyone else. Indeed, blind people all over the world read the same electronic text as their sighted peers, but listen to it using screen reading software that reads it out loud (e.g., JAWS, Apple VoiceOver) rather than viewing it on a monitor, use a refreshable Braille display to read digital text.

Unfortunately, the ebooks and ereaders sighted people read are largely inaccessible to blind people due to the technological barriers used to protect copyright. Since digital books are easily illegally shared, publishers bind ebooks up in digital rights management (DRM) technology to prevent piracy, which more often than not locks out blind people. DRM technology is optimized to work for users who access text visually in standard font sizes. Copyright law with limitations and exceptions for people with disabilities typically allow the circumvention of DRM technology, but this is often of limited help since users don’t have ready means of circumventing technology that is specifically designed to thwart circumvention.

This means we cannot ignore ways that technology can and often does replicate many of the same social exclusions and normative thinking operating in the rest of society. As Ellis and Kent (2011) argue, we must address the “trend in digital design where socially constructed features from the analog world are migrated to the digital environment” (p. 39).

An example of this tendency to migrate socially constructed features from the analog to the digital can be seen in a controversy and lawsuit surrounding the Amazon Kindle in the US. A lawsuit filed by the National Federation of the Blind (NFB) and the American Council of the Blind (ACB) against four American universities considered whether adopting the Kindle e-reader as a means of distributing electronic textbooks to its students was discriminatory. In this case, both technical design of the Kindle device (including assumptions about its use) and understandings of providing access for university students with disabilities were at stake.

As a technology, the Kindle was touted to feature text-to-speech or spoken text technology that could read textbooks aloud. This feature of the Kindle would potentially provide important access to both blind users, as well as to individuals with other print and learning disabilities. Yet, the actual user interface of the Kindle (i.e., its menus) were inaccessible to blind users. This lack of basic functionality made it impossible for blind users to purchase books from the Kindle store, to select a book to read, or even to turn on the text-to-speech feature. In this case, as in many, technology was not the issue. Spoken text is a proven and widely used technology. The political, ideological, and social understandings of technology use that shaped the Kindle's design were the very cause of its inaccessibility. Although spoken text was built in to the Kindle, it was never designed with users with disabilities in mind. Instead, the inclusion of this functionality was presumably included to provide a talking interface for mobile users (e.g., while driving). Because of this, spoken text was not implemented to support the spoken interface familiar to many assistive technology users. The inclusion of text-to-speech also fell into a gray area regarding copyright—publishers felt that text-to-speech represented a different form of presentation for which they could not control pricing or distribution. As a result, publishers were given control over whether a text could be accessed via text-to-speech or not.

The decision to use the Kindle on a university campus as a way to distribute textbooks represents an approach to technology use that continues to assume that technology use for students with disabilities will be addressed exclusively through accommodations and alternate formats.

References

Attewell, P. (2001). The First and Second Digital Divides. Sociology of Education, 74(3), 252-259.

Biggs, J. (1999). Teaching for quality learning at university: What the student does. Buckingham, UK: Open University Press.

Carbone, E., & Greenberg, J. (1998). Teaching large classes: Unpacking the problem and responding creatively. In Kaplan, M. (Ed.), To improve the academy, Vol. 11 (pp. 311-316). Stillwater, OK: New Forums Press and Professional and Organisational Development Network in Higher Education.

Foley, A., & Masingila, J. O. (2013). Building capacity: Challenges and opportunities in large class pedagogy (LCP) in Sub-Saharan Africa. Higher Education. doi:10.1007/s10734-013-9697-6

Friedman, T. L. (2007). The world is flat: A brief history of the twenty-first century (1st ed.). New York: Farrar, Straus and Giroux.

Johnson, L., Smith, R., Levine, A., & Haywood, K. (2010). 2010 horizon Report: K-12 Edition. Austin, TX.

Mohamedbhai, G. (2008). The effects of massification on higher education in Africa. Report from the Working Group on Higher Education of the Association for the Development of Education in Africa. http://www2.aau.org/wghe/scm/meetings/mai08/adea/study_massification.pdf.

Mulryan-Kyne, C. (2010). Teaching large classes at college and university level: Challenges and opportunities. Teaching in Higher Education, 15(2), 175-185.

Zachary, G. P. (2009). Giving up on the grids. MIT Technology Review.

ENHANCEMENT OF SCIENCE PERFORMANCE THROUGH COMPUTER ASSISTED INSTRUCTION AMONG SELECTED SECONDARY SCHOOL LEARNERS IN KENYA

Samuel N. Jesse, Dr. Nicholas W. Twoli and Dr. John N. Maundu

Abstract

The performance of learners in Science in Kenyan secondary schools has been consistently low over the years. Many factors contribute to this poor performance and among them are the inappropriate teaching approaches that are teacher centered rather than learner centered. The purpose of the study reported in this paper was to investigate the influence of instructional methods on efficiency in delivery of content to the learner and eventually improved performance in science. Quasi-experimental design was used, based on the performance in science when the Conventional Instructional Techniques (CIT) are used and when a combination of Computer Assisted Instructions (CAI) and conventional instructional methods are used. Biology, Chemistry and Physics teachers and Form Two learners from six provincial secondary schools situated in the greater Embu district were involved in the research. Data collected using Standard Students Assessment Tests (SSAT) was analyzed and used to find out whether there was a significant difference in performance of the learners in science before and after the treatment. The study found out that learners taught through CAI performed significantly better than learners taught through CIT in science. Based on this study, it was concluded that use of Computer Assisted Instruction improves secondary school learners' performance in science. This paper ends with some recommendations for further research.

Key Words: Computer assisted instruction, Conventional instruction techniques, Science, Performance, Teaching approach

Introduction

Biology, Chemistry and Physics are the three pure science subjects offered in Kenyan secondary schools curriculum (KIE, 2002). In the national examinations conducted by the Kenya National Examinations Council (KNEC), the three subjects are categorized in group two with Biology taking code 231, Physics 232 and Chemistry 233. According to the

Programme for International Student Assessment (PISA, 2002), the performance of a country's students in science subjects has implications on the part that country will play in tomorrow's advanced technology sector and for its general international competitiveness. The report also emphasized the critical role of science subjects in the socio-economic development of a country. Despite this critical role, performance of students in science subjects in secondary schools in Kenya has continued to be low for many years. According to Musyoka (2004), it is common knowledge that students' achievement in science subjects is wanting as reflected by performance in the national examinations. The feedback from formal examinations and observations by stakeholders constantly indicate a shortfall in these subjects.

According to Munywoki (2004), parents, the government and other stakeholders continue to invest heavily in the education of young Kenyans every year with the hope that the inputs would result to better outputs. The immediate expected output from the education system is good performance in examinations. Learning achievement was adopted as a key indicator of the quality of education during the 1990 World Conference on Education for All (EFA) in Jomtien, Thailand (UNESCO, 2000). The low performance trend in science subjects in Kenyan secondary schools is a cause of worry to many stakeholders. As outlined in the KNEC reports (2006 – 2011), the performance of students in Biology, Chemistry and Physics has remained below average (Table 1.1).

Table 1.1 Percentage mean scores of Biology, Chemistry and Physics from 2005 – 2010 in Kenya.

Subject	**Mean score (percentage)**						**Average MEAN**
	2005	2006	2007	2008	2009	2010	
Biology	32.01	29.84	44.70	30.32	27.20	29.23	**35.23**
Physics	35.99	40.82	42.23	36.71	31.33	35.13	**37.04**

Chemistry	29.44	27.01	27.69	22.74	19.13	24.91	**25.15**

Source: Kenya National Examinations Council Reports (2006, 2007, 2008, 2009, 2010 and 2011)

This poor performance in science may be attributed to several factors such as attitude, teaching approaches/methods, content and resource mobilization and management (Musyoka 2004). According to Kibe (JICA-Kenya personal communication) in Muraya and Kimamo (2011), many factors contribute to poor performance of science subjects at Kenya Certificate of Secondary Education examinations. These factors include student attitude towards the subjects which they perceive as difficult, inappropriate teaching approaches that are teacher centered rather than student centered, inadequate mastery of teaching subject by some teachers, inadequate teaching and learning resources, poor terms of service for teachers and heavy teaching loads. According to Fraser and Walberg (1995), appropriate instructional activities can be effective in promoting the development of logical thinking, as well as the development of some inquiry and problem solving skills.

For effective teaching and learning to occur, the teacher should use an effective approach of conveying the information to the learner (Brown et al., 1982). In order to increase students' motivation to learn science, a variety of innovative instructional techniques can be used (Fraser and Walberg 1995). Various studies have suggested that inappropriate teaching approaches employed by science teachers in Kenyan secondary schools may be one of the contributing factors to poor performance in science. According to Kolawole (2008), teacher centered teaching approaches are dominant at the secondary school level where the teacher presents information to students in a lecture and students complete assignments out of the class and later take examinations to demonstrate their degree of understanding and retention of subject matter. Most of the instructional methods the teachers use in our classrooms are usually teacher – centered and hence, give fewer opportunities or roles to play in the classroom discourse. Apparently, such situations tend to limit students' active participation (Kiboss, 2000; Tanui 2003). The UNESCO - Education for All, Global Monitoring Report (2005) notes that practitioners broadly agree that teacher dominated pedagogy where students are placed in a passive role is undesirable, yet such is the norm in the vast majority of classrooms in Sub-Saharan Africa.

To improve academic achievement, the teaching approaches adopted by a teacher should make learning more learner-centered so as to promote imaginative, critical and creative skills in the learners resulting in better achievement in instructional objectives. The learner centered teaching and learning approaches actively engage the learner in the learning process for effective mastery of the subject content and promotes a positive attitude towards the subject (Ministry of Education Science and Technology, 2011). KNEC (2011) noted that schools should use e- learning to enable students access diversified information for easy understanding of science concepts.

According to Wambugu and Changeiywo (2008), the teaching approach that a teacher adopts is one factor that may affect students' achievement and therefore the use of an appropriate teaching approach is critical to the successful teaching and learning of science. Many topics in science may require innovative instructional methods such as Computer Assisted Instruction (CAI) to foster the learners understanding and facilitate adequate coverage of all the science processes and concepts (Jesse, 2011). In chemistry for example, neither practical nor theory teaching can effectively cover certain areas like preparation of poisonous gases such as chlorine and carbon II oxide. In Biology, areas that deal with the functioning of the body parts are very difficult to explain since no practical activity can be done to illustrate them. In 2006, KNEC noted that questions like: Describe how the human kidneys function was poorly done. The KNEC (2006) report pointed out that details of what happens at the nephron were lacking, there was confusion of what happens in the loop of henle and there was confusion of what is ultra-filtered. These topics can easily be taught using computer simulation and animations making it easier for a learner to understand. CAI would even make it easier to cover the science syllabus since many practical activities are already simulated and learners can replay them even in the absence of the teacher. A positive relationship exists between syllabus coverage and performance at National Examinations level (Amadalo et al (2012).

Computer assisted instruction (CAI) refers to teaching and learning through computer-based programs that mostly involve drill and practice, tutorial and computer simulation activities offered either by themselves or as supplements to traditional, teacher directed instruction (Stennet, 1985). CAI can provide an effective supplement to the teacher. Eggen and Kauchak (1993). Over the recent years, CAI has witnessed great development in many countries. Kinnaman (1990) observes that in America for example, the number of schools owning computers increased from approximately twenty five percent to virtually a hundred percent between 1981 to the end of the decade. In Kenya however, the use of CAI is not widespread. According to Wragg (2000), studies indicate that most teachers feel threatened by the computer because it forces them to organize their classrooms differently which reduces their control and makes their normal approach of monitoring progress difficult to implement. Selwyn (1999), Olson (1992) and Kiboss (1997) also observed that teachers feel bereft of influence because they feel unable to monitor what goes on and are uncertain about their proper role in the class. Their fear of losing control or power in the classroom is probably what makes them behave negatively to the use of CAI in their classrooms.

A lot of research and studies have been done on CAI teaching and most of them recommend it as a very useful instructional tool. Capper and Copple (1985) indicate that the single best-supported finding in the research literature is that the use of CAI as a supplement to traditional teacher directed instruction produces achievement effects superior to those obtained with traditional instruction. Rupe (1986) observed that as well as enabling students to achieve at higher levels, researchers have also found that CAI enhances learning rate. Student learning rate is faster with CAI than with conventional instruction. According to Kulik (1987), students receiving CAI learn better and faster and students' scores on delayed tests indicate that the retention of content learned using CAI is superior to retention following traditional instruction alone. Dalton and Hannan (1988) indicate that while both traditional and computer-based delivery systems have valuable roles in supporting instruction; they are of greatest value when complementing one another. As such, the success to integrate CAI into teaching and learning of science rests on the teachers to accept and to embrace the new innovation, ability to make informed judgments about the suitability of CAI to meet their particular teaching and learning goals and to consider CAI in their search for new instructional approaches. There was therefore, a great need to investigate the effects of introducing CAI into science instruction in Kenyan secondary schools.

Methodology

Research Design

A research design is a structure of research. It is the 'glue' that holds together all the elements in a research project (Kombo and Tromp 2006). This study used a two-group quasi-experimental pre-test, post-test design. Form two classes in three out of the six provincial schools that offer computer studies in Embu district were randomly assigned the experimental group while the form two classes in the other three provincial schools were labeled the control group. This was based on the academic performances and learning facilities especially the number of computers available in the computer laboratories. Both groups were measured before the treatment was given by use of standard student test (pre-test). The experimental group was then exposed to CAI in the computer laboratories (treatment) while the control group was only exposed to the normal Conventional Instructional Techniques in the normal classes (no treatment).

The design can be depicted as follows:

CIT entailed application of commonly used instructional methods in science such as lecture, teacher demonstrations and practicals. CAI involved instruction through up to date instruction software and therefore students could learn their Biology, Chemistry and Physics lessons in the computer laboratories. After a period of four weeks, the two groups were measured again by use of another standard test (post-test).

Target Population

The target population in this study was teachers who taught science subjects and students who took Biology, Chemistry and Physics in secondary schools that offered computer studies in Embu district. There were eleven secondary schools that offered computer studies in Embu district. These schools had a population of five thousand, two hundred and nineteen students with one thousand three hundred and seventy one being form two students. The total number of science teachers in the eleven schools was seventy-three, where seventy of them taught the Form Two classes. Table 1.2 shows the total number of students and science teachers in the eleven schools, the total number of students in form two and the science teachers involved in teaching the form two classes. The percentage of the schools, teachers and students that were targeted by the study is also shown in the table. This meets the recommended percentage in statistical terms, which is ten percent (Orodho and Kombo, 2002).

Subject	Total Number	Percentage
Secondary schools that offer computer studies	11	100%

Schools involved in the study	6	55%
Population of students in the eleven schools	5219	100%
Population of Form Two students in the eleven	1371	26%
Science teachers in the eleven schools	73	100%
Form Two science teachers in the eleven schools	70	96%

Source: Embu District Education Office and pre-study survey

The sample and Sampling Procedures

According to Webster (1995), a sample is a finite part of a statistical population whose properties are studied to gain information about the whole. Purposive sampling was used to select secondary schools that offer computer studies in Embu district. This was because a key resource that comprises computer laboratories was required for the CAI lessons. The experimental group also required learners with basic computer skills. The six provincial schools that offered computer studies in the district were selected for the study. This was to ensure that the pre- requisite skills or the knowledge level of the students in the science subjects was almost the same. In the sample schools, the form two classes were purposively selected for the study. This was because the learners at this level had fully adapted to the environment but they have not yet selected the subjects that they will be examined in the Kenya Certificate of Secondary Education examination. The form two classes in three of the six provincial schools were randomly assigned the experimental group while in the three remaining provincial schools the form two classes were assigned the control group. Each study school therefore had either three experimental groups or three control groups resulting to a total of eighteen study groups in all the study schools.

Research Instruments (Instrumentation)

Written assessment tests (standard students' assessment tests) were used to measure the learners' performance in the three science subjects that were being studied. Two types of assessment tests were used: the pre-test and post-test. Pre-test assessment tests were used to measure the performance of both the experimental and the control groups before the treatment was administered. This was to ensure that both groups were of relatively same ability. In Biology, the tests were set from **Nutrition in Plants and Animals** while in Chemistry **Air and Combustion**, and **Water and Hydrogen** are the two topics that were included in the pre-test. In Physics, **Electrostatic I, Cells and Simple circuits** were used in the pre-tests. These topics were selected because they are the last topics in the form one syllabus and this study was carried out in first term. Post-test assessment tests were used to measure the performance of the learners in both groups after the experimental group had received the treatment. In Biology **Transport in Plants and Animals** was used to construct the post-test while the **Structure of the atom and the Periodic table** was used in Chemistry. **Magnetism** was used to set the Physics post-test. These topics were selected because they are the first topics in form two and this study was carried out during first term of school. Pre-tests and post-tests were set from different topics to ensure that achievement in the post-test was not based on the previous knowledge. Both pre-test and post-test were set by a panel of five teachers per subject who are specialized in teaching that particular subject at secondary school level for a period of not less than five years. These teachers were also involved in ensuring that the tests they set were standardized. The teachers in those panels were selected from other schools, which were not involved in the study to avoid leakage of the tests before they were done.

Content validity of the assessment tests was determined using the content validity formula developed by Lawshe in 1975. In this case five panelists were selected from subject teachers who have at least five years of experience in teaching the subject. The panelists in each subject went through each item in the tests indicating whether the item was essential, useful but not essential or not necessary to the performance of the construct. The formula CRV = (ne – N/2) / (N/2) where CRV=content validity ratio, ne=number SME panelists indicating essential and N= total number of SME panelists involved. This formula yields values that range from +1 to –1 where positive values indicate that at least half the SME panelists rated the item as essential. In the pre-test, the mean CRV across items was 0.94 in Biology, 0.95 in Chemistry and 0.97 in Physics. In the post-test, the mean CRV across the items it was 0.99 in Biology, 0.96 in Chemistry and 0.93 in Physics. This means that at least half of the SMEs in each subject rated each item as essential and therefore the content validity ratios were positive.

Reliability of the assessment tests was determined using the Split-Half method. In this method, the total number of items was divided into halves by assigning the odd numbered items to one half and even numbered items to the other half of the test. A correlation was then taken between the two halves. A statistical correlation to estimate the reliability of the whole test was then done using Spearman-Brown prophecy formula: Pxx” = 2Pxx’/1+Pxx’ where Pxx” is the reliability coefficient for the whole test and Pxx’ is the split-half correlation. In pre-tests the Pxx” and Pxx’ for the three subjects were as follows: Biology had Pxx” = 0.87 and Pxx’ = 0.93, Chemistry had Pxx” = 0.75 and Pxx’ = 0.86 while Physics had Pxx” = 0.91 and Pxx’ = 0.95. In the post-test, the values were as follows: - Biology had Pxx” = 0.82 and Pxx’ = 0.90, Chemistry had Pxx” = 0.86 and Pxx’ = 0.92 while Physics had Pxx” = 0.89 and Pxx’ = 0.94. All the subjects had positive reliability values meaning they could yield consistent results on repeated trials. Little modifications were however done on chemistry pre-test that had a reliability value of less than 0.9.

Data Collection Procedure

Research permit to carry out the research in schools in Embu district was granted from the National Council for Science and Technology (NCST) a government agency in the Ministry of Higher Education, Science and Technology (MHEST) in Kenya. Sampled schools were then visited to seek permission to carry out the research from the school principals. A meeting with the science and computer studies teachers was then organized where basic issues about the study and its benefits were discussed. Teachers were requested to explain to their students about the study since it was expected to affect their normal learning programmes.

Data was collected in two stages during the main study. At the beginning of the study, the two research groups were given a standard assessment test (pre-test). The results of this test were obtained and analyzed to ascertain the relative level of both the experimental and the control groups at the beginning. The experimental group was then exposed to the treatment (computer assisted instruction) for a period of four weeks while the control group continued with the conventional instructional methods. At the end of the four-week period, another standard test (post- test) was given to the two groups and results obtained were recorded.

Results and Discussion

The data obtained during the pre-test and post-test assessment tests was analyzed using means and followed by t-Test. This enabled the researcher to find out whether there was any statistically significant difference between the performance of the experimental and the control groups both before and after the treatment. This way, it was possible to determine the impact of CAI on performance in science subjects. Statistical Package for Social Sciences (SPSS) was used to facilitate the analysis of the data.

Results for the Pre-test

Data that were obtained after marking the pre-test were used to calculate the mean, standard deviation and the standard error of both the experimental and the control groups in all the three science subjects. The means for both experimental and control groups were close. This suggests that the samples were of almost equal ability in science. Table 1.3 summarizes the results that were obtained.

Table 1.3 Mean, Standard deviation and Standard errors

				Std. Error
BIOLOGY	EXPERIMENT	55.04	13.040	1.021
	CONTROL	55.05	12.872	1.096
CHEMISTR	EXPERIMENT	54.59	11.352	.889
	CONTROL	54.67	12.057	1.026
PHYSICS	EXPERIMENT	50.98	12.251	.960
	CONTROL	51.01	12.384	1.054

The test for the equality of the means was then carried out using the independent samples t-test (Table 1.3). Equal variances were assumed during the t-test since the levense's significance values for Biology, Chemistry and Physics were 0.74, 0.394 and 0.747 respectively. These values were higher than α value of .05, that is, p>α. The significant values for the t-test (p values) were 0.993 for Biology, 0.954 for Chemistry and 0.982 for Physics. Since these values for the t-test were higher than α value of .05, this then implies that there is no significant difference in student performance in Biology, Chemistry and Physics between the experimental and the control groups.

Table 1.4 Independent Samples t-test for the pre-test

	t-Test for Equality of Means						
						99% Confidence Interval of the Difference	
			Sig. (2-	Mean		Lower	Upper
BIOLOGY Equal variances assumed	-.009	299	.993	-.014	1.500	-3.901	3.874
CHEMISTRY Equal variances assumed	-.058	299	.954	-.078	1.351	-3.580	3.425
PHYSICS Equal variances assumed	-.023	299	.982	-.033	1.424	-3.725	3.659

Results for the Post-test

The mean, standard deviation and the standard error were calculated as was done for the pre-test. The means of the experimental groups were found to be a lot higher than those of the control groups in all the three science subjects. Based on this performance, one can suggest that the treatment had quite an effect on the experimental group. It can be viewed, therefore, that CAI has a positive effect on the learning of science in secondary schools. The results are presented in Table 1.5

Table 1.5 Mean, standard deviation and standard error of the post-test

				Std. Error Mean
BIOLOGY	EXPERIMEN	60.27	10.288	.806
	CONTROL	55.39	10.452	.890
CHEMIST	EXPERIMEN	57.84	11.805	.925
	CONTROL	53.32	12.179	1.037
PHY SICS	EXPERIMEN	59.55	10.678	.836
	CONTROL	55.67	9.348	.796

The independent samples t-test was then used to test the equality of the means. The significance values for the t-test (p values) obtained were .001 for all the three science subjects. Since these values are typically below α value of .05, it therefore implied that there was a significant difference in students' performance in Biology, Chemistry and Physics between the experimental and the control groups. A summary of the results obtained is provided in Table 1.6.

Table 1.6 Independent Samples t-test for Post-test.

		t	df	Sig. (2-	Mean Differenc	Std. Error	99% Confidence Interval of the Lower	Upper
BIOLOGY	Equal variances	4.070	299	.001	4.879	1.199	1.771	7.986
CHEMISTRY	Equal variances	3.263	299	.001	4.522	1.386	.930	8.114
PHYSICS	Equal variances assumed	3.323	299	.001	3.878	1.167	.852	6.904

Comparison of the Mean Difference between the Experimental and Control Groups

In the pre-test the mean difference between the experimental and the control groups was -0.014 in biology, -0.078 in chemistry and -0.033 in physics. The average means difference between the experimental and the control groups during pre-test was therefore -0.041. This value is very small thus implying that the two groups were of relatively equal ability at the beginning of the study.

In the post-test the mean difference between the experimental and the control groups in biology was 4.893, 4.60 in chemistry and 3.911 in physics. The average mean difference in the three subjects during the post-test was 4.468. This value is visually large enough therefore it indicates a difference between the experimental and control groups in terms of performance in the tests. The means difference between the two groups is summarized in Table 1.7.

Table 1.7: Comparison of the means difference between the experimental and the control groups.

SUBJECT	MEAN DIFFERENCE		
	Pre-test	Post-test	Difference
Biology	-0.014	4.879	4.893
Chemistry	-0.078	4.522	4.600
Physics	-0.033	3.878	3.911

Conclusion

In the pre-test, a t-test revealed no significant difference between the performance of the experimental and the control groups in Biology, Chemistry and Physics. In all the three cases, the p values were greater than α values (p>α). In the post-test, a t-test revealed a significant difference between the performance of the experimental and the control groups in Biology, Chemistry and Physics. In all the three cases, the p value was smaller than α values of 0.05, (p<α).

A comparison between the mean difference in the two groups revealed that in the pre-test, the performance of the experimental and the control groups was almost equal since the mean differences in Biology, Chemistry and Physics were 0.014, -0.078 and -0.033 respectively. In the post-test, a wide difference between the performance of the experimental and the control groups was noted with the mean differences of Biology, Chemistry and Physics being 4.879, 4.522 and 3.878 respectively. Computer Assisted Instruction therefore improves the achievement in science.

Given that in the pre-test for the three subjects, the t-test significance value (p) was greater than α value of .05 ($p>\alpha$) and in post-test the p value was less than α of .05 value ($p<\alpha$), then CAI has a positive impact on the performance of learners in science subjects (Biology, Chemistry and Physics). This confirms the observations by Rupe (1986) that as well as enabling students to achieve at higher levels, CAI also enhances learning rate leading to better performance. In addition, Fraser and Walberg (1995) noted that use of computer for instruction resulted to increased student interest, co-operation, improved achievement by students in science and an increase in the amount of science curriculum that was covered.

Since the improvement in science performance by the experimental group resulted from application of CAI in science lessons, then the instructional methods used by the teachers influence the performance of the learners. According to Kulik (1987), students receiving CAI learn better and faster and students' scores on delayed tests indicate that the retention of content learned using CAI is superior to retention following traditional instruction alone. Wambugu and changeiywo (2008) also noted that the teaching approach that a teacher adopts is one factor that may affect students' achievement and therefore use of an appropriate teaching approach is critical to the successful teaching and learning of science.

From classroom observation, it was evident that the students under CAI looked keen and showed a lot of interest during lessons. They were curious to observe what was coming next. This sort of expectation created readiness to learn and to be engaged. It appears therefore that interest plays an important preliminary role in CAI and triggers engagement of learners creating an enhanced environment for a science teacher to positively exploit (figure 1.1).

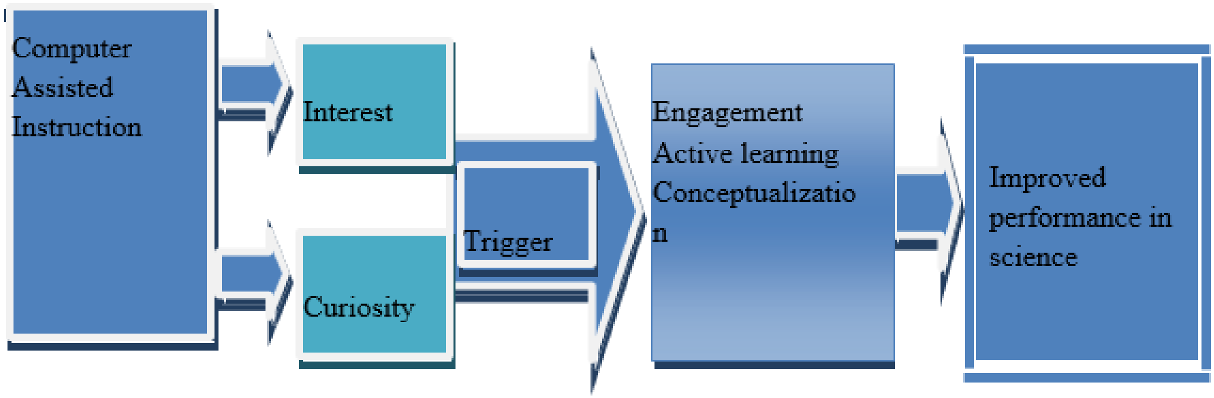


Figure 1.1: CAI transmission in learning secondary school science

This inductive thinking has been supported by some scholars (Marilyn et al, 2010) who indicated that, participative engagement in particular creates enjoyable environment, which provides the catalyst for active learning and conceptualization in science. It can be taken that it is the engagement role that is responsible for the improved performance.

The foregoing findings pose a challenge to the traditional teacher-talk predominating in Kenyan secondary school classrooms including science education lessons. It is imperative therefore in the interest of forming a good technological base for future generations that science teachers embrace the integration of technology in classroom practice. This should hopefully translate to improved learners performance in KCSE examinations thereby paving way for science-based careers later in life.

This paper winds up with some recommendations for further research. First, the role of interest in CAI is central and schools are becoming technology pervasive. It is often experienced that interest can be short lived. As a mediating factor, if it dies off, the whole process ‘dies.” There is need, therefore, to determine the long effect or sustainability index of this factor by designing a longitudinal study. Second, gender effect was not addressed in this study. We recommend that a study be carried out to determine the effect of CAI on gender.

References

Amadalo, M.M., Shikuku, B.N. and Wasike, D.N. (2012): Investigation of Factors that Influence Syllabus Coverage in Secondary School Mathematics in Kenya. Masinde Muriro University of Science and Technology, Kenya. www.ijhssnet.com.

Brown, N.R., Oke F.E. and Brown D.P. (1982). Curriculum and Instruction: an Introduction to Methods of Teaching. Macmillan Publishers Limited, Kuala Lumpur.

Capper, J., and Copple, C. (1985) Computer Use in Education: Research Review and Instructional Implications. Washington, DC: Center for Research into Practice.

Dalton, J. and Hannan, W. (1988): Effect of Computer-Assisted Instruction (CAI) on Reading Achievement: A Meta-Analysis. Honolulu, HI: Pacific Regional Education Laboratory.

Fraser, B.J. and Walberg, H.J. (1995): Improving Science Education. Chicago, Illinois: National Societal for the Study of Education.

Jesse, S.N. (2011). Comparison of Computer Assisted Instruction and Conventional Instructional Techniques in Science among Selected secondary Schools in Embu District-Kenya. Master's Thesis presented to Kenyatta University, Nairobi, Kenya.Kauchak, D.P and Eggen P.D (1993): Learning and Teaching: Research Based Methods. Allyn and Bacon, Boston.

Kenya Institute of Education (2002): secondary Education Syllabus Volume two. Kenya Institute of Education, Nairobi.

Kenya National Examination Council. (2006): Year 2005 K.C.S.E Examination Report. City square, Nairobi, Kenya.

Kenya National Examination Council. (2007): Year 2006 K.C.S.E Examination Report. City square, Nairobi, Kenya.

Kenya National Examination Council. (2008): Year 2007 K.C.S.E Examination Report. City square, Nairobi, Kenya.

Kenya National Examination Council. (2009): Year 2007 K.C.S.E Examination Report. City square, Nairobi, Kenya.

Kenya National Examination Council. (2010): Year 2007 K.C.S.E Examination Report. City square, Nairobi, Kenya.

Kenya National Examination Council. (2011): Year 2007 K.C.S.E Examination Report. City square, Nairobi, Kenya.

Kiboss J.K (1997). Relative effects of a computer-based instruction in physics on students' attitudes, motivation and understanding about measurement and perceptions of the classroom-learning environment. Doctoral Thesis presented to the University of Western Cape, Bellville, South Africa.

Kiboss J.K (2000). Teacher/pupil perspectives on computer-augmented physics lessons on measurement in Kenyan secondary schools. J. Inf. Technol. Teach. educ.

Kinnaman, D.E. (1990): Star development: How to develop your winning team. Technology and learning, 11(2).

Kombo, D and Tromp, A. (2006): Proposal and Thesis Writing: an introduction. Nairobi: Paulines publications Africa

Kolawole, E.B. (2008). Effects of Competitive and Cooperative learning strategies on Academic Performance of Nigerian Students in Mathematics. Educ. Res. Rev., 3(1).

Kulik, J. A., and Kulik, C. C. (1987) Computer-Based Instruction: What 200 Evaluations Say. Paper presented at the Annual Convention of the Association for Educational Communications and Technology, Atlanta.

Lawshe, C.H. (1975). A Quantitive Approach to Content Validity. Personnel Psychology, 28(4). 563-575.

Marilyn, P.A., Ruth, V.S. and Sarah, A.C. (2011). Curiosity, Interest and Engagement in Technology-pervasive learning environments: a new research agenda. Education Technology Research Development. Vol. 59: 181- 198.

Maundu, J.N., Sambili, H.J. and Muthwii S.M. (2005). Biology Education. A Methodological Approach. Nairobi: Lectern publications Ltd.

Munywoki, N. (2004) Student Cantered Teaching. A paper presented during the first cycle of SMASSE project. Unpublished.

Muraya, D.N. and Kimamo, G. (2011). Effects of Cooperative Learning Approach in Biology Mean Achievement Scores of secondary Schools students in Machakos District, Kenya. CEMASTEA, Nairobi. http://www.academicjournals.org/ERR.

Musyoka, J. (2004) 'ASEI' movement and the 'PDSI' approach. A paper presented during the first cycle of SMASSE project. Unpublished.

Olson, J. (1992): Understanding Teaching. Buckingham: Open University press.

Orodho, A. and Kombo, D. (2002): Research Methods. Nairobi: Kenyatta University Institute of Open Learning.

Rupe, V. S. (1986): A Study of Computer-Assisted Instruction: Its Uses, Effects, Advantages, and Limitations. South Bend, IN: Indiana University.

Selwyn B. and Kramer, S (1999). "Organizing Computers for Reading Instruction." COMPUTERS-IN-THE-SCHOOLS, 4 (1), 53-66.

Stennet, R.G. (1985) Computer Assisted Instruction: A review of reviews. Research report 85-01, London board of education, Education research services.

Tanui, E.K. (2003): Relative effects of a computer-based instruction in accounting on students' achievement, perception of classroom environment and motivation in secondary schools in Kenya. Doctoral Thesis presented to Egerton University, Njoro, Kenya.

UNESCO (2000). World Education Forum: The Dakar framework for Action, Education for All: Meeting our Collective Commitments. UNESCO, Paris.

UNESCO (2005). Global Monitoring Report; Education for All, the quality Imperative. UNESCO, Paris.

Wambugu, P.W. and Changeiywo, J.M. (2008). Effects of Mastery Learning Approach on Secondary Students Physics Achievement. Eurasia J. Math. Technol. Educ., 4(3); 293- 302.

Webster, S. (1995). Educational Research. Competence for Analysis and Applications, 6th edition. New jersey: Macmillan.

Wragg , E.C.(2000). An introduction to classroom observation. London: Routledge.

CHALLENGES FACING TEACHERS AND STUDENTS IN THE USE OF INSTRUCTIONAL TECHNOLOGIES: A CASE OF SELECTED SECONDARY SCHOOLS IN KISII CENTRAL DISTRICT, KISII COUNTY

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Abstract

In this era of information technology, the role of teachers is changing from providing information to organizing the entire learning process. This is mainly because, learners can easily access any information they need by use of instructional technologies such as Internet, Mobile phones and graphics, unlike in the past where text books were the only source of information. Technology is very essential in the instruction of students in secondary schools today and this is especially so in a developing country like Kenya. Instructional technologies enhance mastery of the content, provide information as comprehensive as possible in different formats and provide teachers with a variety in presentation of content. The rationale was based on the view that properly designed learning materials inspired by instructional technology and delivered by technology add value to a teaching situation where contact hours are limited. The curriculum needs, academic standards and the development of digital age skill for the 21st century learners. The literature review focused on the meaning and use of instructional technologies in teaching and learning in institutions in Kenya and other parts of the world. However, it did not address the use of instructional technologies in secondary schools. This was a descriptive survey design. Despite the importance of instructional technologies, Kenyan secondary schools face challenges. A study was conducted in ten purposively selected secondary schools in Kisii Central District, Kisii County between March 2011 and March 2012. Data was collected using questionnaires, interview schedules and observation schedules. The obtained data were analyzed systematically using descriptive statistics and presented with the help of frequency tables, graphs and percentages. The study findings revealed that teachers were influenced by availability of instructional technologies, knowledge and skills in use. Findings also revealed myriads of challenges faced by teachers

and students. Finally, it is paramount that teachers plan teaching, and learning which applies technology to maximize students learning.

Background of the Study

Education in the world over has been recognized as an important means for promoting economic and social development both at individual and national levels. The growth of the global economy and the information-based society has pressurized education systems around the world to use technology to teach students the knowledge and skills they need (UNESCO 2005). In Kenya, Learning institutions are under increasing pressure to use the instructional technologies in teaching the students the knowledge and skills they need in the 21st century. The challenge confronting our educational system is how to transform the curriculum and teaching and learning process to provide students with the skills to function effectively in this dynamic era – rich and continuously changing environment. Even after the teacher's initial fear of getting involved with technology has been overcome, serious challenges still remain in terms of providing enough technical support that teachers will not be discouraged by equipment failure or software behavior that they do not understand (IJEDICT, 2007).

Though the hope is that information technology can add a powerful punch to the modern educational environment, many educators in the United Emirates as Moore et al. (2003) notes have found that it is the proper use of available instructional technologies rather than the presence of that technology that advances learning. Even longtime favorites pencil and paper and the Overhead Projector still have a place in the well-rounded modern classroom. Whether old or new, each technology has inequalities (or "affordances") (sic) of which advantages can be taken.

Brown et al. (1973) acknowledge that, researchers in education have shown that with present inadequate infrastructure, large class sizes, and lack of technologically skilled teachers and traditional modes of training of teachers, it is difficult to intensively achieve the goals and objectives of education and training. Further, most of the teachers use expository methods, which do not have the potential of achieving technological know-how in the current technology era. Essentially, in modern classroom teaching, the objectives should be multidimensional in nature, so for their achievements, multiple methods are used in an integration whereby instructional technology will be highly recommended.

According to (IJEDICT 2007), modern children are keen to use relevant modern equipment to help them with their learning at school and their confidence enables them to acquire competence quickly and easily. This modern equipment use is instructional technology in the teaching and learning process. Computer studies as one of the instructional technologies is now offered as a subject but Amutabi (2004) in a study on ICT in Kenya Public Universities notes that, the computerization project in secondary schools in Kenya is at its infancy stage. Moore et al (2003) notes that, "properly designed learning materials delivered by modern technology (sic) add value to a teaching environment in which contact hours are limited."

At present, the use of instructional technologies may be of great help. It is a well-known fact that, not a single teacher is capable of delivering up to date and complete information in his/her own subject. The use of instructional technologies can fill this important gap because it will provide access to different sources of information. It will provide information that is as comprehensive as possible and in different formats with different examples. (ANSTI Nov. 2005). Duffy et al. (1993) note that:

> *Tools are being helpful in developing the learner's mental models of objects, systems or other phenomena that brings about visual spatial capabilities. Visualization tools help learners to construct those mental images and visualize activities.*

The use of instructional technologies will provide chat facility (text messages) so that learners will make use of it, exchange their ideas and views and get clarification of any topic with different experts, practitioners so as to broaden there information base. Instructional technologies will assist teachers to provide variety in the presentation of content, which will help learners on concentration, better understanding, and long retention of information. The learners will get opportunities to work on any live project with learners from other countries (Omwenga 2008). The use of instructional technologies will actually provide flexibility to a learner, which is denied by the traditional process and method. On the Internet, many Websites are available freely which will be utilized by students and teachers to develop reasoning, critical thinking, analysis and problem solving hence helping them in sharing resources. Betz (1990) notes that instructional technologies attract attention; which is paramount to learning. Instructional technology also helps teachers to engage students through production work (Dale 1969). To make learning more meaningful to students: teachers often try to involve them in creating their own technology-based products. Instructional technologies promote learning by linking students to information resources. This lets them access the materials, obtain information and have experiences that they will not have had. They also help students visualize problems, solutions and link students to learning tools especially when using computers (Newby et al. 2006). Roblyer (2003) acknowledges that there is substantial empirical evidence indicating that teachers frequently capitalize on the novelty and attraction of the media used to achieve the essential instructional goal of capturing and holding students' attention.

Moore et al. (2003), have described rich-text materials (material combining multimedia) as potentially enriching experiential, flexible, fun, powerful, self-paced, and time saving. They also believed that properly used technology could further critical thinking and independent learning, expand individual exploration, Shift some of the learning out of the classroom expand time for classroom activities, Liberate (students and teachers alike) form the mundane, create an environment of learning, experimenting, doing and enjoying, and level of playing field between the public and private schools.

Kenya is at an infant state in the use of instructional technology (IJEDICT 2007). Muriithi (2005) further notes that in Kenya like most developing countries, instructional technology usage is still limited. The pertinent question one would ask at this point is whether the schools in Kenya are benefiting from these emerging technologies. If not, then why is it that they are not benefiting from these emerging technologies? Therefore, this study was set to establish challenges facing teachers and students in using instructional technologies.

Objectives of the study

i) Examine factors, which influence interactivity and effective use of instructional technologies in the teaching and learning processes.

ii) Establish the challenges faced in coping with the use of various instructional technologies in teaching and learning processes.

iii) Offer solutions to the challenges to: a) teachers and b) students.

Research Methodology

Research Design

The study was conducted by using a descriptive survey design. This study used both quantitative and qualitative techniques in collecting and analyzing data

Target Population

The target population for this study comprised 67 public secondary schools in Kisii County. However, ten secondary schools were purposively selected and used for this study.

Research Instrument

According to Wellington (2000), in carrying out a research, a researcher should use methods, which provide high accuracy. Data was collected using three instruments namely; the questionnaire, interview schedule and observation schedule.

Findings of the Study

Interactivity and effective use of instructional technologies

This study was to examine factors that influence interactivity and effective use of instructional technologies in teaching and learning processes. It is obvious that for teaching and learning to be effective and meaningful, the use of instructional technologies was inevitable. The instructional technologies also determine the instructional method the teacher will employ in the teaching and learning process. Since the researchers was to examine the factors that influence effective use; it was necessary for her to first find out the availability of the instructional technologies in the sampled schools. Apart from that, the researcher was to find out whether the instructional technologies used in other parts of the world were available in Kenya. This was with good intentions of finding out whether teachers and students in the entire country benefited from teaching the same way other parts of the country and world do. **Table 1.1** analyzes factors that influence teachers' interactivity and use of instructional technologies:

Table 1.1 factors that influence interactivity and use of instructional technologies

	Frequency	Percentage
Availability of instructional technologies	11	11.1
Skills and knowledge of technology use	11	11.1
Importance of the instructional technology	12	12.1
If readily available in the school	19	19.2
High population/Enrolment of students	15	15.2
Availability of money to buy some materials	12	12.1
Enough resources	23	23.2

N/B: Percentages are based on the number of responses for each item.

Out of 104 respondents, 11(11.1%) of the teachers revealed that they were influenced by the availability of the instructional technologies, 11(11.1%) revealed that they were influenced by knowledge and skills on use, 12 (12.1%) of the teachers were influenced by the importance of the instructional technologies, 19(19.2%) of the teachers were influenced if the instructional technologies were readily available, 15(15.2%) of the teachers were influenced by enrolment of students in class, 12(12.1%) of the teachers were influenced by availability of funds to buy the needed materials, 23(23.2%) of the teachers were influenced by adequacy of the instructional technologies while other teachers in negligible percentages revealed that they influenced by the time available to prepare for the technology, versatility of the instructional technologies, reliable power supply, if involved in the procurement process, attention given by the administration, if instructional technologies are provided by the school, availability of spacious room, versality of the technologies, the importance of the instructional technologies in teaching the topics, students' level of understanding and, accessibility to the instructional technologies, syllabus requirement, load of the subject and freedom of use and the cost of instructional technologies.

An item in the teachers' questionnaire asked how often instructional technologies were used for learning process. **Table 1.2** analyzes teachers' responses on how often teachers used instructional technologies as follows:

Table 1.2 How often teachers used instructional technologies

	Never		Once a year		Once a month		Once a week		Every time	
	f	%	F	%	f	%	F	%	f	%
Use of printed instructional technologies	1	1.0	1	1.0	3	2.9	4	3.9	93	91.2
Use of projected instructional technologies	56	62.2	7	7.8	15	16.7	8	8.9	4	4.4
Use of non-projected instructional technologies	17	18.7	4	4.4	16	17.6	26	28.6	28	30.8

N/B: Percentages were based on number of responses per item

The table shows that out of 104 respondents; 93(91.2%) of the teachers reported that they used printed instructional technologies every time they taught whereas other percentages were negligible, 56(62.2%) of the teachers reported they never used projected instructional technologies whereas 15(16.7%) of the teachers reported that they used projected instructional technologies once a month; other percentages on use of projected instructional technologies were negligible, 28(30.8%) of the teachers reported that they used non-projected instructional technologies every time, 26(28.6%) of the teachers that they used non-projected instructional technologies once a week, 16(17.6%) of the teachers reported that they used non-projected instructional technologies once a month and 17(18.7%) of the teachers reported that they never used instructional technologies whereas other percentages were negligible on use of non-projected instructional technologies. Figure 4.5 below further emphasizes the distribution of teachers' responses on how often they used instructional technologies.

Further, teachers were asked whether the instructional technologies they used were adequate. Out of 104 respondents, 30(29.1%) of the teachers reported that instructional technologies were adequate whereas73 (70.9%) of the teachers reported that instructional technologies were not adequate. Both the head of department and principals of the selected schools confirmed their availability but inadequate. The head of departments confirmed further that teachers used instructional technologies regularly. To confirm what the teachers, heads of departments and the Principals said; an item in the students' questionnaire asked the instructional technologies used for learning process. **Table 1.3** analyzes the responses as follows:

Table 1.3 Instructional technologies for learning processes

Items	No		Yes	
	Frequency	Percentage	Frequency	Percentage
Maps and diagrams	39	7.3	494	92.7
Globes	181	36.9	310	63.1
Charts	68	13.0	455	87.0
Magazines	206	40.6	301	59.4
Journals	344	72.4	131	27.6
Radio	345	71.3	139	28.7
Television	330	68.5	152	31.5
Video recordings	391	82.3	84	17.7
Computer	247	47.7	271	52.3

N/B: Percentages are based on the number of responses for each item

Table 1.3 shows that out of 544 respondents; 494(92.7%) of students reported the use of maps and diagrams for learning process whereas 39(7.3%) reported that they never used Maps and diagrams, 310(63.1%) reported the use of the globes whereas 181(36.9%)reported that they never used globes, 455(87%) reported the use of charts whereas 68(13.0%) reported that they never used charts, 301(59.4%) reported the use of Magazines whereas206 (40.6%) reported that they never used Magazines, 131(27.6%) reported the use of Journals whereas 344(72.4%)reported that they never used Journals,139(28.7%) reported the use of Radio whereas 345(71.3%) reported that they never used radio,152(31.5%)reported the use of television whereas 330(68.5%) reported that they never used television, 84(17.7%) reported the use of video recordings for learning whereas 391(82.3%) reported that they never used Video Recordings, 271(52.3 %)reported the use of computers for learning whereas 247(47.7%) reported that they never used computers for learning. On the other hand, the heads of departments confirmed that teachers' interactivity and use of instructional technologies was influenced by of their availability even though some of the instructional technologies' use posed a big challenge to some teachers.

The study used the observation schedule to confirm what both teachers and students gave. The researcher decided to investigate further whether the instructional technologies were adequate for both teachers and students in order to make fair judgment about interactivity and use of instructional technologies in the sampled schools. The research confirmed interactivity and use of instructional technologies though use of some instructional technologies were challenging to some teachers. The head of departments also confirmed interactivity and use of instructional technologies though they were inadequate.

UNESCO (2002) affirms that learning is an active and not a passive process. To allow students to move towards competence, they must be actively engaged in the learning. According to Hung & Khine (2006), meaningful learning occurs when learning is interrelated, interactive and interdependent. That is, learning and instructional activities should engage and support combinations of active, constructive, intentional, authentic and cooperative learning because they are synergetic. Omwenga, (2008) in his study confirmed that other teachers in the world used instructional technologies in teaching and learning, therefore by using them both teachers and students are moving to the digital era.

However, according to Patel (1986), the availability of instructional technologies does not necessarily mean the proper utilization of the same whereas Newby et al. (2006)

asserts that the use of technology cannot become meaningful support for students' work if they have access to it for only a few minutes a week. But Kemp & Dayton (1985) argue that the use of instructional technologies can help to reduce the length of time for instruction and assist in a lot of content in summary form.

The findings of the study revealed that teachers were influenced by certain factors such as availability of instructional technologies, knowledge and skills on use, time available to prepare, reliable power supply, procurement process, attention given by the administration, if the instructional technologies are provided by the school, availability of room, versatility of the technology, their importance in teaching the topic, students' level of understanding and enrolment, syllabus requirement, accessibility to the resources, teachers' load and the cost of resources.

The teachers especially if they wish to reap from the endeavors of their teaching, should pay attention to the use of instructional technologies when teaching their students. The research therefore opted to investigate the preparedness of teachers on how to successfully use instructional technologies in teaching and learning process.

Challenges faced by both: (a) teachers and (b) students on use of instructional technologies:

Table 1.4 analyzes teachers' responses as follows:

Table 1.4 Challenges facing teachers on use of instructional technologies

Challenges faced by teachers	Frequency	Percentage
Unskilled /ICT illiteracy/limited skills	38	37.6
No enough/unavailable of instructional technology	35	34.7
Unavailability of funds to buy instructional technology	35	34.7
Limited time/lack of time	27	26.7
Lack of support from administration/educational authorities	12	11.9
Many students	16	15.8

N/B: Percentages based on the number of responses given

Out of 104 respondents, 38(37.6 %)of the teachers reported that they had limited skills/unskilled, 35(34.7%)of the teachers reported that instructional technologies were not enough/unavailable, 35(34.7 %) of the teachers reported unavailability of funds to buy instructional technologies, 27(26.7%) of the teachers reported that they had limited time to use the various instructional technologies as the syllabus was so wide that they may not cover it, 12(11.9 %) of the teachers reported that they lacked support from school administration as some principals locked some instructional technologies in stores and make very strict rules for anybody who wished to use them,16(15.8 %)of the teachers reported that there were many students in classes which made it impossible to use some instructional technologies, other teachers in negligible percentages reported that they were not consulted in the procurement process, no time to improvise instructional technologies to use, some teachers reported that some teachers were lazy and did not bother to use the instructional technologies, some teachers reported of unreliable power supply, lack of infrastructure (storage facilities) and space for installing materials, poor budgeting/administration unwilling to by enough instructional technologies, lack of opportunities to apply technology, low equipped laboratories, loss of materials from students and school, lack of motivation as teachers are overtaken by events as some heads of departments and principals do things without consultation, some instructional technologies such as radios breakdown hence students miss lessons and low response on material requisition in departments whereas some teachers still believed that if a teacher explained well the information to the students; the students would understand the information even if the teacher did not use the instructional technologies.

Further, an item in students' questionnaire required students to state challenges they faced when instructional technologies were used. Table 1.5 analyzes students' responses as follows:

Table 1.5 Challenges faced by students on use of instructional technologies

Challenges faced by students	Frequency	Percentage
Some can't be understood easily (contradicting)	195	37.4
Some teachers are fast when explaining	140	26.9
Some experiment/science procedures are hard to follow	79	15.2
Are not enough in school (sharing of computers in the lab)	169	32.4
Background technology wise (some students are illiterate)	71	13.6
Small room/congested (can't accommodate all students)	61	11.7
No enough explanations	55	10.6

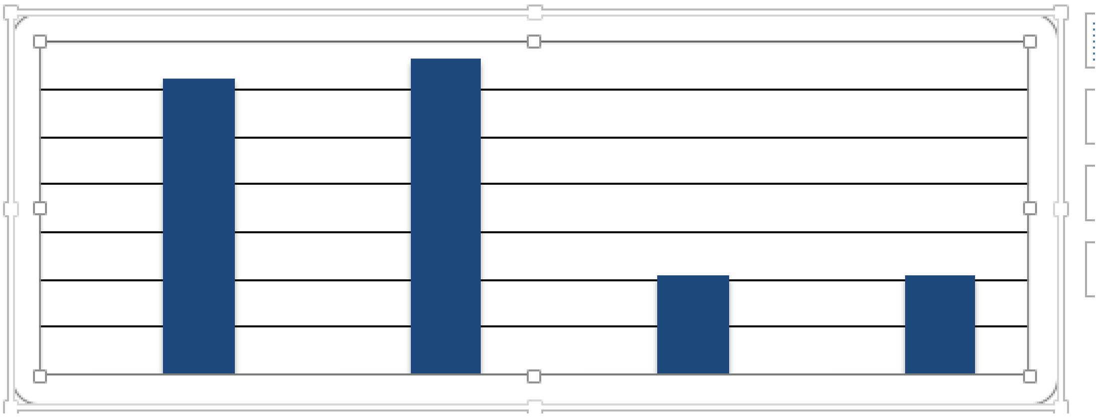
N/B: Percentages are based on the number of responses for each item

Out of 544 respondents, 195(37.4%)of the students reported that some instructional technologies could not be understood easily (were contradicting), 140(26.9%) of the students reported that some teachers were fast when explaining which made them not to comprehend the lesson, 79(15.2%) of the students reported that some experiment procedures were hard to follow when done once thus they need more practice which was denied due to inaccessibility to the science laboratories during their free time, 169(32.4%)of the students reported that they shared some instructional technologies thus limiting individual accessibility and practice,71(13.6%)of the students reported that they had limited technological knowhow on use of some instructional technologies, 61(11.7%)of the students reported congestion in classrooms,79(15.2%)of the students reported that they had limited time to access some instructional technologies available, 55(10.6%) of the students reported that there was no enough explanations given when some instructional technologies were used. Other students in negligible percentages reported lack of accessibility to some instructional technologies during their free time, lack of skilled personnel to provide assistance especially from some teachers and laboratory assistants, some students steal the resources for others not to use, while others felt that the use of some instructional technologies waste time and others said some subject teachers use instructional technologies while others don’t use at all.

To verify the information given by teachers and students, the research sort information from the head of departments and principals whereby there was an item asking those challenges teachers and students faced and they both confirmed what both teachers and students gave.

The teachers and students were further asked to give suggestions regarding the challenges they experienced when using instructional technologies. Figure 1.1 shows teachers’ suggestions on how to overcome the challenges faced.

Results: Figure 1.1 Teachers' suggestions on overcoming the challenges faced



Out of 104 respondents; 30(31.2 %) of the teachers suggested that teachers should be trained on how to handle /use instructional technologies such as computers /ICT, 32(33.3 %) of teachers suggested that the schools buy more instructional technologies to cater for swollen classes, 10(10.4%)of teachers suggested that the schools to organize harambee s/ask donors to assist in buying instructional technologies, 10(10.4%)of teachers suggested that the government should ensure there is reliable power supply in all schools, 10(10.4%) of teachers suggested that students should be exposed to technology early. Other teachers in negligible percentages suggested that the schools should put up infrastructure for computer installation in classes, buy modern computers/renovate and repair facilities, acquire enough instructional materials, have other power alternatives, provide security and stores for keeping facilities, management to collaborate with teachers on material requisition, admit manageable number of students, develop INSETS for teachers to replenish their skills on use of instructional technologies, provide internet to enable them share what other teachers are doing in the world, employ more teachers especially those with technical skills to reduce teachers' work load, equip the laboratories as a long term project, motivate teachers for improvisations and the government to help schools to purchase more materials by providing more funds.

Table 1.6 Students' suggestions on overcoming the challenges faced

Suggested ways of overcoming the challenges faced	Frequency	Percentage
Teachers to use simple terms when teaching	55	11.3
Timely managed (Slow the speed of presenting)	81	16.6
Allow students use computers& science labs freely for practical	276	56.7
More instructional materials (buy enough/quality computers &other instructional materials)	242	49.7
Add more skilled/experienced teachers	53	10.9

N/B: Percentages are based on the number of responses for each item

Out of 544 respondents, 55 (11.3 %) of students suggested that teachers to use the simple terms when teaching, 81(16.6%) of students suggested teachers should slow down the speed of presenting, 276(56.7%) of students suggested that students should be allowed to use computers and science laboratories freely for practice during their free time, 242(49.7%) of students suggested that schools should buy enough instructional technologies such as quality computers and other instructional materials, 53(10.9 %) of students suggested that the schools should add more skilled teachers on use of instructional technologies. Other students suggested in negligible percentages that the schools should build bigger rooms/laboratories to accommodate the enrolled population, connect computers to the internet, be exposed to technology early, have generators in case of power failure, update/hire laboratory technicians with modern technological skills, allow students to access available materials freely and expose them fully to the resources, government to implement policies that it can meet especially on provision of instructional technologies and modify classes to be compatible with instructional technology facilities. Figure 4.11 below emphasizes the results shown on the table above, and the percentages show students' suggestions on how the challenges can be overcome.

The findings revealed a myriad of challenges facing both teachers and students in the use of instructional technologies. This conquers with Mogeni (2005) in a study on factors influencing the utilization of resources in the teaching of Kiswahili in Transmara district whereas Msei (1985) in a survey of teaching resources for teaching and learning of Kiswahili in primary schools in Central Division, Machakos District found out that most teachers in schools did not use teaching resources partly due to ignorance of their importance and called for the organization of seminars, symposia and workshops to help equip the teachers with the skills and awareness to effectively use instructional resources. Andafu (1996) also in a study of factors affecting the teaching of Kiswahili in secondary schools in Lame District indicated that most teachers did not make any effort to use even simple teaching aids.

Conclusion

The main question that this study endeavored to answer was what challenges faced teachers and how students used instructional technologies.

Based on the findings of the study, the following conclusions were made:

1. Although many teachers in the selected secondary schools in Kisii County were academically and professionally qualified, they had very limited post-training on the use of instructional technologies.

2. The teachers appreciated the role played by the use of instructional technologies in teaching and learning process. However, they hardly use most of these instructional

technologies available in their schools. They mainly use textbooks, chalkboards and laboratory equipments for Chemistry, Biology and physics.

3. Print resources were the most commonly available instructional technologies in the selected secondary schools in Kisii County. However, many of the available instructional technologies were inadequate in both quality and quantity; despite their being accessible to teachers and students.
4. Though schools provided a few, parents were the main providers of instructional technologies for teaching and learning process. However, teachers were sparingly consulted or involved in the procurement process.
5. Very minimal instructional technologies were being prepared locally by teachers for use during the learning process thus, students were hardly involved in the preparation some of the instructional technologies. This was mainly because schools lacked enough funds to buy the raw materials and provide storage facilities while on the other hand; administration didn’t allow students to assist for the same.
6. The instructional technologies that were preferred by teachers in teaching and learning process were charts, Globe, maps models, audio cassettes, handouts, class readers (books), pamphlets, radio, news papers and diagrams. Some schools had computers but they were mainly used for computer studies subject and SMASE teachers (Mathematics and Science) rarely used the Liquid Cristal Display (LCD).
7. The main driving force that influenced the teachers’ choice of instructional technology for teaching learning process were the availability of the instructional technologies, the class or form and the students’ level of understanding.
8. The major challenge teachers expressed as impeding their effective use of instructional technologies were that some instructional technologies made them spend a lot of time in

teaching topics, rigid administration in provision and providing storage facilities and the suitability of the instructional technologies to suit topics being taught.

9. Scarcity of some instructional technologies and especially lack of modern efficient instructional technologies in the schools, lack of technological assistants and lack of sufficient knowledge of use of these technologies made the teaching and learning process very difficult.

“Learning is facilitated when new knowledge is integrated into learners’ world…’’Education as central to a knowledge society must produce people who are able to create and gain from the new knowledge (Bereiter 2002).

Hung & Khine (2006) adds that; learners need access and manipulate available resources and appreciate the skills and knowledge each instructional technology provides. This is because the choice of instructional technologies can greatly affect the way information may be structured and manipulated.

The research will give educators a better understanding of the importance of functional, usable, communicative, and aesthetically appropriate use of instructional technologies.

Recommendations of the study

The following recommendations were made based on the findings of the study:

1. The study findings revealed that the instructional technologies available in schools were barely enough and some were outdated. The Ministry of Education, Science and Technology (MoEST.

Further, the Ministry of Education, Science and Technology should:

Organize seminars, workshops and any other in-service courses frequently to familiarize and sensitize with a wide range of instructional technologies and their potentials. This could trigger teachers' creativity and innovation in the use of instructional technologies in teaching and learning process.

Moreover, the planners/organizers of such seminars and workshops should ensure that the teachers personally get information about the seminars/workshops to avoid communication breakdown and encourage them to attend.

Ensure that the authors and publishers avail the necessary new, instructional technologies especially textbooks in the market and schools promptly whenever the syllabus is revised.

This will ensure that schools acquire and use the current instructional technologies and adequately prepare students for the national examinations.

Regularly seek information from teachers and students on the challenges they face in teaching learning process using instructional technologies. This will enable the Ministry of Education to organize necessary in-service courses for the teachers to mentor direct and monitor improved production and provision of instructional technologies; design instructional technologies with the teachers and students in mind, or otherwise seek alternatives of solving or easing the teachers' problems thus enabling them to teach more effectively. Establish instructional technologies centers as close as possible to teachers including instructional technologies mobile services.

2. Planning and designing learning environments and experiences. To achieve these teachers should:

Design developmentally appropriate learning opportunities that apply technology-enhanced instructional strategies to support the diverse needs of learners.

Apply current research on teaching and learning with technology when planning learning environments and experiences.

Identify and locate instructional technologies and evaluate them for accuracy and suitability.

Plan for the management of instructional technologies within the context of learning activities.

Plan strategies to manage student learning in a technology-enhanced environments.

Planning helps teachers to determine instructional technologies they will use. Instructional plan plays a critical role in directing the selection and use of all other tools within the learning environment (Newby et al. 2006).

3. Plan teaching, learning, and the curriculum, which apply technology to maximize student learning. To realize this teachers should:

Apply technology to develop students' higher-order of skills and creativity.

Facilitate technology-enhanced experiences that address content standard standards and student technology standards.

Manage student-learning activities in a technology-enhanced environment.

Use technology to support learner-centered strategies that address the diverse needs of students.

4. Teachers use technology to enhance their productivity and professional practice by:

Using instructional technology to engage in ongoing professional development and lifelong learning.

Continually evaluate and make reflection on professional practice to make informed decisions regarding the use of instructional technology in support of student learning.

Apply technology to increase productivity.

5. Teachers understand the social, ethical, legal, and human issues surrounding schools and apply those principles in practice. Teachers should:

Promote safe and healthy use of instructional technology.

Apply instructional technology to enable and empower learners with diverse backgrounds, characteristics, and abilities.

Facilitate equitable access to instructional technology for all students.

References

Amutabi, M.N (2004). Challenges facing the use of ICT in Kenyan Universities. UNESCO Forum collegiums on Research and Higher Education Policy 1 –3 December 2004

Andafu, O.I. (1996). "A study of the Factors Affecting the Teaching and Learning of Kiswahili in selected secondary schools in Lamu District.'' Kenyatta University-Unpublished P.G.D.E. project.

Anglin, G. J. & Gary, J. (1995). Instructional Technology: Past, Present and Future. Second Edition. Englewood co: Libraries Unlimited, New York

Atchison, J. (1998). Access to books and Journal articles by postgraduate students. University of Natal. South Africa

Ayot, H.O. (1986). Instructional Materials for Educational Communication and Technology. First Edition. Kenyatta University, Kenya

Azeb, D. (1975) An investigation of the Utilization of Community Resources in Elementary Schools of Ethiopia to Provide Relevant Basic Education.Unpublished PhD Thesis, Ohio University

Babbie, E. (1992) The practice of Social Research. Belmont, C.A Wadsworth/Thomson Leaening 2001

Bates, A.W. (1990). Media and Technology in European distance education: Proceedings of the EADTU workshop on Media Methods and Technology Open University, Milton Keynes

Bell, J. (1993). Doing Your Research Project. Open University Press. Buckingham

Bereiter, K.D. (2002). Education and Mind in the Knowledge Age. Lawrence Erbaum Associates, NJ, Mahwah

Best, J. (1993). Doing Your Research Project. Open University Press, Buckingham

Best, J.W. & Kahn, J. V. (2000). Research in education. Sixth edition. New York

Betz, B. H. (1990). Visuals and Learning. Pacific Press, Nampa

Bogonko, S.N (1992). Reflection on education in East Africa, OUP, Nairobi

Bless, C. & Higsons S. (1995). Fundamental of social research method. An African Perspective, second edition. Julai Kenwyn

Borg, R.W. & Gall M.D. (1989) Educational research: an introduction. Longman Inc: New York

Bork, H. (2004). Professional Development and Teacher Learning: Mapping the Terrain. Educational Research, 33(8), 3-15

Brown, J.W.; Lewis, R. B.; & Harcleroad, F. F. (1973) av instructional technology media and Methods, Fourth Edition. McGraw Hill, Inc, New York

Dahiya, S.S. (2004). Education Technology towards Better Teacher Performance. Shipra, New Delhi

Dale, E. (1969). Audio-Visual Methods in Teaching Third Edition. The Dryden press, New York

Facer, K., Furlong, R. & Sutherland, R. (2003). Screenplay. Children and Computing in home. Routledge/Falmer, London

Fraenkal, J.R. & Wallen, N.E. (1993).How to Design and Evaluate Research in Education. McGraw-Hill, Inc.

Gacegoh, J.N. (1990). “A study of the Utilization of learning Resources in Teaching of Christian Religious Education in Secondary Schools in Embu, Kenya”. Unpublished Thesis, Kenyatta University

Gagne, R.M. (1965). The Conditions of Learning. Holt, Rinehart and Winson. New York.

Gamble, K.T. (1984): Communication works. Random House, Inc: New York

Gay, L.R. (1996). Educational Research: Competences for analysis and application, forth edition: Macmillan Publishers, New York

Grabe, M. & Grabe, C. (1998). Integrating Technology for meaningful learning: Second edition, Houghton Mifflin Company. Boston

Groenewegen, T.G. (2006). Visually handicapped learners learning from sighted teachers. A Conceptual framework for research into special instructional technology. African Journal of Education. Kenyatta University, Nairobi

Gerlach, V. S and Ely D. P (1971). Teaching Media; a systematic Approach, Prentice – Hall, inc. Englewood cliffs (N.J)

Hadad, W. D., & Draxler, A. (Eds) (2002) Technologies for Education: Potentials, Parameters and Prospects.AED /UNESCO, Washington D.C

Heinich, R.; Molenda, M. &. Russell, J.D. (1985) Instructional Media and the New Technologies of instruction. John Wiley & Sons, Inc. New York

Hoban, C. (1962). Research in New Media in Education, “Three Conference Working Papers” (Washington D.C American Association of College for Teacher Education p. 22 – 23)

Hooper, S. R. (2002) Educational Multimedia. In R.A. Reiser & J.V. Demps (ed).Trends and Issues in Instructional Design and Technology. Upper Saddle River, N.J Pearson Education. Inc. New York

Hung, D. & Khine, M.S. (2006). Engage Learning with Emerging Technologies. Nangang Technological University, Springer publisher, Singapore

Johassen, D. H. (2000) Computers as Mind tools for Schools: Engaging Critical Thinking. Upper Saddle River, N.J: Prentice Hall, Inc. New York

Kane, E. (1995). Seeing yourself: Research handbook for Africa. Second Edition

Learning Resources

Kemp, J. E & Dayton, D.K, (1985) Planning and Producing Instructional Media, Harper and Row Publishers, New York

Kimui, V.W. (1988). A study of Availability and use of the Learning and Teaching Resources in Primary Teachers' Colleges in Kenya" Kenyatta University-Unpublished PhD Thesis

Kinyanjui, L. (1997). Availability and Utilization of instructional media in Teaching and Learning Physical Education in some selected Primary Teachers' Colleges in Kenya. Kenyatta University-Unpublished M.Ed. Thesis

Kinyua, G.W. (2009). Availability and use of Teaching Learning Resources in Public Diploma Teachers' Training Colleges in Kenya.'' Kenyatta University-Unpublished M.Ed. Thesis.

Kothari, C.K. (2004). Research Methodology: Methods and Techniques Second Edition. New age international publishers, New Delhing

Lee, K.T. (2000C). Enhancing teaching and learning in schools through facilitation of online learning: Issues of implementation in Hong Kong schools. In J. Massion (Ed.), connecting the future, proceedings of the Global summit of online knowledge Networks (123-29), March 4-5, Adelaid, Australia.

Linns, M. C. (1997). Learning and Instruction in Science education: Taking advantage of Technology. In D, Toin & B.J Fraser (eds), International handbook of Science Education. Kluwer, Netherlands

Locatis, C.N. & Atkinson, F.D. (1984). Media Technology for Education and Training. Charles E. Meril Publishing Co; Columbus, Ohio

Locke, F.L.T. Silverman, J. S. & Spirduso (2004). Reading and Understanding Research. Sage Publications Inc. California

Lumumba, P.O. (2008).'' A survey of challenges facing e-learning Public Secondary Schools. A case study of Nepad schools in Kenya.'' Unpublished Research Project

Macharia, K. (1987). Teaching Methodologies. Trust Printers, Nairobi

Maleche, A.J. & Krystal, A. (1974). ''The Library as an educational tool.'' Maktabar official Journal of Kenya Library Association

Mehra, P. & Mital, M. (2007). Using ICT to Transform Education. The University of the Western Indies India

Ministry of Education, Science and Technology (2005). Sessional paper No.1 of 2005, A policy Framework for Education, Training and Research, Nairobi Government printers

Mishra, P. & Koehler, M.J. (2006).Technological Pedagogical content knowledge: A framework for teacher knowledge. Teachers' college Record, 108(6), 1017-1054, New York

Misoy, C.C. (1987). "Availability of instructional materials in teaching Geography in Secondary Schools in Kenya with special Kenyatta to Kericho County," Unpublished P.G.D.E Project." Kenyatta University

Mogeni, J.M. (2005).''Factors Influencing Utilization of Resources in Teaching Kiswahili in Selected Public Secondary Schools in Transmara District, Kenya.'' Kenyatta University – Unpublished M.ed. Thesis

Msei, I. (1985). A survey of Resources for Teaching and Learning Kiswahili in some selected Primary schools of Central Divisioon, Iveti South, Machakos District, 'University of Nairobi-Unpublished M.Ed. Project

Muchiri K. D. (1997). Investigating the availability and use o0f teaching and learning resources in Mbugithi Secondary School. Unpublished PGDE Thesis. Kenyatta University

Mugenda, O.M & Mugenda, A.G. (1999). Research Methods: Quantitative and Qualitative approaches. Africa centre for technology studies (ACTS) press Nairobi Kenya

Mukwa, C.W. (1979). Towards a systematic Approach to Educational Media use in the Secondary School of the Republic of Kenya. A field Survey of Tools and Technologies Education for learning" Unpublished PhD Thesis Michigan State University

Munyilu, F.M. (1985). ''A survey of instructional Resources for Mathematics in Selected Primary schools of Kathonzweni Educational Zone, Machakos District,

Kenya 'Kenyatta University-Unpublished M.Ed. project Muriithi, P. (2005).

A framework for Integrating I.C.T in the Teaching and Learning Process in Secondary Schools: School of Computing and Informatics, University of Nairobi, Kenya

Murray, L. & Lawrence, B. (2000). Practitioner-Based Enquiry: Principles for Postgraduate Research. Falmer Press, London.

Mwiria, K. & Wamahiu, S.P. (1995). Issues in Educational Research in Africa. East African Educational Publishing Limited, Nairobi

Newby, T. J., Stepich, D. A., Lehman, J. D. & Russell, J.D. (2006).Educational Technology and Learning for Teaching and Learning. Pearson Merrill Prentice Hall, New Jersey

Nkpa, M. (1997). Educational Research for Modern Schools; fourth edition: fourth dimension publishing company. Enugu-Nigeria

Nwana, O.C. (1981). Introduction to Educational Research. Heinemann Educational Books Ltd, Ibadan

Ogechi, C.O. (1992). Availability, utilization and management of geography teaching-learning resources in Kenya secondary schools: A case of Nyamira county. Unpublished M.Ed. Thesis. Kenyatta University

Omwenga, N.M (2001). Use of Media resources during teaching practice (A study of Kamagambo and St. Paul). Kenyatta University, Unpublished, Med Thesis

Onadivan, G.T. (1981): A Study of School Library Resources in selected Secondary Schools in Nigeria unpublished Ph.D. thesis Boston. University Education

Orina, W.M. (2001). Availability, utilization and management of geography teaching-learning resources in Kenya secondary schools. A case of Nyamira County." Unpublished M.Ed. thesis Kenyatta University

Orodho, J.A (2004). Techniques of Writing Research Proposal and Reports in Education and Social sciences fifth edition Mosola publishers, Nairobi (2008 edition). Techniques of Writing Research Proposal and Reports in Education and social sciences fifth edition Masola publishers, Nairobi

Oure, A.L. (1985).''A survey of Learning Resources in selected schools of Amagoro Division, Busia District, Kenya.'' Unpublished M.Ed. project, Kenyatta University

Patel, M. M. (1986). Instructional Materials for Educational Communication and Technology First Edition. Kenyatta University, Nairobi

Patton, M.Q. (1990). Qualitative evaluation and research methods safe publications, Newbury Park, California

Robler, M.D. (2003). Integrating Educational Technology into Teaching. Upper Saddle River, NJ Merril prentice Hall, New York

Romiszonski, A. J. (1974). The Selection and use of Instructional Media. Kogan Ltd. London Heinich, R.; Molenda, M. &. Russel, J.D. (1985). Instructional Media and the New Technologies of instruction. Third Edition, Macmillan Publishing Company, New York

Saettler, P. (1990). The Evolution of American Educational into Technology. Englewood, co: Libraries Unlimitted, New York

Scholl, G.T. (ed) (1986). Foundation of Education for the Blind and Visually Handicapped Children and Youth: Theory and Practice New York. American foundation for the Blind inc. A.W.

Shitahi, E. (1992) 'An investigation into the use of the component in training In-Service Primary Teachers.' Kenyatta University-Unpublished M.Ed. Research Proposal

Shulman, L.S. (1986). Those who understand: Educational Researcher, 15(2), 4-14

Shanguya, M.N. (1995). Factors Relevant to Teacher Training Improvement. A Case study of Instructional Technology in the curriculum of Teacher Education Programme of Kenyatta University."Unpublished Thesis

Sproul, N. (1995). Handbook of research methods. A guide for practitioners and students in Social Sciences, second edition. Meuthen Scare Scrow, London Stabler,

E. (1969). Education Since Uhuru: The schools Kenya. Wesley University Press, Middletown. Connectivity.

Travers, R. N.W. (1973). Second Handbook of Research on Teaching. Rand Mc Nally Company Chicago

UNESCO, (2002). Information and Communication Technologies in Teacher Education: A planning guide. Division of higher Education, France (Paris): UNESCO

Unwin, D. & Mclease, R. (1978). The Encyclopedia of Educational Media Communication and technology. The Macmillan press

Vygotsky, L.S. (1978). Mind in Society. Harvard University press, Cambridge, Massachusetts U.S.A

Waema, J.M. (2005). In ETA, F.E and Elder, L. (ed). A Brief History of the DVI of ICT policy in Kenya. At crossroads: ICT policy making in East Africa. East Africa Educational publishers Ltd. Nairobi, Kenya

Wagner, R. (1961). Design in Education, the newsletter volume xxvii, November 1 (college of education, the Ohio State University, coulombs, Ohio)

Walton, J. & Ruck, J. (1975). Resources and Resource Centre. London Ward Lock Educational, London

Wellington, J. (2000). Educational Research: Contemporary Issues and Practical Approaches. London: Continuum

Wendt, P. (1975). Audio-Visual Instruction. NEA, Washington D.C. United States

Wilbur, S. (1962). Instructional Material, Media and Technology Educational Research April. (P.156), Washington D.C, United States of America

Wiman R.V (1969) Educational Media; theory into practice, Merril, Columbus, Ohio.

Wirris, P. & Lawler, M. (2007). International Journal of education and development. Volume 1. Investigating ICTs in educational Institutions in Developing Countries

Wittch, W.A. & Schuller, C.F. (1962). Audio-Visual Materials: Their Nature and Use. Harper & Row, New York Internet Sources

Duffy, J. Johassen D, and Lowyck, J. (1993). Designing constructivist learning environments, springs- w.w.w.zu.ac.ae/the http://groups.yahoo.com/LTHE International Journal of Education and development using Information and Communication Technology (IJEDICT) 2007, Vol. 3, pp 2-4.Article by Mary Daniels Brown. Archived Information

Moore, A. H.; Moore, J.F. & Bofern, P. H.R. (2003). Information Technology Review, Zayed University Dubai, United Emirates. www.zu.ac.ae/the

Muriithi, P. (2005). A Framework for Integrating ICT in the Teaching and Learning process In Secondary Schools: school of computing and informatics, University of Nairobi eomwenga@uonbi.ac.ke

Newhouse, (2005). The impact of ICT on Learning and Teaching. A Literature Review, Western Australia Department of Education. Archived Information

Omwenga, I.E. (2008). Pedagogic Issues and E-Learning Cases: Integrating ICTS into Teaching- Learning process. School of computing and informatics. University of Nairobi, eomwenga@uonbi.ac.k

UNESCO, (2005). Toward the Knowledge Society: UNESCO World Report: Paris: UNESCO. Available online, www.unesco.org/en/worldreport

EFFECTS OF A PROBLEM-SOLVING APPROACH ON COGNITIVE LEVELS OF PERFORMANCE OF PROSPECTIVE TEACHERS IN MATHEMATICS: A CASE STUDY OF GHANA'S UNIVERSITY OF CAPE COAST

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Abstract

The research was carried out to examine the effects a problem-solving approach will have on the cognitive levels of performance in mathematics of 2012/2013 first-year Centre for Continuing Education students enrolled in the 3 year Diploma in Basic Education programme of University of Cape Coast, Ghana. The data collected were based on the following cognitive levels of learning domains: Knowledge (scored out of 5), Comprehension (scored out of 6), Application (scored out of 9), and Analysis (scored out of 5). A sample of 253 students from four learning centres took a pre-test prior to an intervention of a problem-solving approach. These same groups of students were taught in three meetings (face-to-face sessions) for nine hours, using a problem-solving approach, after which they completed a post-test. Analysis of the pre-test scores for 253 students from the four study centres showed the following means (μ) and standard deviations (σ) of levels of cognitive learning domains: knowledge (μ=1.4545, σ=1.10326), comprehension (μ= 1.0435, σ= 1.35154), application (μ= 1.0277, σ= 1.44036) and analysis (μ=0.0316, σ= 0.2498). Analysis of a post-test score for 253 students from the same four study centres showed the following results: knowledge (μ=.6047, σ=.90070), comprehension (μ=.9644, σ=1.17629), application (μ =.6759, σ= 1.26212) and analysis (μ= 0.0830, σ= 0.50102). The results of the research indicate clearly that the students demonstrated limited understanding of mathematical concepts and were unable to solve novel problems. The implications of these findings for teaching and learning of Mathematics in Ghana's University of Cape Coast, Centre for Continuing Education programme (the distance education programme) will be discussed.

Key words: Cognitive levels, Learning domains, Problem-solving approach

Introduction

Mathematics plays an important role in the scientific and technological development of a nation. Ghana's poor performance in Mathematics from the results of Trends in International Mathematics and Science Study (TIMSS) in 2003 which Ghana was ranked 44th out of 45 countries calls for a complete overhauling of the mathematics curriculum of both the Basic and Second cycle Schools and a review of how mathematics is taught. The trend of abysmal performance by the Ghana's University of Cape Coast 3- year Diploma in Basic Education first year students of the Centre for Continuing Education in mathematics since 2001 to date (Table 1.1) is worrying, since the majority of these students are prospective mathematics teachers in Ghana's elementary schools.

Table 1.1. Mathematics Achievement of First-year and Third-year UCC-CCE Distance Learners over a ten-year Period, 2001-2010

YEAR	SCORE BELOW 55% FIRST YEAR	SCORE BELOW 55% THIRD YEAR
2001	36.2	16.5
2002	34.0	30.1
2003	35.4	40.6
2004	47.4	40.8
2005	37.8	55.4
2006	41.1	40.7
2007	45.9	55.7
2008	41.2	52.0
2009	47.6	N/A
2010	49.6	N/A
AVERAGE	**44.0**	**43.0**

Source: Compiled by researcher from programme records.

These trends in abysmal performance in mathematics by majority of students in Ghana may be due to how mathematics is taught and not on what is taught in mathematics (content). Methods used in teaching mathematics in majority of schools (including teacher training colleges) in Ghana since post independence has not undergone significant metamorphosis. An executive summary of Ghana's vision 2020 (captioned, 'The First Step') states in the guidelines for formulation and implementation of policies programmes under education (section 5.1.12) that the vision will substitute teaching methods that promote inquiry and problem-solving for those based on rote learning. This is one of the medium-term (1996-2000) policies under education that is yet to materialize and it is long overdue.

This study calls for an alternative approach for teaching mathematics to 3-year Diploma in Basic Education students of Ghana's University of Cape Coast Centre for Continuing Education, of who the majority are prospective mathematics teachers in the country's elementary schools, since teachers are critical determinants of students' learning and educational progress.

Background to the Study

Mathematics is crucial not only for success in school but in being an informed citizen, being productive in one's chosen career, and in personal fulfillment. In today's technology driven society, greater demands have been placed on individuals' ability to interpret and use mathematics to make sense of information and complex situations (Rivkin, Hanushek, & Kain, 2005).

Mathematics is seen as the pivot on which all other subjects revolve. As a result, the poor performance of students, especially prospective basic school mathematics teachers, in mathematics cannot be left unattended to. These prospective teachers need to be trained to be capable enough to assist the learners they teach to do critical thinking during mathematics lessons instead of encouraging the learners to produce correct answers alone. That is to say learning should be negotiated as opposed to imposition. Thompson (1985) argues that 'if one thinks that learning mathematics as tantamount to memorizing mathematical 'facts', or an accretionary building of elaborate set of behaviors, then much of what follows will be irrelevant'. Thompson (1985) goes on to argue that the aim of mathematics education is to promote mathematical thinking. The pre-service student who is a prospective mathematics teacher's content knowledge in mathematics and cognitive levels of learning domains in mathematics is therefore critical. The prospective mathematics teacher should therefore have worth of mathematical content knowledge and problem solving competencies that will enable him or her teach mathematics effectively to the learners s/he handles (Carpenter, Fennema, & Franke, 1996).

It is argued that a prospective mathematics teacher is likely to teach the way he or she was taught by his or her mathematics teacher. The approach used by majority of mathematics teachers in Ghana to teach mathematics in majority of schools is by the rule-based, teaching-by-telling approach rather than a problem-solving approach. This approach provides few opportunities for students to develop a range of graduate skills such as critical thinking, problem solving, communication and working in groups. Such an approach of rule-based, teaching-by-telling approach, when used in teaching mathematics will likely produce majority of learners who will operate or perform at the lower levels of cognitive learning domains. Thus a shift from the rule-based, teaching-by- telling approach to a problem-solving approach to mathematics must be encouraged in Ghana's pre-service teacher training programmes. This change when done will enable prospective mathematics teachers in Ghana's basic schools to see mathematics as a doing subject and as a science of pattern and order, in which learners actively explore mathematical ideas in a cooperative and collaborative classroom environment.

Pre-service and In-service Teachers Content Knowledge in Mathematics

Central to raising students' cognitive levels of learning domains in mathematics it is improving the quality of teaching. The role of teacher education, as argued by Lappan and Theule-Lubienski (1994), is to enable teachers to choose worthwhile tasks; orchestrate classroom discourse; create a learning environment that emphasises; problem-solving, communication, and reasoning; and develop ability to analyse their teaching and students' learning (a practice rarely seen in the learning of mathematics by UCC-CCE distance learners). In order for teacher education to effectively accomplish this role, Lappan and Theule-Lubienski (1994) identify three widely accepted domains of knowledge needed by mathematics teachers: knowledge of mathematics, knowledge of students, and pedagogy of mathematics. They stress the need for teacher education to understand what knowledge and beliefs constitute these domains and what form teacher education programmes should take in order to educate teachers so that they can integrate these forms of knowledge into an effective instructional programme.

Focusing on the teachers' mathematical content knowledge, Ma (1999) advocates that elementary teachers should have profound understanding of mathematics. In order to conceptualize and clarify the domain of teachers' knowledge, Shulman (1986) classifies teachers' knowledge into seven domains namely: knowledge of subject matter, pedagogical content knowledge, knowledge of learners, knowledge of other subject content, knowledge of the curriculum, knowledge of the learner, knowledge of educational aims, and general pedagogical knowledge. Ernest (1989) also proposes a detailed analytical model of the six different types and components of knowledge of mathematics teaching, which for the purposes of this study are relevant to be examined. The different types are: subject matter knowledge of mathematics (content knowledge of mathematics), knowledge of other subject matter, knowledge of teaching mathematics, knowledge of organization for teaching mathematics, knowledge of the context of teaching, and knowledge of education. Research on mathematics teaching suggests that many teachers do not possess the requisite subject-matter knowledge to implement high-quality instruction (Ball, 1990; Ball & Bass, 2000; Ma, 1999). What then is mathematical knowledge for teaching?

Mathematical Knowledge for Teaching

In their papers, Shulman (1986) and Ball (1990) take teachers' subject-matter knowledge as mathematics teacher's mathematics achievement. Thus, subject-matter knowledge is considered as a measurable performance indicator for assessing teachers' mathematics achievement. For example, some policy makers and others have a strongly held belief that what is needed for competent teaching in any domain is a combination of subject matter knowledge and either "common sense" or general pedagogical training (Schoenfeld, 2005). Teachers' content knowledge of mathematics is a complex conceptual structure that is characterized by a number of factors, including its extent and depth, its structure and unifying concepts; knowledge of procedures and strategies; knowledge about mathematics as a whole and its history (Ernest, 1989). Ernest correctly argues that this knowledge provides an essential foundation for teaching mathematics and that the major goal of teaching mathematics is to facilitate the reconstruction of some portion of the teacher's knowledge by the learner.

For Ernest (1989), whatever means of instruction are adopted, the teacher needs a substantial knowledge base of the subject in order to plan for instruction and to understand and guide learners' responses. Furthermore, he argues that the teacher's knowledge of mathematics will underpin the teacher's explanations, demonstrations, diagnosis of misconceptions, acceptance of children's own methods, curriculum decision (such as emphasizing central concepts), and so on. In effect, Ernest seems to suggest that the knowledge of mathematics provides a foundation for the teacher's pedagogy since substantial knowledge of the subject matter of mathematics is requisite to a teacher's confidence and competence in teaching mathematics. The teaching approach that is likely to elicit and develop such substantial knowledge of the teacher's subject matter of mathematics is a problem-solving approach. The student's content knowledge of mathematics according to Wu (2003), includes the knowledge of how mathematics is usually done: the unending trials and errors, the need to search for concrete examples and counter-examples to guide one's intuition, and the need to make wild guesses as well as subject these guesses to logical scrutiny.

A Problem-solving Approach to Teaching and Learning Mathematics

A problem-solving approach taught in books is based on the work of George Polya (1945). Polya's problem-solving model involves four stages: understand the problem, devise a plan for solving the problem, carry out your plan, and look back. In this teaching approach, students are expected to learn to apply and adapt a variety of appropriate strategies to solve problems. These strategies include using diagrams, looking for patterns, listing all possibilities, trying special values or cases, working backward, guessing and checking, creating an equivalent problem, and creating a simpler problem. Problem solving is crucial in mathematics education because it transcends mathematics. By developing problem-solving skills, we learn not only how to tackle mathematics problems, but also how to logically work our way through any problem we may face. The essence of mathematics therefore resides in inventing methods, tools, strategies, and concepts for problem solving (Rav, 1999). These are learning strategies that are lacking in several UCC-CCE distance learners and this study intend to develop these learning strategies in the distance learners so as to improve their achievement in mathematics through a problem-solving approach in teaching mathematics.

Teaching mathematics through a problem-solving approach therefore provides a learning environment for students to explore problems and to invent ways to solve the problems on their own. According to D'Ambrosio (2003), proponents of teaching mathematics through problem solving base their pedagogy on the notion that students who confront problematic situations use their existing knowledge to solve those problems, and in the process of solving the problems, they construct new knowledge and new understanding. Furthermore, D'Ambrosio (2003) illustrates how learning mathematics through a problem-solving approach has been put into practice with three examples: using elementary, middle, and secondary school students. It is interesting to note in the study that learners in all the three cases although they had no formal instructions on how to solve the problems, they demonstrated a high sense of mathematical thinking and competency. Each of the examples uses the approach of confronting students with a truly problematic situation to grapple with. In effect, the outcomes of D'Ambrosio's study mean that teaching mathematics through a problem-solving approach offers the promise of fostering students' learning (Schroeder & Lester, 1989). The understanding and skills demonstrated by students in each case of the study, supports the claim that problem solving is a vehicle for developing deeper understanding of mathematical ideas and processes.

In teaching through a problem-solving approach, the discussion of a problem and its alternative solutions usually takes a longer time than the demonstration of a routine activity. In a study, Hiebert and Wearne (1993) found that classrooms with a primary focus on teaching through a problem-solving approach used fewer problems and spent more time on each of them, compared to those classrooms without a primary focus on problem solving. Moreover, they point out that in a problem-solving approach classroom, teachers ask more conceptually oriented questions (e.g., describe a strategy or explain underlying reasoning for getting an answer) and fewer recall questions than teachers in the classrooms without a primary focus on problem solving. The study by Hiebert and Wearne (1993) suggests that a judicious use of time requires effective organization of problem-solving activities and class by the teacher. This suggestion also means that the teacher should be ready to give up his or her role of transmitter of knowledge and rather become a facilitator of learning.

Teaching and learning of a mathematical topic begins with a problem that expresses key aspects of this topic, and mathematical techniques should be developed in the search for reasonable answers to the problem given. The steps also define more challenging roles by the teacher. This approach to teaching is different from what exist in a conventional (traditional teacher-centered approach) classroom. Table 1.2 shows a summary of the contrasts between a traditional (teacher-centered) approach and learning through a problem-solving approach in mathematics.

Table 1.2 Contrast between a Conventional (Traditional) Approach and Learning through a Problem- solving Approach

Approach to Learning Mathematics	
Conventional (Traditional) Approach	A Problem-solving Approach
Teacher's Role	
Lectures	Guides and facilitates
Assigns seat work	Poses challenging questions
Dispenses knowledge	Helps students share knowledge
Student's Role	
Works individually	Works in a group
Learns passively	Learns actively
Forms mainly "weak" constructions	Forms mainly "strong" constructions

Source: Masingila, Lester & Raymond (2011, p. 13)

The ultimate goal of a problem-solving approach in teaching mathematics is to enable learners develop understanding of concepts and procedural skills in mathematics, and thereby improve their cognitive levels of learning domains and therefore their academic achievement in mathematics. Theoretically, this idea of teaching mathematics via a problem-solving approach may sound feasible but its practice or implementation in the field may be challenging.

According to Tripathi (2009), when researchers who are driven by constructivist frameworks realized the practical implications of implementing teaching mathematics through a problem-solving approach, they were forced to examine the question: How does one implement the process of teaching mathematics via a problem-solving approach? Tripathi (2009) agreeably reports that the researchers suggest that the problem lies with students' classroom experiences wherein students find little scope or motivation for them to learn how to reason. What this suggestion may mean is that the teacher must give up his her transmitting way of teaching mathematic and develop problem skills in his or her learners by facilitating their learning. The learners also have to give up their ingrained negative attitudes and beliefs towards the teaching and learning of mathematics and then assume the role taking risk and doing critical thinking when learning mathematics.

The teachers' view of mathematics may direct his/her approach of teaching the subject. Ernest (1988) outlines three conceptions of mathematics: the problem solving view (a dynamic, problem-driven view, the Platonic view (static but unified body of knowledge), and the instrumentalist view (a set of unrelated but utilitarian rules and facts). It is therefore obvious that a teacher with a problem-solving view of mathematics will direct his teaching to be more learner-focused by actively involving the students in the learning process and are constructivist driven in their approach to teaching as against a teacher with instrumentalist view of mathematics who will stress on rules, facts and procedures when teaching mathematics.

Purpose of the Study

Selecting a good teaching method to be used to enhance, promote, and sustain academic performance in mathematics is an important step in any pre-service teacher preparation institution. It is therefore necessary for teachers who are likely to teach mathematics to children to undergo the use of such a teaching approach in learning mathematics so as to improve their cognitive levels domains in mathematics. The purpose of this study is to examine the effects a problem-solving approach will have on pre-service teachers' levels of cognitive domain (knowledge. comprehension, application, and synthesis) in mathematics.

Significance of the Study

The findings of the study will help assist mathematics educators in Centre for Continuing Education in Ghana's University of Cape Coast and mathematics course tutors who teach the students mathematics to use a problem-solving approach to teach mathematics, and also to design activities for teaching and learning mathematics through a problem-solving approach. The study will also help to enrich existing literature on a problem-solving approach and provide new grounds in a problem-solving approach for further research in Ghana.

Hypothesis

A null hypothesis was set to direct the study as follows:

There is no significant difference in the pre-test and post-test performance in cognitive levels of learning domains in mathematics of students who used problem-solving approach to learn mathematics.

Methodology

Research Design

The research was aimed at examining the performance of 2012/2013 first year distance education students offering 3 year Diploma in Basic Education programme of University of Cape Coast, Ghana in Mathematics. The quasi-experimental design was employed as the research design for the study since the research was conducted in the classroom setting and was not possible to assign subjects randomly to groups.

The study utilized a problem-solving approach as the independent variable while the performance in the various levels of cognitive learning domains was used as the dependent variable. An independent t-test was used to test the hypothesis that there is no significant difference in the pre-test and post-test performance in cognitive levels of learning domains in mathematics of students who used problem-solving approach to learn mathematics.

Data Collection

The data collected were based on the following cognitive levels of learning domains: Knowledge (scored out of 5), Comprehension (scored out of 6), Application (scored out of 9), and Synthesis (scored out of 5). Eight (8) mathematics course tutors who handle the students from four study centres were invited for a three days intensive orientation workshop on the use of a problem-solving approach in teaching mathematics. An expert researcher, who is also a mathematics educator, teamed up with the researcher as a resource person for the workshop. Topics treated during the workshop included: Introduction to Problem solving (Polya's strategies of problem solving), Importance of Rationale of a Problem-solving approach, Introduction to facilitator's role in a problem-solving approach, and Discussion on Cooperative learning (the role of an instructor and students in problem solving). These topics were interspersed with viewing and discussion of video clips of students engaged in a problem-solving task, as well as group activities and reporting by the participants.

A sample of 253 students' scores was randomly drawn from four learning centres after the students have taken a pre-test prior to an intervention of a problem-solving approach. These same groups of students were taught in three meetings (face to face sessions) for nine hours, using a problem-solving approach, after which a post-test was carried out and scores for 253 students randomly drawn for analysis. A descriptive and an inferential statistics were used to analyze the results.

Instruments

The instruments used for data collection contained nine multiple and structured test items for both pre-test and post-test, rubrics for marking the responses, and an observation guide for observing teaching and learning Question 1 consisted of 10 matching items which required simple recall of mathematical facts (knowledge), Question 2, 3, 4, and 5 requested students to explain or define terms to measure their understanding mathematical concepts (comprehension), Questions 7 and 8 requested students to apply their knowledge in mathematics to solve word problems (application), and Question 9 requested students to break down a novel problem into simpler problems before solving it (analysis).

Results and Discussions

Data that were obtained in both pre-tests and post-tests for the four study centres were analyzed in statistical tables.

Data for Pre-test and Post-test

Data obtained for both pre-test and post-test scores were analysed in frequency distribution tables for each of the levels of cognitive domains (Tables: 2.1s, 2.2s, 2.3s, and 2.4s etc). The first questions for pre-test and post-test for knowledge were divided into 10 parts, as shown below:

Question1, (Pre-test). Identify and match the property for integers that is illustrated in each example.

a. 4+0=4 k. commutative property for addition

b. 5•6=6•5 l. additive inverse

c. 5•1=5 m. additive identity

d. (2•7)•5=2•(7•5) n. multiplicative identity

e. 6+3=3+6 o. associative property for multiplication

f. 7 + -7 =0 p. distributive property

g. 5•6=30 q. closure for addition

h. (3+4)+9=3+(4+9) r. commutative property for multiplication

i. 9+7=16 s. associative property for addition

j. 7(5+2) =7•5+7•2 t. closure for multiplication

Question 1. (Post-test) Write down an example for each mathematical statement illustrated using the integers 13, 23 and 37.

Commutative property for addition:

……………………………………………………………………………..

b. Additive inverse:…………………………………………………….

c. Additive identity:…………………………………………………….

d. Multiplicative identity:…………………………………………………….

e. Associative property for multiplication:…………………………………….

f. Distributive property:……………………………………………………..

g. Closure for addition:……………………………………………………………………..

h. Commutative property for multiplication:………………………………………………..

i. Associative property for addition:………………………………………………………..

j. Closure for multiplication:……………………………………………………….....

Table 2.1 Results for Knowledge (Pre-test and Post-test). Marked out of 5

	Pre-test		Post-test	
SCORE	Frequency	Percent	Frequency	Percent
0	48	19.0	152	60.1
1	97	38.3	64	25.3
2	70	27.3	23	9.1
3	23	9.1	13	5.1
4	13	5.1	2	0.8
5	2	0.8	0	0.0
Total	253	100	253	100.0

Mean difference = 0.84980; Standard error = 0.08682; t = 0.000, at 5% confidence level

Results from Table 2.1 show that 85% of the students scored at most 2 out of 5 in the pre-test against 94.5% in the post-test. 15% scored at least 3 out of 5 in the pre-test against 5.9% in the post-test. These results show that majority of these students could not solve most of the mathematical facts they were taught in Senior High School and after learning through problem solving. Although the same questions were set for the post-test as in the pre-test, in the post-test, students were required to give examples of the mathematical facts instead of matching the facts to given examples as was in the pre-test. What this result may mean is that students may have done a lot of guesswork in the pre-test. Also during the intervention, students did not master the mathematical facts through relational learning.
The second questions for pre-test and post-test for comprehension were divided into four parts, as shown next:

Pre-test questions on Comprehension

2.1C Write in your own words the meaning of the statement: ‘the set of natural numbers is closed under the operation multiplication.’

2,2C Explain the relationship between the set of integers and the set of rational numbers.

2.3C Why is the number one (1) not a prime number?

2.4C Evaluate and give a reason for your answer to the mathematical sentence; $14+26\div 2$

Post-test questions on Comprehension

2.1C. Write in your own words the meaning of the statement: ‘the set of natural numbers are closed under the operation multiplication.’

2.2C. Explain the relationship between the set of integers and the set of rational numbers?

2.3C. Why is the number 1 not a prime number?

2.4C. Evaluate and give a reason for your answer to the mathematical sentence: $14+26\div 2$

Table 2.2 Results for Comprehension (Pre-test and Post-test). Total score of 5

	Pre-test		Post-test	
SCORE	Frequency	Percent	Frequency	Percent
0	131	51.8	121	47.8
1	45	17.8	52	22.1
2	34	13.4	54	21.3
3	27	10.7	14	5.5
4	11	4.3	4	1.6
5	4	1.6	2	0.8
6	1	0.4	2	0.8
Total	253	100	253	100.0
Mean difference = 0.08696; Standard error = 0.11229; t = 0.866, at 5% confidence level				

From Table 2,2, only 6.3% of the 253 sampled students demonstrated some understanding of the four comprehension questions asked by scoring at least 3 out of 6 in the pretest against 8.9% in the post-test. The rest representing 93.7% scored at most 2 out of 6 in the pre-test against 91.3% in the post-test. Also from the table, about half of the sampled students, representing 51.8%, scored zero or did not attempt any of the questions asked on comprehension in the pre-test. This result is against 47.8% in the post-test after the students had been taught through a problem-solving approach. Although, these results show some improvement in students’ performance after receiving the intervention, the improvement is statistically quite insignificant. Majority of the students demonstrated deficient understanding of the questions in the comprehension test items.

The third question for pre-test and post-test for application were divided into four parts, as shown next:

Pre-test questions on Application

3.1A. A certain stock firm registered the following gains and losses in a week: First it rose by 7 points, then it dropped by 13 points, then it gained 8 points, then it gained another 6 points, and finally lost 8 points. Write a mathematical expression that uses addition as the only operation, and then find the net change in what the stock was worth during the week?

3.2A. It takes Mamuna and Kojovi one-third of an hour and half an hour respectively to walk round the school field in the same direction. When will be their first time of meeting if they should all start at 6.30 am from a starting point?

3.3A. Round off the decimal fraction of $\frac{5}{13}$ to the nearest ten-thousandth without using any calculating instrument.

Post-test questions on Application

3.1A. A certain stock registered the following gains and losses in a week: First it dropped by 7 points, then it rose 13 points, then it gained 8 points, then it lost another 6 points, and finally gained 8 points. Write a mathematical expression that uses addition as the only operation, and then find the net change in what the stock was worth during the week?

3.2A. It takes Mamuna and Kojovi one-third of an hour and half an hour respectively to walk round the school field. When will be their first time of meeting if they should all start at 6.30 am from a starting point?

3.3A. 13 women shared 5litres of oil equally. How much litre(s) of oil to the nearest ten-thousandth litre(s) will each get? Do not use any calculating instrument.

	Pre-test		Post-test	
SCORE	Frequency	Percent	Frequency	Percent
0	141	55.7	181	71.5
1	43	17.0	27	10.7
2	15	5.9	7	2.8
3	38	15.0	26	10.3
4	10	4.0	8	3.1
5	4	1.6	4	1.6
6	1	0.4	0	0.0
7	1	0.4	0	0.0
8	0	0.0	0	0.0
9	0	0.0	0	0.0
Total	253	100	253	100.0

Mean difference = 0.34387; Standard error = 0.11348; t = 0.013, at 5% confidence level

Table 2.3.1 shows that out of a total score of nine of the pre-test items for application, 93.7% scored at most four as against 97.6% in the post-test. Only 6.3% scored at least 5 against 2.4% in the post -test. This result again demonstrates students' low level of applying knowledge acquired in mathematics to solve word problems. Critical thinking might have been played down. It may be that students were looking out for rules to use to solve the problems and therefore did no critical thinking to enable them solve the problems. The teaching approach perhaps failed to develop such a skill of critical thinking.

The fourth question for the pretest was of only one part. The same questions was repeated for the post-test as shown next:

Analysis of questions for both pre-test and post-test

4.1S. Formulate a rule for finding the sum of the page numbers of a newspaper with 30 pages.

Table 2.4 Results for Analysis (Pre-test and Post-test). Marked out of 5

	Pre-test		Post-test	
SCORE	Frequency	Percent	Frequency	Percent
0	248	98.0	244	96.4
1	3	1.2	4	1.6
2	1	0.4	1	0.4
3	1	0.4	1	0.4
4	0	0.0	3	1.2
5	0	0.0	0	0.0
Total	253	100	253	100.0

Mean difference = -0.04941; Standard error = 0.03282 t = 0.435, at 5% confidence level

Table 2.4 shows 99.6% of the students scored at most 2 out of 5 in the pre-test against 98.4% in the post-test. Also 98.0% of students scored zero (0) or did not attempt the question in the pretest. This is against 96.4% (a slight improvement) in the post-test. Only one (1) student representing 0.4% scored 3 out of 5 in the pre-test against four students (4) representing 1.6% (an improvement) scored 3 or 4 out of 5 in the post-test. Although there were some improvements in students' performance in the post-test as compared to the pre-test, majority of students demonstrated their inability to do critical thinking, take risk, plan and adopt strategies to solve novel problems.

Discussion of Results

The results obtained in both the pre-tests and post-tests for the study were not encouraging. The general performance clearly indicates students' weakness in all the four levels of cognitive domains assessed in the study. For instance, 210 out of 253 (representing 94.1%) students scored at most 3 out of 5 in the pre-test while in the post-test, 248 out of 253 (representing 98.1%) scored at most 3 out of 5. The results for the other cognitive levels of domains, such as comprehension and application, were not different. Students' performance in analysis needs special mention: 248 out of 253 (representing 98%) of the students scored zero (0) out of 5 in the pre-test, while in the post-test, 244 out of 253 (representing 96.4%) students scored zero (0). What these results imply are that the majority of the students could not take the risk of building structures, looking out for patterns, putting parts together to form a whole and creating new meaning or structures from novel problems. Practically, the majority of the students were lacking the ability to do critical thinking and logical reasoning.

The researcher made several observations during visits to the centres. Firstly, most course tutors could not effectively use the problem-solving approach to teach the students. Their inability was due to several factors and challenges they encountered. First and foremost, most of these tutors could not give up their roles as transmitters of knowledge to assume the role of facilitators of learning. Most tutors were pushed to teach this way because the students agitated for it and students felt unenthusiastic to do their own thinking and take risk to learn on their own and with their own mates. The approach seemed new to the students. This observation confirms Ernest's (1988) argument that a teacher's ingrained beliefs about the nature of mathematics and the teaching and learning of mathematics can affect his or her teaching.

Secondly, the students' module for mathematics was not written to promote the use of a problem-solving approach. Course tutors did not find time and so it was not easy therefore to re-write the topics in an activity-oriented manner. They were forced to handle the topics the way they have been presented in the module.

Thirdly, the issue of large class size also contributed to the poor delivery of the intervention. Maturity of the classrooms had enrolments of 60 to 70 students. This is in support of Kraft's (1994) argument that class sizes above 40 have negative effects on students' achievement. These large numbers rendered group work impossible and class management difficult. However, the class size could not have been a problem, since students could have worked in pairs or threes. Class management would have been a challenge for most of the facilitators since their training did not cater much for how to manage large classes when teaching mathematics through a problem-solving approach.

Lastly, the drive of completing the unit within a stipulated time was also a challenge to the facilitators. Quoting one facilitator, "We can't finish if we should go by this approach." There was the will to teach using a problem-solving approach but the workload and time did not allow the facilitators to implement the intervention to its fullest; hence, the poor results obtained after the intervention.

Conclusion

It could be inferred from this study that although there is wide spread agreement that a problem-solving approach for teaching mathematics holds the promise of fostering students learning, in this study, because of poor implementation of the intervention in this study by facilitators with other challenging factors, this approach did not make the positive impacts expected in the learning outcomes of the learners. On the contrary, the study has also shown that the teacher-centered approach that was predominantly used by the facilitators did not significantly improve the cognitive levels of learning domains of the students. The following recommendations are made to forestall future occurrences.

Recommendations

The centre should have a clear policy that will compel the teacher to implement the curriculum to the letter. This policy can be achieved if the facilitators are given in-depth training on the use of a problem-solving approach in teaching mathematics. The training should get the facilitators to give up their ingrained negative beliefs about the teaching and learning of mathematics. Teachers during the training should be made to understand that their role in classroom during teaching is to facilitate learning and not to transmit knowledge profusely.

All mathematics modules used by students in the centre must be re-written to promote the use of a problem-solving approach in teaching and learning of mathematics. The modules should be activity oriented and problem-based that will encourage students to do critical thinking and learn mathematics actively by doing, talking and recording. Mathematical laboratories equipped with requisite and adequate teaching and learning materials should be provided in all the study centres to forester the effective teaching and learning of mathematics through a problem-solving approach.

Students' assessments in mathematics should go to test not only the lower levels of cognitive domains but also the higher levels. By so doing, the facilitators will tailor their teaching in this direction to ensure students good performance in mathematics.

References

Ball, D. L. (1990). The mathematical understandings that prospective teachers bring to teacher education. Elementary School Journal, 90, 449-466.

Ball, D. L. & Bass, H. (2000). Interweaving content and pedagogy in teaching and learning to teach: Knowing and using mathematics. In Jo Boaler (Ed.), Multiple Perspectives on the Teaching and Learning of Mathematics, pp. 83-104. Westport, CT: Ablex.

Carpenter, T. P., Megan, L. F., Jacobs, V. R., Fennema, E., & Empson, S. B. (1998).

A Longitudinal Study of Invention and Understanding in Children's Multi-digit Addition and Subtraction. Journal for Research in Mathematics Education, 29, 3–20.

D'Ambrosio, B. S. (2003). Teaching mathematics through problem solving: A historical perspective. In H. L. Shoen (Ed.), Teaching mathematics through problem solving, Grades 6-12 (pp. 39-52). Reston, VA: National Council of Teachers of Mathematics.

Ernest, P. (1989). The knowledge, beliefs and attitudes of the mathematics teacher: A model. Journal of Education for Teaching. 15, (1), pp.13-33.

Hiebert, J., & Wearne, D. (1993). Instructional task, classroom discourse, and students' learning in second grade. American Educational Research Journal. Vol. 30, 393-425.

Kraft, R. J. (1994). Teaching and learning in Ghana. Boulder, CO: Mitchell Group.

Lappan, G. & Theule-Lubienski, S. (1994). Training of teachers or educating professionals? What are the issues and how are they resolved? D. Robitaille, D.

Wheeler, and C. Kieran (eds). Selected Lectures from 7th International Congress on Mathematics Education, 1994, pp. 249-261.

Ma, L. (1999). Knowing and teaching elementary mathematics: Teachers' understanding of fundamental mathematics in China and the United States. Mahwah, NJ: Lawrence Erlbaum Associates.

Masingila, J. O., Lester, F., & Raymond, A. M. (2011). Mathematics for elementary teachers via problem solving. Instructor Manual Copley Custom Textbooks: XanEdu Publishing Inc.

Polya, G. (1945). How to solve it: A new aspect of mathematical method. Princeton University Press: Princeton, New Jersey.

Rav, Y. (1999). Why do we prove theorems? Philosophia Mathematica, 7(1), 5–41.

Rivkin, S. G., Hanushek. E. A., & Kain, J. F. (2005). Teachers, schools, and academic achievement. Econometrics, 73(2), 417-458.

Schoenfield, A. H. (2005). Mathematics teaching and learning: A draft for the Handbook of Educational Psychology, second edition. See also <http//gse.berkeley.edu/faculty/ahschoenfeld/Schoenfeld MathsTeachingAndLearning.pdf>

Schroeder, T. L. & Lester, F. K. Jr. (1989). Developing understanding in mathematics via problem solving. In New Directions for Elementary School Mathematics, 1989 Yearbook of the National Council of Teachers of Mathematics, edited by Paul R. Trafton, pp. 31–42.

Shulman, l. S. (1986). Those who understand: Knowledge growth in teaching. Educational Researcher, 15(2), 4-14.

Thompson, P. W. (1985). Experience, problem solving, and learning mathematics: Considerations in developing mathematics curricula. In Edward A. Silver (Ed). Teaching and Learning Mathematical Problem Solving: Multiple Research Perspectives, pp 189-236. Lawrence Erlbuam Associates, Publishers. Hillsdale, New Jersey, London.

Tripathi, P. N. (2009). Problem solving in mathematics: A tool for cognitive development. State of University of New York, USA.

CASE STUDIES ON THE USE OF SCIENCE TEXTBOOKS IN THREE PRIMARY SCHOOLS IN KENYA

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Abstract

Few studies have looked at how text materials are used in the classrooms in developing countries by teachers as well as the pupils. Even fewer studies have explored the matter to see if there are differences in use where textbooks are in short supply. This study was to find out how teachers and pupils used science textbooks in differing Kenyan primary schools in standard 4. It set out to compare the use of science text material in schools in different socioeconomic and sociolinguistic contexts. The study involved classroom observation, taped interviewing of pupils and teachers as well s observing and listening to pupils reading from the textbook. After this, pupils were tested on their knowledge of the double page spread used. Eight teachers and twenty-four teachers were interviewed in depth. Findings showed that half of the teachers did not use textbooks at all in their teaching even in classrooms where pupils had textbooks. The underlying point emerging from this study is that the provision of good text material is necessary but not sufficient condition for improvement in pupils' learning. Other constraints on teaching and learning like language, teachers' skill levels, commitment and pedagogical mindsets are working against the effective use of text material. These constraints could be tackled particularly but not exclusively during teacher training.

Background

Several studies have been carried out about the quality of instruction in developing countries' classrooms. They emphasize the lack of textbooks and other learning materials from studies by Eisemon, Nyamete and Cleghorn (1980), Heyneman and Jamison, (1980), MacDonald, (1980) and Wandiga (1994). The implications drawn from these studies are that the quality of instruction and students' instruction would improve if text materials were more plentiful, students would become more efficient readers if more books were available, that scores on national tests would improve and that more students would graduate from secondary schools.

Few studies however have looked closely at the ways text materials are actually used in developing countries' classrooms by students and teachers. Even fewer have explored this matter comparatively to find out if there are differences in use where textbooks are in short supply. Yet evidence such as this is crucial in determining whether or not text material can make the differences claimed by research. If text material exists but is not used, or if use by students is not encouraged, then the gains predicted from a supply of such materials will not be realized. This study therefore set out to compare the use of science textbooks in primary schools in different socioeconomic and sociolinguistic contexts.

The purpose of this research was to find out how teachers and pupils used science textbooks in differing types of primary schools in Kenya. Standard 4 classes were chosen for the study since this is the stage at which pupils begin to study their subjects in English as opposed to the vernacular languages or Kiswahili that are used in standard 1-3.

A pilot study was conducted which was followed by data gathering in eight schools. These were chosen to represent differing locations and language populations as shown in table below.

Distribution of schools in the study

	Nairobi	Western Province
High cost schools	2	2
Low cost schools	2	2

High cost schools (usually private) charge tuition feed and are run by individual entrepreneurs or companies. They tend to be located in urban areas and are well resourced in terms of facilities such as classrooms, textbooks and other learning facilities. Pupils from these schools tend to do better in national examinations.

Low cost schools are mainly government schools and most of them do not have good physical facilities as well as sufficient textbooks. The key distinction is that high cost schools operate almost exclusively in English as the medium of instruction, while in low cost schools vernacular languages and Kiswahili are used up to standard 4 and beyond even though the official language policy requires English.

Literature Review

Van Rooyen (1990) did research in South Africa and found out that the normal pattern of teaching science was for the teacher to teach orally then give pupils a summary of what they thought was important from the textbook. Woodward (1987) in his research in the United States of America found out that many teachers were dependent on the teachers' guides and textbooks in their teaching. So textbooks had special authority. MacDonald (1990) found out that pupils did not use science textbooks without the mediation of the teacher. In Kenya, Ochola (1983) stated that textbooks were used by teachers and pupils to provide information and that the role of activity and enquiry was not evident. Hunkin (1990) also found out that there was a lot of dependence on science textbooks as a reliable source of information for both teachers and pupils. Textbooks seemed to provide authoritative referencing in a way that the science teacher was unable to emulate.

Some research has been done about the level of the content of textbooks compared to the ability of the learners and the following are some findings from studies that have been done. Scruggs (1988) and Carrell (1987) in their studies found out that most science textbooks were written above the level of the learners for whom they were written. The effects of the difficulty of the textbooks according to Hamblett (1977) is that it made the teaching less efficient as the teachers had to devote more class time than they were supposed to explaining the textbook. The above studies could probably be an explanation as to why textbooks are used by both teachers and pupils in the way the case studies will show.

Methodology

The study involved classroom observation, taped interviewing of pupils and teachers and observing/listening to pupils reading from textbooks, after which pupils were tested on their knowledge of the double page spread used. The teacher interviews were unstructured, whilst pupil interviews used a semi-structured interview schedule. Eight teachers and twenty-four pupils were interviewed in depth.

All teachers were interviewed in English and pupils according to their preference in English, Kiswahili or Kiluhya, the vernacular language of the pupils in Western province and the first language of the researcher. Pupils" reading was analyzed using methods adopted from Primary Language Record Handbook (Barrs, Ellis, Hester and Thomas 1912). The evidence below is first presented in the form of detailed discussion of case studies, followed by a summary of the more general evidence from the pupil observations and interviews.

Case studies of teaching in three schools

The three examples chosen were taken from rural low-cost school, an urban low-cost school and an urban high-cost school. They varied in terms of availability of books, space and resources for teaching and learning and the language used in the classroom.

Case Study 1: Rural low-Cost School-Standard 4.

The school was not well equipped and generally three pupils shared a desk designed for two. The teacher spoke the same vernacular language (Luhya) as the pupils as well as English. These pupils spoke their mother tongue most of the time, even in class. Their knowledge of English did not much beyond the names of items like books table, chair and a few short phrases read to them and repeated.

A thirty minute science lesson was observed, which began by pupils standing up and chorusing in English, 'good morning our teacher and our visitor.' The teacher then asked a few questions about what she and taught in the previous lesson on soil. The questions were directed to the class, and students gave back chorus answers, which appeared to be rehearsed as follows:

Teacher: What is soil made of?

Pupils: Dead animals, dead leaves and broken rocks

Teacher: Is all soil the same?

Pupils: No, not all the soil is the same.

After this revision, the teacher wrote TYPES OF SOIL on the blackboard and introduced the topic again by telling pupils that soil has different types like loam, clay and sand. She wrote these words on the board and went on to give an explanation of their meanings.

Teacher: Sticky nikhuli shindu nishihandi menya ikamu. (Sticky is when something sticks like glue) Muhulili? (Have you understood?)

Pupils: Yee madam. (Yes madam)

Each of the thirty-one pupils had brought a bag of soil. They were asked to feel the soil that they had brought and say aloud which type of soil was theirs. Hands were put up and the teacher chose a few pupils to give answers. Most of them had loam soil from their gardens at home.

The teacher sent two pupils to the school kitchen to bring a jerry can of water. After the water arrived, pupils were pupils were asked to move to the back of the class; plastic bags were spread on the floor and in groups pupils mixed the soils with a little water. Pupils used the space on the floor and some on their desks. During the activity, there was a lot f talk in Kiswahili or the mother tongue. Observing pupils it was clear that their conversations were about the task at hand. Pupils made observations like, "yako inaanguka" (yours is falling apart. After the experiment they were asked t go out and wash their hands. While they were out, the teacher drew the following table on the chalkboard.

	Colour	Texture
Loam		
Clay		
Sand		

After the pupils returned, they drew the table in their exercise books and they were asked to discuss the types of soil they had. The teacher explained the word "texture" as rough, fine or smooth and said that loam had a fine texture. Pupils were asked to describe the colour of the soil by filling the table and they varied lot: black red and so on.

No textbook was used at any stage in this lesson. The teachers' notes were taken from the textbook, which she referred to regularly throughout the lesson. Later the teacher explained that she had to share a copy of the textbook with another teacher in the other standard 4 classes. She also said that pupils had no textbooks to work from. However two pupils from the five that were interviewed had textbooks, which they used for revision since no homework was given for them to do.

Five pupils from this class were given a short passage to read and answer a few questions. One did not need assistance to read and answered most questions correctly. The others needed assistance and so the researcher would from time to time ask them to refer to the passage.

It appeared that in this class, the teacher was not aware that some pupils had their own textbooks and so no attempt was made to textbooks as a learning aid. As a consequence, the majority of pupils had developed few skills for using the text to obtain information

Case Study 2: Urban Low-Cost School- Standard 4.

This school was located in one of the poorest areas in Nairobi. Unlike the rural school, pupils had a desk each that they could lock and a chair. The teacher had twenty years of teaching experience and so was very confident. The lesson that was observed was a double period of seventy minutes.

The lesson began in English as follow:

Teacher: Our topic today is about floating and sinking. Do you know what these two words mean?

Pupils: (In chorus): Staying on top of the water and going to the bottom.

The teacher then wrote FLOATING AND SINKING on the board from one of the recommended textbooks. All the information that the teacher read to the pupils was taken from this book. She explained that they would do experiments to find out which objects floated and/or sank. She had brought some of the apparatus that were illustrated in the book. She called all the forty pupils round her table and put a plastic container in front of them. However, there was not enough room for them to see, so some stood on desks to see the demonstration of the activity described in the book. The session began like this:

Teacher: I will pour some water into the container. I will the put some maize seeds and two nails into the water. What can you see?

Pupils: The nail is sinking and the seeds are floating.

She removed the objects from the containers. She then asked two pupils to go forward and mix sugar and salt with water in separate containers. They continued stirring until the sugar and the salt had dissolved. She then put an

Teacher: Look at the container that has the sugar. Come close so that you can see.

Pupils: It is floating.

Teacher: Look at the other container. Has the egg sunk?

Pupils: It is floating.

In the textbook, other items like petrol and paraffin were recommended for this experiment. The teacher paused to explain what had happened (salt had made the water denser), even though in the textbook the pupils were supposed to do experiments themselves and suggest reasons why the eggs floated. She continued to explain that objects that were lighter than water floated and those that were heavier sank. However, sinkers could be made to float.

The teacher then asked one pupil to fill a container with water and put maize seeds onto the lid and asked what was happening. Pupils replied that the lid was floating. Pupils added more seeds until the lid began to sink. The discussion was held entirely in English. At times, pupils were asked to repeat what the teacher said the example below:

Teacher: Heavy objects sink in water. What do heavy objects do?

Pupils: (in chorus). They sink in water.

Pupils were clearly used to only responding in chorus, since none of them put up their hands to answer a question.

They were then told to go outside the classroom to do their experiments using the containers and material that they had brought. They were divided into five groups. They repeated the experiment that had been done in class and the teacher went round asking questions about which objects had floated. Pupils talked in Kiswahili and English. They often mixed languages when they did not know the relevant word, for example:

"Kalamu ina float" (the pen is floating)

" Mawe ina sink" (the stone has sunk)

After fifteen minutes, they returned to the classroom, settled down and drew a table in their exercise books that the teacher had copied from the textbook onto the board. They were to complete it by adding the objects that they had tested. There were some arguments in Kiswahili between the groups as to which objects had sunk and which had floated. The teacher went around the class ticking the correct answers.

Most pupils did not have textbooks with them but during the interview, one in five claimed to own a textbook, which they used to do home work. The others claimed to borrow them for homework.

Four of the pupils did not read well. They found words like "oxygen" and "carbon dioxide" difficult to pronounce, and did not answer many questions correctly. The researcher asked them to go back to the passage and find the answers: one pupil saw no connection at all between the passage and the questions and so attempted to answer from his general knowledge.

It was clear in this case that the teacher relied on the science textbook because pupils did not have textbooks. The stated that she consistently changed what the book prescribed and explained this on the grounds that she had to simplify it so that pupils could understand. However, what was changed was the process, not the content.

Case Study 3: Urban High-Cost School.

This school had very good facilities, paid for by the parents, which included sufficient textbooks and even a science laboratory. The observed had fifteen years experience. The lesson began with a brief revision of the previous lesson on" grouping animals collected." The discussion opened as follows:

Teacher: How were animals grouped in our last lesson?

Pupil 1: Animals with or without wigs.

Pupil 2: Animals that have2 legs and 4 legs.

In this class, pupils raised their hands and were chosen to answer by the teacher and so there were no chorus answers. The teacher then wrote, DIFFERENCES BETWEEN LIVING AND NONLIVING THINGS on the board after which she asked to open their textbooks n page 27 where the topic began. Apart from one pupil who shared, the remaining 38 had their own textbooks, which they kept in their desks.

The reading ability of this class was well above average. All pupils read confidently except for the word "photosynthesis," which they found hard to pronounce. However, they all knew what it meant and all the five pupils that were interviewed answered the questions correctly. They would at times refer to the passage to find the answer.

The teacher asked individuals to read aloud from the textbook. There were eight short sentences and so eight pupils read in order from the front of the class. The reading included instructions about what pupils were required to do: for example, "go outside the classroom and collect many things."

During the course of the reading, one pupil could not pronounce the word "reproduce" correctly so the teacher repeated the correct pronunciation, followed by the pupil. She explained the meaning of having young ones.

Pupils were then asked to bring out the material they had brought and place them on their desks. Some had brought stones, wood, and beetles in jars. They held up their specimen at the teacher's request, so others could see. During this session all talk was in English. The teacher then wrote on the board:

Living things grow, breathe, reproduce and move. Examples are ------------ and --------

Nonliving things do not feed, grow, breathe and move. Examples are--------and --------

The pupils were asked to fill in the blanks from what they had observed and then complete a table according to the description in the textbook and then write a conclusion. However the teacher sidestepped this activity by writing a few sentence on the board, which summarised the table and that required merely to fill in the correct answers. After being given time to do this, pupils were again asked to read out their answers. The teacher asked questions such as "in which category do sticks belong?" The pupils discussed among themselves and agreed that they were nonliving because they could not grow or reproduce. Before the lesson ended, she gave homework from the science textbook. They were to study a diagram that had pictures of both living and nonliving things, to copy another table, which she drew on the blackboard and fill it in.

It was evident here that pupils used the textbooks for both class work and homework. When interviewed, the teacher was confident that her pupils were able to use the books on their own and often did so in class with minimal direction from herself. Pupils confirmed this in their interviews. The fact that most pupils had books made work easier for the teacher. Pupils were in the habit of opening their books and using them to learn. The teacher followed the book closely and did not add much from other sources. In such a context, textbooks played a central role in the teaching and learning that went on in the classroom.

General Findings

It was observed that half of the teachers did not use textbooks at all in their teaching. Most teachers came into class and placed a copy of the textbook on the table. Besides it, there was a separate exercise book in which they had made lessons notes and they taught using these notes, even though these (and their diagrams) were often copied directly from the textbook. When teachers did use textbooks however, there was no reference whatsoever to tables and other illustrations. Teachers explained that pupils did not have textbooks, which was not entirely the case. Teachers also felt that the textbooks needed to be simplified to save lesson time. However, pupils often said that they were asked to copy diagrams from the textbook for homework.

This evidence raised questions about pupils' understanding of the text and illustrations since they rarely encountered or used them. These were therefore dealt with through the reading comprehension phase of the study.

Reading Comprehension

Pupil were asked to read about "How Animals and Plants Move" from a double-pages s of spread of a widely used standard 4 Science textbook. After reading aloud, they were categorized as good, average or poor readers (Barrs et. al., 1992) then asked questions about their reading of the page, followed by factual questions to see if they had understood the content. Table 2 below, analyses their use of illustrations, first reading a passage from the left-hand page without being asked to look at the illustrations, then again reading from the right-hand page after being asked to use the illustrations to help them.

Table 2: Pupils reading of two passages from the text, in relation t their use of illustrations.

Reading ability	No	When not specifically told to look at illustrations.	No	When asked to use illustrations.	N 0
Good readers	27	Looked	17	Looked	2 7
		Did not look	10	Did not look	0
Average readers	11	Looked	5	Looked	8
		Did not look	6	Did not look	3
Poor readers	10	Looked	1	Looked	8
		Did not look	9	Did not look	2
Non-readers	3	Looked	0		0
		Did not look	3		3
Total	51		51		5 1

The table indicates that the more able pupils were as reader, the more likely they were to make to the Illustration without being prompted. However a substantial number (28) did not even though even the written text specifically asked them to. When asked about the purpose of illustrations, some pupils explained this in relation to the content of the text, like to show plants and animals. Others said to make the book look good. While others could not explain why illustrations were there. This reinforces observations that many teachers did not encourage use of visuals as they taught, and indeed during the interviews, some teachers said that they did not always understand the illustrations themselves, so they could not draw pupils' attention to them.

Pupils; understanding of science concepts on the two pages of text were identified by the final set of questions. The findings are set out in table below.

Table 3: Pupils' content knowledge of the text.

Reading ability	All correct	Some correct	None correct	Totals
Good	22	5	0	27
Average	2	9	0	11
Poor	0	2	8	10
Non-readers	0	0	3	3
Totals	24	16	11	51

The evidence indicates clearly that comprehension of the science messages is strongly related to reading ability, which in turn is related to use of illustrations. Hence pupils who do not or cannot see the purposes of illustrations, or who cannot interpret them are doubly handicapped in terms of comprehension and are not helped by lack of provision of opportunities to ask questions during lessons.

Conclusion

Pupils in low-cost schools have access to very few science resources, are generally poorer readers than their peers in high-cost schools and their teachers have less confidence in teaching science. In such context, the textbook is probably the most important science learning resource for the pupils. It is a paradox therefore that in such schools, pupils often do not have access to a textbook; and even when they do, little or no use of it is made by teachers during lessons, reinforcing pupils' weak literacy skills in both written and graphic terms. Traditional teaching methods that emphasize rote learning and chorus responses are still widely used, as the case studies show; these methods also discourage pupils from direct engagement with the text. Little or no teaching is done. For instance, which helps pupils to construct or interpret tables, diagrams and other illustrations, even though these constitute a large proportion of expository text material. Yet most poor readers in the study did not even look at illustrations even though they were specifically designed to provide information: these pupils perceived no link between words and pictures. In the high-cost school, on the other hand, where the teacher deliberately used the text, pupils showed confidence and ease in interpreting both written and graphic information and in relating these to each to make sense of the science ideas.

Most teachers did not view the textbook as a source of information or enquiry for pupils to use independently, except for mechanical homework exercises; pupils claimed they were not give work to do from the textbook. Even where pupils did homework from the textbook, no time was made in subsequent lessons to ask questions or follow up the work done. A majority of teachers interviewed claimed to prefer one particular text because it had many experiments for pupils to find out by doing, yet no teacher was seen to use the text in this way throughout the whole study. As in Ochola's (1983) earlier study in Kenya, teachers still used text primarily to provide information on which to base lessons; the role of enquiry was not evident.

Some of the difficulties outlined earlier may have been due to the teacher’s own problems with illustrations. It is likely that the teacher training had not placed much emphasis on this. Most primary teachers in Kenya have no choice but to teach science, even though they have little prior study of the subject. In-service training is rare in Kenya and so these problems persist and weak teachers get no chance to improve their practice.

Textbooks are still the main resource for science teaching and learning in most Kenyan primary schools; yet evidence of this study is that they are underused or misused by the majority of primary teachers.

Yet the underlying point merging from this study is that the mere provision of good text material in a necessary but not sufficient condition for improvement in pupils' learning. In most schools it was seen that all the other constraints on teaching and learning (such as language, socioeconomic status of pupils, teachers' skill levels, commitment and pedagogical mind-sets, the pressures of national examinations) are working against the effective use of text material. Until these other constraints are tackled, particularly but not exclusively during training, then even where every pupil has a god textbook, it may not be used to produce the learning that is effective use could generate. In this respect unless teachers are trained in text use and are free to use text as intended, there may be little difference between high and low-cost schools.

References

Barrs, Myra, Ellis, Sue, Hester, Hilary, Thomas & Anne (1992). The Primary Carrell, Patricia (1987). Readability in ESL. Reading in a Foreign Language, 4 (1) 21- 40

Language Record Handbook for Teachers, London: Webber Row.

Chimombo, M. (1988) Readability of Subject Texts; Implications for ESL. Teaching in Africa.

Paper presented at the 22nd Annual TESOL Convention, Chicago.

Clay, M.M. (1972) Reading: The Patterning of Complex Behaviour. Auckland, New Zealand; Heinemann.

Cleghorn, A., Merrit, Marilyn and Abagi, J.O. (1989) Language Policy and Science

Instruction in Kenyan Primary Schools. Comparative Education Review Vol.33, No.1 p.21-39.

Cleghorn, Ailie (1992) Primary Level Science in Kenya: Constructing meaning through English and Indigenous Languages. Qualitative Studies in Education. Vol.5, No.4, p. 34-323.

Eisemon, Owen, T., Nyamete, A. and Ailie, C. (1989) A Note on the language of instruction, teaching and cognitive outcomes of science instruction in Primary Schools in Kisii and Kwale Districts, Kenya. Kenya Journal of Education. Vol. 4 No. 2 p. 153-165.

Heyneman, S. & Jamison, D. (1980). Student learning in Uganda: Textbook availability and other factors. Comparative Education Review, 20 (2), 206-220.S

Macdonald, C. A. (1990). Standard three general science research 1987-1988. (A final report of the Threshold Project) Pretoria: Human Science Research Council.

Ochola, Adume, J. (1983). Investigating the relevance of some suggested textbooks for teaching of new chemistry syllabus in Kenyan secondary schools. African

Studies Curriculum Development and Evaluation. No.88, K.I.E., Nairobi. Meeting of the Southern African Association for Research in Mathematics and Science Education Journal (1997). Johannesburg.

Van Rooyen, H. (1990) The Disparity between English as a subject and English as the medium of learning (a Final Report of the Threshold Project). Pretoria Human Sciences Research Council.

Wandiga, Shem, O. (1994). Education and Science in Africa. Possible Ways of Improvement in the Next Decade. International Commission on Education for the twenty first century, Working Group on Education and Science, UNESCO, Paris, France,January 10-11, 1994.

TO USE OR NOT TO USE CAPTIONING TECHNOLOGY AS A SUPPLEMMENTARY METHOD FOR TEACHING LEARNERS WITH HEARING IMPAIRMENT

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Abstract

Numerous studies have been undertaken to find out ways to improve instructional methods for learners with hearing impairment (HI). One such area that has been of interest is the use of captioned television (TV) programmes to teach learners with HI. There have been several studies assumed to this end; however, such studies in the local scene are sparse. This study seeks to find out the effect of using captioned TV programmes when instructing learners with HI in Karen Technical Training Institute for the Deaf (KTTID) through a descriptive survey research. The study investigated the effect of captioned TV programmes that would improve the instruction of learners with HI to enable more of them access higher levels of education. The objectives of the study were to: i) find out the opinions of learners towards captioning as an instructional tool; and ii) investigate the effects of captioned technology in the education of learners with HI. Population under study consisted of 150 persons. Sample size was 69 respondents obtained through purposive sampling. Data was collected using questionnaires and observation schedule. Data was analysed descriptively. The results indicated a motivating influence of captioned TV characterized by increased rate of understanding of the programmes, improved learning behaviour and ability to remember. In general, the use of captioned TV programmes by learners with HI increased the students' motivation, and improved their learning.

Key Word: Captions - Captions are words displayed on a screen that describe the audio or sound portion of a programme. Captions allow viewers who are deaf or hard of hearing to follow the dialogue and the action of a program simultaneously. They can also provide information about who is speaking or about sound effects that may be important to understanding a news story, a political event or the plot of a programme (NIDCD, 2006)

Chapter One: Introduction

1.1 Background to the Study

Education takes a very high proportion of the national budget and gross domestic product expenditure in Kenya. In the present circumstances, it would be unnecessarily expensive to invest in an education system that does not realize its goals and objectives. Learners who do not acquire all the necessary skills and who fail to achieve the educational goals in the long run retrogress to illiteracy, Burns (2003). In Kenya, the number of learners with HI accessing education is on the rise since the last decade and on the decline for graduates at every subsequent development (TIQET, 1999).

In Africa and Kenya in particular, few studies on the teaching of learners with HI have been conducted. Hitherto, no research on the subject matter of effects on captioned TV technology in instructing learners with HI has been carried out. Low literacy levels of graduates with HI constitute an element of educational wastage in terms of time, human and material resources. It is a great loss a developing nation like Kenya can ill afford at the height of special education emergence in the education system. The participation indices in Kenya's special education, thus point to the available instructional methods of learners with HI. The literacy levels of learners with HI and high drop-out rates among them translate into significant wastage rates that are an important dimension of our schools inefficiency (TIQET, 1999).

Generally, the most important manifestation of schooling quality (however and whichever way defined) are literacy, greater cognitive abilities and better student performance in examinations and school completion (Deolakan, 1999). In view of these inputs, learners with HI require special education, which attempts to give them a fair platform to fight on. There are various factors, which have tended to impede the education of learners with HI, but the language barrier which isolates them from the sound environment is key. One communication skill of the deaf child to have escaped the scrutiny of researchers and educators until the late 80s is the ability to read (Bussey & Bandura, 1999). Learners born severely and profoundly deaf are unlikely to read well no matter what language is used for instruction (Concrad, 1984, Gaines & Yongxin, 1995). The average reading level of deaf learners when they leave school at the age of 19 hovers at the fourth grade, (Lewis 1995).

Several instructional methods have been designed to capitalize on the learners with HI replacing or simultaneously supplementing the auditory portion of speech with visual hand gestures. There are many different ways this might be accomplished, but the most common are cued speech, finger spelling and simultaneous communication. The last method encompassing sign language which has not been without shortcomings, because the assumptions of these methods are all similar, first, that it is possible to adequately represent spoken language in vision (Adoyo, 2002). In simultaneous communication, the gestures represent the words and morphemes of spoken language. Second, the methods assume that the learners can learn language in the same fashion as does the child who can hear, albeit through a combination of gestured and spoken language as long as the deaf child is provided with a complete and frequently occurring visual language model. Thus, it is the researcher’s view that introducing captioned TV programmes as an instructional tool for learners with HI, no doubt complements the present modes of instruction and increase learner comprehension and participation in class.

1.2 Statement of the Problem

It is pertinent to note that while the educational opportunities for learners with HI continue to be of great concern, sizeable percentage of them continue to graduate with very low grades in language. Kenya National Examinations Council - technical series in KTTID for the years 2006, 2007 and 2008 indicate mass failure in the trade theory subjects and support subjects such as English, Science and General Studies. Analysis of the results indicated that the learners performed dismally poor as compared to their hearing counterparts. The performance in language acquisition subjects was poor (scores as low as 8) as compared to the trade practices; computers, clothing and textiles, carpentry and joinery, agriculture and masonry where they score distinction one.

The feature of Kenya's special education and training system has been the poor performance of learners with HI, as the educational programmes offered have been unable to produce HI graduates who can favourably compete in the present systems for education. Part of the reason for the poor performance is lack of trained teachers in various fields to teach learners with HI, irrelevant curriculum and the lack of concrete special education policies in Kenya, (Adoyo, 1995). This study therefore focused on a complimentary instructional method that attempted to improve the literacy levels and language acquisition of learners with HI among others. Hitherto, no study has attempted to study captioned TV programmes as an alternative mode of instruction.

1.3 Purpose of the Study

Based on the problem already stated, the purpose of this study was to find out the effects of captioned TV programmes in teaching learners with HI at KTTID. The study investigated the effect of captioned TV programmes and whether it would improve the instruction of learners with HI.

1.4 Research Questions

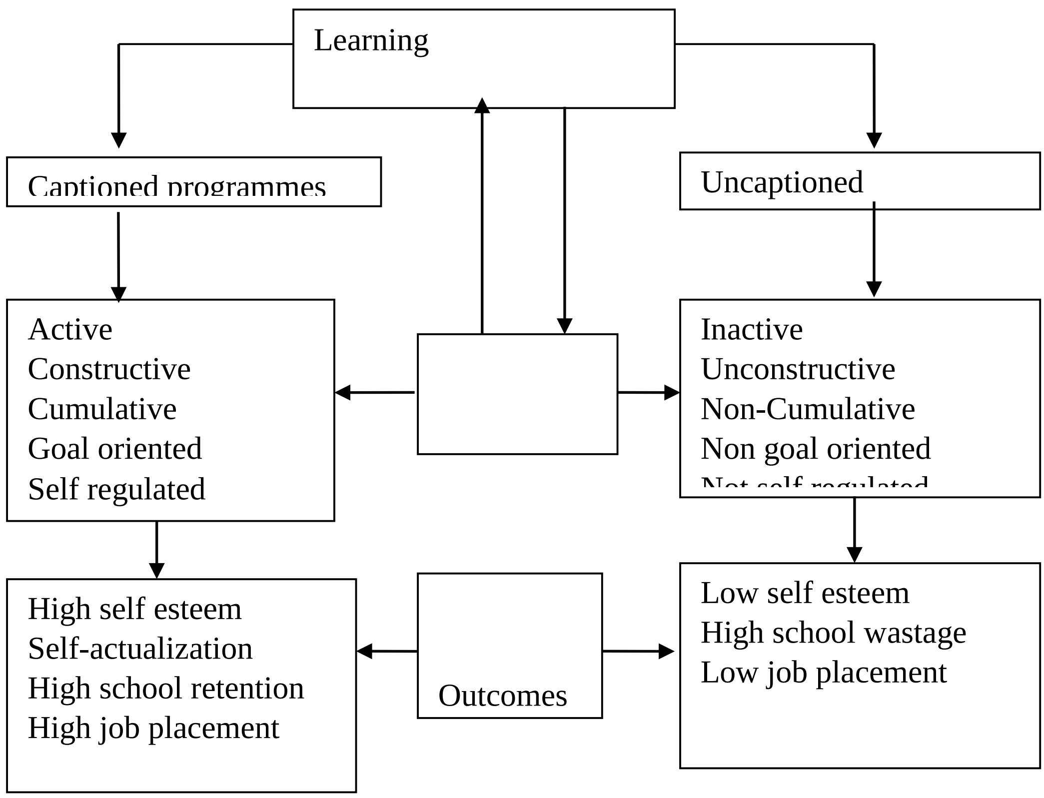
What are the attitudes of learners exposed to captioning as an instructional tool? How effective will captioning technology be in the education of learners with HI, as assessed by teaching staff at KTTID?

1.5 Significance of the Study

This study is meant to contribute to effective learning in KTTID and to supplement the urgently needed knowledge to facilitate the provision of effective educational services to learners with HI.

1.6 Conceptual Framework

6 Conceptual Framework



Source: Researcher

The learners were exposed to the prepared captioned programmes, while a control group was exposed to uncaptioned formats and their effectiveness in enhancing learning in a classroom setting assessed. Effectiveness was based on, at least in part, the degree of observational learning and vicarious reinforcement observed in the learners. Content recall combined with an understanding of the general theme of the captioned programme are some aspects that were used to determine the extent of meaningful learning achieved. The learners were actively engaged in watching captioned TV programmes that led them to be constructive, goal-oriented, and self-regulated. This led to cumulative knowledge and self-actualization hence positive learning processes.

Chapter 2: Literature Review

2.1 Introduction

This chapter reviews literature related to the study

2.2 Performance of Learners with HI

Studies on the education of learners with HI show that a majority of them retrogress in their studies instead of progressing. They repeat steps in education and eventually drop out of the system, which contribute a lot to hurting their self-image and prospects for future success (Karanja, 2003). Most important in developing countries, learners who enter an educational system and eventually fail to complete the duration of study or succeed, raise the costs per year of school. Proponents of schools of thought for learners with HI propose remedial teaching, individualized educational programmes and meeting their special needs (SN) through adaptive programmes (Lang, 2004). One of the reasons offered as an explanation for failure of retention is lack of improved academic achievement, that students are often retained in programmes that are not beneficial to them in the first place, and that teaching methods fall in the second place, (Adoyo, 1995). Failure to secure adequate training relevant to the process of socio-economic development is also likely to transform these graduates into social misfits that are vulnerable to social ills as indiscipline, juvenile delinquencies and agents of poverty among others (Karanja, 2003).

In support, Kinaga, (1987) reveals research on academic achievement that shows learners with HI lag behind their hearing counterparts academically. He also takes into account the role school environment plays in academic achievement. He states that:

"Educational occupation occurs as a result of societies' inability to adequately help deaf people develop and use their abilities rather than the result of inherent deficiencies in their abilities. The problems of a learner with HI can be created by the environment including those in charge of their education (Kinaga, 1987)."

2.3 Background of Karen Technical Training Institute for the Deaf

To offer learners with HI tertiary and higher education, the Government of Kenya with the initiative of Kenya Society for Deaf Children established the Karen Technical Training Institute for the Deaf (KTTID). KTTID is situated along Karen road near World Vision International. A legal notice through the MoE saw KTTID open its doors to students in September 1990. The MoE designated it as a national technical institute for deaf children in line with objectives of Technical, Industrial, Vocational and Entrepreneurship Training (TIVET). The institute's main functions include to; provide and increase training opportunities for learners with HI that will enable them to be self-supporting, develop practical skills and attitudes, which will lead to income-earning activities in the urban and rural areas, provide technical knowledge, vocational skills and attitudes necessary for man power development and produce skilled artisans, craftsmen, technicians and technologists for both formal and informal sectors.

Challenges facing the learners with HI in the institute include but not limited to; low language acquisition, poor academic performance especially in trade theories, inability to comprehend, short memory, low literacy, and inability to express one-self. Vilviz, (2000), further paints a grim picture that in Kenya today, only 0.1% of the learners with HI can be traced in higher education e.g. tertiary, diploma, university, undergraduate, masters and doctorates. And it is against this backdrop that this study was based, to examine the effects of captioned TV programmes as a complementary instructional method for learners with HI in KTTID.

2.4 Development of Education for Persons with HI in Kenya

Deaf education in Kenya has faced a downward trend in recent decades. Findings over the years (Ndurumo, 1993; Okombo, 1994; Adoyo, 1995) show that the deaf have consistently trailed behind their hearing counterparts in academic performances. Education achievement for persons with HI in Kenya stands in sharp contrast with hearing persons. Some deaf persons attain doctor of philosophy degree, but the average deaf person is grossly under educated. These gross under education is due to failure of the education system to develop the intellectual capacity of learners with HI and to some extent, is evidence of tremendous impediment to academic and other learning resulting from deafness. It is worth noting here that the education system and educational trends for the deaf have contributed to gross under education of the deaf in Kenya.

Studies on the deaf child`s performance in Kenya and later generalized to other countries (UNESCO, 2003) that included 93% of learners of age 16 years and above showed that only 5% achieved tenth grade level or better, most of these being hard of hearing or post lingual deafened. Up to 60% were at tenth grade or below and 30% were functionally illiterate. A deaf twelfth grader may very well be 20 years old and achieving at fourth grade level. All inquiries have pointed to teachers' lack of competence in the language of instruction (sign language) as the major obstacle to their academic development.

2.5 Types of Captioning Available for Persons with HI

According to National Centre for Accessible Media, (NCAM, 2006), captions are created from the transcript of a programme and a caption specialist separates the dialogue into captions and makes sure the words appear in sync with the audio they describe. A specially designed computer software programme encodes the captioning information and combines it with the audio and video to create a new master tape or digital file of the programme. Captions in a video are text located somewhere on a picture and where this is done, they are referred to as non-broadcast applications. There are two types of captions: closed and open captions. Closed captions are captions that are hidden in the video signal, invisible without a special decoder. Open captions are captions that have been decoded, thus becoming an integral part of the picture. These cannot be turned off (Burgstahler, 2006).

Captioning is one of the special adaptive instructional tools that can be used as an educational tool (refer to appendix 1) and may offer learners with HI a new approach to providing access to classroom teaching and discussions (King and Quigley, 1985). This is confirmed by (Jensema, 2003) that captions availed to children who are deaf enable them to experience what their hearing counterparts have enjoyed all along.

A relatively new concept is the captioned TV for learners with HI that was introduced to supplement the regular instructional materials for teaching children with hearing impairment, (Jensema, 2003). Captioned TV and films make up part of the special and adaptive instructional materials (refer to appendix I) that follow the principles and techniques for attracting the attention of children reinforcement techniques, frequent repetition, rehearsal and motivation. They represent a form of interactive graphical communication that provides considerable enjoyment for millions of children, both deaf and hearing (Levitt, 1985). Captioning in technology helps to maintain the deaf students' interest and motivation (Scherer, 2004). Motion pictures capture the children's attention and entertain them while they learn.

2.6 Positive Contribution of Captioning in the Education of Learners with HI

Early studies of the educational utility of TV, (Boyd and Valder, 1972), investigated deaf students understanding of a film that was captioned by teachers of the deaf. The study found that captions adjusted to the linguistic level and reading rate of the viewers significantly improved information gain. Braverman and Hertzog (1981), report that captioning rates affect comprehension but the language level of the captions does have a significant effect on comprehension. Baker (1985) points out that a reduced captioning rate necessitates simplifying the language level of the captions and in a series of studies, demonstrate that the combination of a reduced rate and a reduced language level improve programme comprehension for school children.

According to Jelinek & Jackson (2001), captioning normally addresses the deaf viewers' communication needs by enhancing their general language and reading skills and message comprehension. Using specially constructed captions, Nugent (1983) compares deaf and hearing students' comprehension for programmes with visuals only, captions only, visuals and captions together. For both groups, comprehension is highest for the condition with both visuals and captions. Nugent notes that students with HI`s scores on captioned videos are equivalent to hearing students` reading the captions without visuals (giving an idea of the importance and effectiveness of captions in education of learners with HI).

In a similar study, The National Captioning Institute (NCII, 2006) also observes that students with HI who view TV with captioned TV programmes have higher comprehension scores than those who watch the programmes without captioning. The importance of captioning in deaf education can be appreciated from the observation by (NCII, 2006), who observe that children who are deaf or hard of hearing watch as much, if not more television, than their hearing peers. NCII, (2006) observes that TV plays a key role in influencing children's learning and socialization skills across their lifespan and by middle to late childhood, children begin to recall more information central to the plot. This study, therefore, sought to investigate the effects of captioned TV in the education of learners in KTTID to support captioning as an additional instructional tool.

2.7 Summary of the Literature Review

Captioning accelerates learning by enhancing the learners with HI's ability to symbolize that is, extract meaning from their environment, construct guides for action, solve problems cognitively, support forethoughtful courses of action, and gain new knowledge. Captioning also enhances learning through observation improving attention, retention, production and motivation.

Chapter Three: Methodology

3.1 Introduction

This chapter focuses on the research methodology that was used in the study.

3.2 Research Design

This study adopted a descriptive design utilizing quantitative approach and used questionnaires and observation checklists. Questionnaires catered for the quantitative aspect, which has the advantage of getting responses of the same questions from a large number of people and these responses can be quantified for conclusions to be drawn from them (Bell, 1993). As anticipated, the design was most appropriate for this study, and obtained exhaustive and accurate accounts of the study.

3.2.1 Variables under Study

In this research design, the independent variable was captioning, while the dependent variable was the learning process of learners with HI. Learners with HI' learning experience was evaluated on captioning technology.

3.3 The Study Locale

The study was conducted in Karen Technical Training Institute for the Deaf (KTTID), Nairobi, Kenya. MoE designated the institute to meet the objectives of Technical, Industrial, Vocational, and Entrepreneurship Training (TIVET) aimed at producing skilled human resource for industrial development among learners with HI. Having taught in the institute, the researcher has professional interest to conduct this research here.

3.4 Description of the Target Population

KTTID was purposively selected because it is the only tertiary institution in Kenya and according to the institute's registration records; there were 150 learners with HI.

3.5 The Sampling Techniques and Sample Size

3.5.1 Sampling Procedures

The researcher selected the institute purposively since it is the only one of its kind to have been established in Kenya. A total of 69 students were sampled for this study. This number represents 46% of the total number of the population, which is adequate to constitute a sample in a study of this nature. This was composed of all second year students as per the school records, in 2nd term of year 2006. The 69 students were purposively selected as they were more settled compared to first year students and as compared to third year students who were preparing for final examinations.

3.6 Research Instruments and Techniques

The study utilized a combination of instruments. The researcher used a questionnaire and interview schedule as data collection tools that covered all research questions.

3.6.1 Questionnaire

The student questionnaire was a mixture of open-ended and forced response type and it was divided into two sections. There were three questions in section one and five questions in the second section. Both sections were seeeking to establish the opinions of the learners towards captioning as an instructional tool. Open-ended types of questions gave respondents freedom of response while the forced types facilitated consistency of certain data across respondents.

3.6.2 Observation Checklists

Mugenda and Mugenda, (1999) observe that the researcher must define the behaviour to be observed and then develop a checklist. The areas observed were the manner in which the available captioned TV programmes were utilized in instructing the learners, their response to the use of captioned TV programmes as instruction tools and the problems encountered in actual classroom teaching-learning. Other incidental facets of the problem under study were also observed and noted by the researcher. Observations by the researcher were made thrice a week for 10 weeks. The researcher observed all activities during viewing of the programme and in every lesson.

3.7 Piloting of Instruments

To ensure reliability and validity, a considerable amount of time was spent in the TV room and classroom for observation in order to establish rapport with the respondents. The researcher wrote down what was observed in the viewing/learning of the learners. The interview schedule was also piloted. The pilot study was undertaken at Reverend Charles Muhuro School for the Deaf in Nyeri, Central province.

3.7.1 Reliability

Reliability of the instruments was tested using the test-retest method. The instruments were administered to the subjects selected for piloting. From the respondents, Spearman's Rank-order Correlation was employed to compute the correlation coefficient in order to establish the extent to which the contents of the questionnaires were consistent in eliciting the same responses every time the instrument was administered. A correlation coefficient (r) of 0.8 was arrived at and was considered high enough and thus indicating reliability of the instrument.

3.7.2 Validity

The content validity was ascertained through the pilot study. The instruments were tried to measure and determine if the set of items accurately represented the items under study. Their recommendations were incorporated in the final questionnaires.

3.8 Data Collection Techniques

The selected learners with HI and teachers were educated on the purpose and significance of the study. During such meetings, arrangements were made as to when the observation routines of the TV room and classrooms would take place. The questionnaires for students with HI were researcher administered. This gave the researcher an opportunity to clarify the meaning of any terms and content the students found to be unclear. The researcher observed all activities during viewing of the captioned TV programmes in every lesson. Conclusions were made on every observation item and documented in respective spaces in the observation checklist.

3.9 Data Analysis

This research yielded data that required quantitative analysis. The data was analysed using SPSS programme. Quantitative data was analysed and tabulated using descriptive statistics such as frequencies, means and percentages. This mode of presentation gave a quick visual impression of the quantifiable variables affecting the effects of captioned TV on instructing learners with HI.

The information that was generated through observation schedules was transcribed into written texts through note taking. The data was examined for completeness and relevance, data was categorised to ascertain the theme, and then data was coded and then entered to arrive at the descriptive analysis. The usefulness, adequacy, and credibility in answering the research questions were also taken into consideration. Quantitative analysis helped to numerically establish how learners with HI performed from viewing captioned programmes. The data collected allowed the researcher to analyse the responses and gain an understanding of the students' perspectives on the effectiveness of captioned TV.

Chapter four

Results and Discussion of the Findings

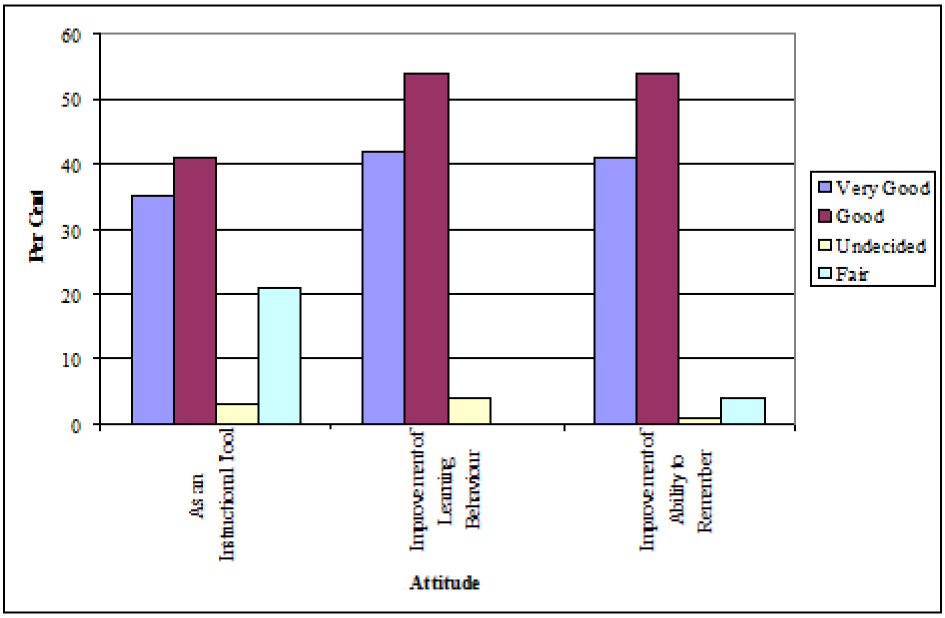
4.1 Introduction

The findings presented in this chapter are based on the data collected from the respondents. A response rate of 96 per cent was achieved from the 69 questionnaires filled and in addition, a total of 93 observations were made.

4.2: Attitudes of Learners towards Captioning as an Instructional Tool

The study revealed that 35% of the respondents were of the opinion that captioned technology was very good as an instructional tool, 41% thought it was good, and 21% reported that it was fair, while 3% disapproved the method. In general, over 76% supported the use of captioning as shown in figure 4.1 below. With regard to improvement of learning behaviour, up to 42% reported that captioning was very good while 54% reported that it was good. Finally, regarding the ability to remember, up to 41% reported that captioning was good while 54% reported that it was very good and only 4% reporting that it was fair. The learners who were undecided on the use of captioning as an instructional tool were 3%, while those who supported improvement of learning behaviour were 4% and those on improvement of ability to remember were 1%, as used to measure the attitudes of learners towards captioning as an instructional tool.

4.1 Attitudes of Learners with HI towards Captioning as an Instructional Tool



4.1 Attitudes of Learners with HI towards Captioning as an Instructional Tool

These results indicate that majority of learners had already developed opinions towards captioning as a medium of instruction. The results revealed a motivating influence of captioned TV on learners characterized by increased rate of understanding of captioned TV programmes, improved learning behaviour and improved ability to remember. Learners therefore found it a good instructional tool and had extremely positive attitudes towards it.

4.3 Effects of Captioned Technology in the Education of Learners with HI

With regards to effects of captioning technology in the education of learners with HI, the learners were asked how captioned TV programmes had improved their level of attentiveness and interest. Up to 99% indicated that the programmes had improved their attentiveness and interest either very much or much (Figure 4.3) below.

When asked how captioned TV programmes had improved their participation in the learning processes, majority of the students comprising 51% reported very much while 43% reported much with the remaining 3% being undecided. Captioned TV Programmes had very much improved language skills in 48% of the respondents as compared to 46% who reported the positive influence to be much. With regards to the respondents' ability to comprehend, most learners indicated they were able to comprehend very much comprising 59% while 33% comprehended much.

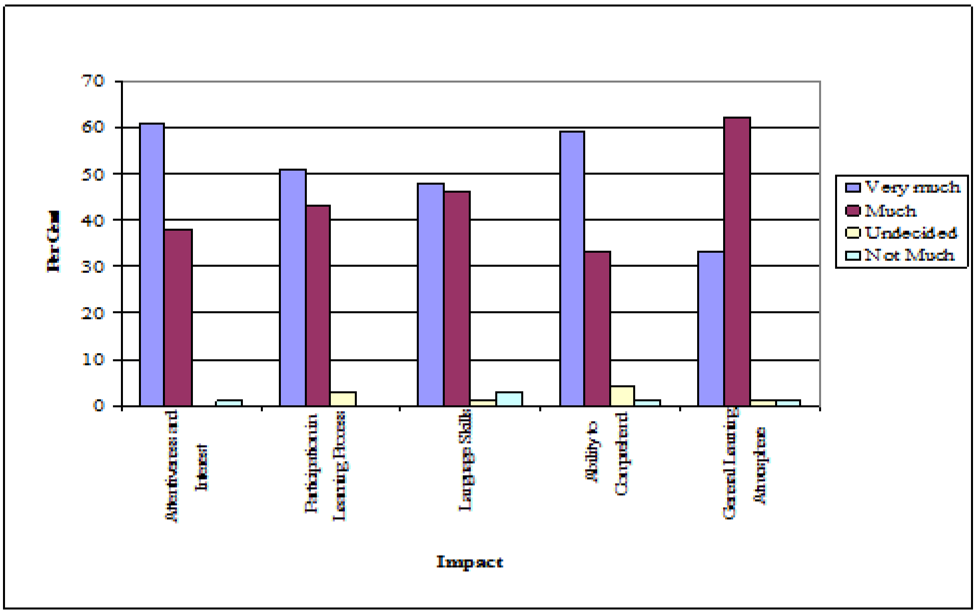


Figure 4.2: Effects of Captioned Tech. in the Education of Learners with HI

Learners with HI, particularly those deaf from birth, were profoundly hampered in the way they learned. They often did not have ample opportunities to learn normally as compared to other hard of hearing counterparts. As a result, these students often had poor skills, usually below that of their peers who were hard of hearing. From these results, it was clear that technological advances especially in captioning did much to compensate for the student's hearing and enhanced their learning experience.

4.4 Relevance of Captioned TV as an Instructional Tool for Learners with HI Time intervals of ten minutes were plotted against aggregated mean ranks as observed by the researcher (Figure 4.3 below)

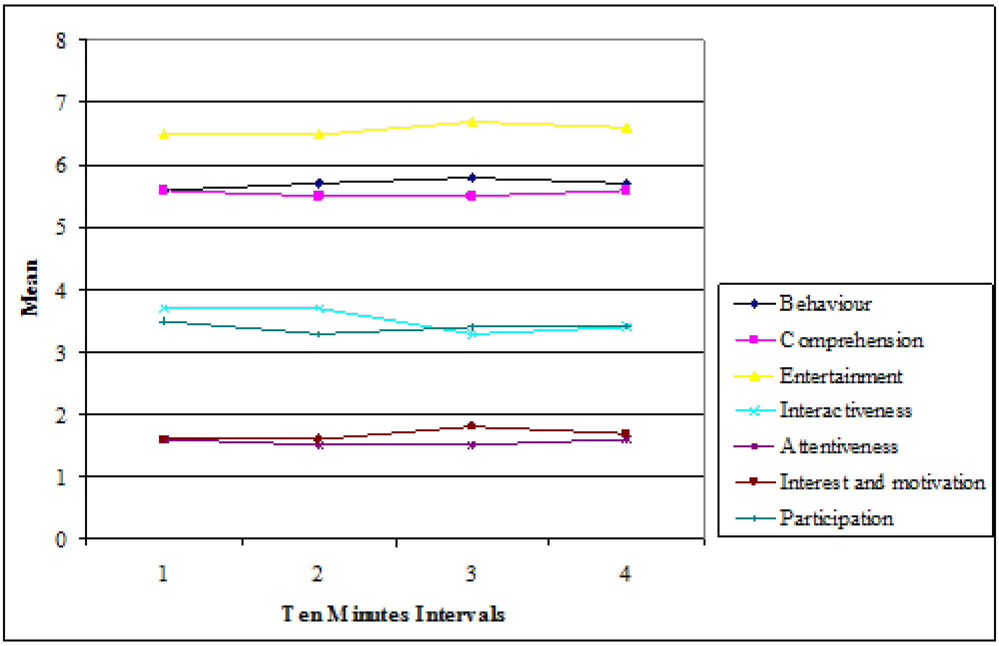


Figure 4.3: Relevance of Captioned TV on Instructing Learners with HI

Behaviour of learners such as self-regulation and association with characters on the screen improved to the third interval and then declined after the learners became used to the captioned material. Comprehension of the plot or theme of captioned material was more or less constant throughout the session with only a slight variation around an aggregated mean rank of 5.5. Entertainment like jokes and laughter from the captioned material shown to the learners tended to be constant in the first two intervals only to increase in the third interval. The same trend was exhibited by interest and motivation though at a lower aggregated mean rank of about 1.5. This was possibly because the first two quarters were spent trying to understand the captioned material before learners could comprehend and appreciate the jokes or get interested in the subject matter.

On instruction, learners were absorbed in the learning process and relevancy of comments by students were constant for the first two intervals at an aggregated mean of 3.7

but declined in the third and fourth quarters as the learners became more absorbed in the lesson. On the other hand, attentiveness, interest, and motivation were more or less constant at an aggregated mean of 1.5 showing that this mode of instruction was capable of capturing learners' attention over a long period of time. Participation in the learning process through asking relevant, intelligent questions reduced in the first interval to an aggregated mean of 3.3 but remained constant in the third and fourth quarters as the learners became more absorbed in the learning process.

In general, the findings indicate that the use of captioned TV programmes with learners with HI increased their motivation. This led to the improvement of their learning behavior, comprehension, entertainment, attentiveness, interest, motivation and general participation in the learning process.

4.6 Discussion of the Findings

4.6.1 Attitude of Learners towards Captioning as an Instructional Tool

The findings show that, captioning was a very good instructional tool with a motivating influence on learners. This was characterized by increased rate of understanding of captioned material, improving learning behaviour and the ability to remember. This made it a preferred instructional tool. Further results reveal that, captioning of audio-visual material is essential for learners with HI to gain equal access to the curriculum.

4.6.2 Effects of Captioned Technology in the Education of Learners with HI

According to the findings, captioned TV programmes had improved learners' levels of attentiveness and interest in learning a great deal. Captioned TV programmes had improved their participation in the learning processes particularly those deaf from birth.

Chapter Five

Summary Conclusions & Recommendations

5.1 Summary of the Findings

The results indicated a motivating influence of captioned TV on learners characterized by increased rate of understanding of captioned TV programmes, improved learning behaviour and improved ability to remember. Learners therefore accepted captioned TV programmes as a good and alternative instructional tool that had extremely positive attitudes toward this medium of instruction.

5.2 Conclusions from the Findings

The study concludes that captioned TV programmes is one of the special adaptive instructional tools that can be used as a supplementary mode of teaching learners with HI. This new approach can provide more access to classroom teaching and discussion.

5.3 Recommendations

There is need to review the current curricula and begin the task of appropriate curriculum development for learners with HI, in order to attain the required SNE purposes and experiences. This follows the findings that captioning has a tremendous positive impact on learners with HI. All audio-visual material should have captions for the HI for immediate and equal access to information. There is also need to constantly evaluate special education curriculum to ensure that it is in line with the emerging trends of technology and development in SNE. If implemented, students with special needs will have an equal opportunity to lifelong learning able to realise set goals and objectives.

5.5 Areas for Further Research

There is need to find out the relevance of the existing curricular for learners with HI as it affects the use of captioned TV programmes. The involvement of teachers for learners with HI in the teaching, monitoring and assessment practices should also be studied, as the findings will contribute to the use of captioned TV programmes.

References

Adoyo, P. O. (1995). An investigation of Kenyan sign language, Unpublished PGDE

Dissertation, University of Bristol, U.K, Retrieved on 25th May 2006 http://66.249.93.104/search?q=cacherp4u4PyIJ

Baker, T. L. (1994). Doing Social Research (2nd Edn.). New York: McGraw-Hill Inc.

Bell, J. (1993). Doing your research project. Buckingham. Open University Press.

Best, J. W. & Khan, J. V. (1993), Research in Education. Prentice-Hall Inc. New York.

Bishop, J. M., Taylor, L. and Froy F. (2000). Computer mediated communication use by the deaf and hard of Hearing. Kybernetes, 29(9/10), 1078-1086.

Braverman, B. B. (1981). Television captioning strategies: A systematic research and development approach. American Annals of the Deaf, 126, 1031–1036

Burgstahler, S. (2006). Creating video and multimedia products that are accessible to people with sensory impairments. University of Washington, Retrieved on 24th May 2006 http://www.Washington.Edu/doIt/Brochures/Techno logy/vid_sensor y.html.

Burns, F. N. (2003). Report on universal education in Kenya.

Bussey, K. and Bandura, A. (1999). Social cognitive theory of gender development and differentiation. Psychology Review, 106, 676-713.

Clymer, E. W. and McKee, B. G. (1997). The promise of the worldwide web and other telecommunication technologies within deaf education. American Annals of the Deaf, 142, 104-106.

Concrad, R. (1984). The deaf school child. London: Harper and Row.

Deolakan, R. V. (1999). Has the law made a difference? Beyond separate education, 2nd ed. Baltimore: Brookes.

Frazier, C. and Ryan, T. (2005). Using information effectively in education (istc 201); assistive technology: an aid in deaf education. Chante Frazier's Online

Research Portfolio, retrieved on 15th May 2006 from http://tiger.towson.edu.

Gaines R., and Yongxin, P., (1995). Chinese deaf children's reading skills and signing skills. Silver Spring, MD: Linstok Press.

Jelinek, L. M. S. and Jackson, D. W. (2001). Television Literacy: Comprehension of Program Content using Closed Captions for the Deaf. Journal of Deaf Studies and Deaf Education, 6, 43–53.

Jensema, M. S. (2003). Hoe worden ondertitelde televisieprogramma's bekeken? [How does one view captioned television programs?]. De Psychology, 24, 425–431.

Karanja, J (2003, May 6). Disabled pupils must benefit too. Daily Nation P.

Kinaga, T. D. (1987). Teaching young students with hearing impaired problems. Nairobi: Ronald Press.

King, E. J., and Quigley, L, H. (1985). The psychology of reading. Cambridge, MA: The MIT Press.

Levit, H. (1985). Education of the hearing impaired child. Taylor and Francis Ltd. London.

Lewis, R. B., and Doorlag, D. H. (1983). Teaching Special students in the mainstream. Columbus: Ohio: Charles E. Merill.

Mugenda, O. M. and Mugenda A. G. (1999). Research Methods. Nairobi: Acts Press.

National Captioning Institute Inc. (2006). A brief history of captioned television, retrieved on 10th May 2006 from: http://www.ncicap.org/Docs/history.html.

National Center for Accessible Media (NCAM), (2006). International Captioning Project, Asia and Australia, Retrieved on 10th May 2006

Ndurumo, M. M. (1993). Exceptional children: development consequence and interventions. Nairobi: Longman, Kenya Ltd.

Okombo, O. & Akach, P. O. A. (1997). Language convergence and wave phenomena in the growth of a national sign language in Kenya.

Republic of Kenya, (2003). Koech Commission (1999) TIQET Totally integrated quality education and training. A report of the commission of inquiry into the education system of Kenya.

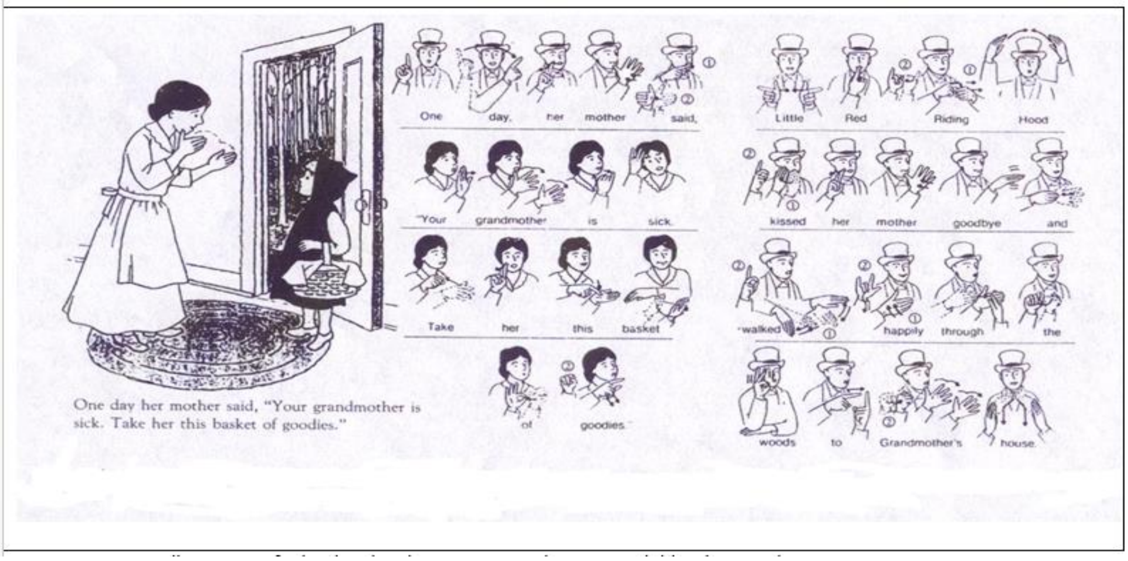
Scherer, M. J. (2004). Connecting to learn: educational and assistive technology for people with disabilities. Washington, DC: American Psychological Association.

UNESCO (2003). Review of the present situation in special needs education. Paris: UNESCO.

APPENDIX I

Edi

The wolf blows hard!



An illustration of edited and verbatim captions depicting a children's story that: -

Provides information about who is speaking and signing

About sound effects that may be important

Understand a children's story

Shows the sequence of the story.

EFFECTS OF MATHEMATICAL VOCABULARY INSTRUCTION ON STUDENTS' ACHIEVEMENT IN MATHEMATICS IN SECONDARY SCHOOLS OF MURANG'A COUNTY, KENYA

Benson Njoroge Wanjiru

Abstract

The purpose of the current study will be to explore the influence of mathematical vocabulary instruction on students' Mathematics achievement. The central thesis of the study will be that success in Mathematics requires knowledge in mathematical vocabulary; a specific, which enables the teachers to communicate mathematical concepts and the learners to learn, understand and communicate Mathematics. The study will be guided by the following objectives:(1) To determine the extent to which mathematical vocabulary influences Mathematics achievement (2) To establish the factors that contribute to mastery of mathematical vocabulary (3) To develop a prototype for a lesson plan for Mathematics vocabulary based instruction. The study will be a quasi-experimental pre-test and post-test design. It will be conducted in two county secondary schools in Murang'a County, Kenya: one Girls' school and the other a Boys' school. The schools will be chosen purposively since they are the best performing county schools in the District. The study will target 1450 secondary school students in Kahuro District of Murang'a County. The study sample will involve two hundred and eight (208) form two students in the two county schools and six mathematics teachers. Both the experimental group and the control group will consist of fifty-two (52) students. The experimental group will be exposed to a combined direct and indirect approach of vocabulary instruction for four weeks. In addition the experimental group will be exposed to the Mathematics Vocabulary Dictionary found at the website www. Maths dictionary for Kids by Jenny Eather. The study will employ four (4) instruments namely: Students' Vocabulary Test (SVT), Students' Vocabulary Dictionary (SVD), Students' Mathematics Achievement Test (SMAT) and Mathematics Teachers Questionnaire (MTQ) to collect both qualitative and quantitative data. Paired t-test will be used to determine if there is any significant mean difference in students' performance in Students' Vocabulary Test and Mathematics achievement scores between the control and experimental groups. The statistical significance of the results will then be examined at

α=0.05 statistical confidence level. The study contends that precise mathematical vocabulary instruction is a prerequisite for improved mathematical achievement.

Background to the Study

Mathematics is a compulsory subject in the secondary school curriculum in Kenya. The importance of school mathematics cannot be overemphasized. Mathematics is crucial not only for success in school, but in being an informed citizen, being productive in one's chosen career, and in personal fulfilment. In today's technology driven society, greater demands have been placed on individuals to interpret and use mathematics to make sense of information and complex situations. Mathematics is an essential tool in many fields, including natural science, engineering, medicine, and the social sciences. It is also used in day-to-day activities at home, in the market places and in offices. Mathematics is a compulsory subject in the secondary school curriculum in Kenya. Despite the importance to which the society values mathematics, the performance of students in KCSE has been dismal.

A key component in understanding mathematics is learning vocabulary. Vocabulary is the knowledge of a word and meanings (Staley, 2005). However, it also encompasses comprehending how words are used in oral and written formats. According to Miller (1993: 12), students are likely to be handicapped in their effort to learn mathematics if they do not understand the vocabulary that is used in mathematics classrooms, textbooks and assessment tests. Mathematical vocabulary refers to words that label mathematical concepts for example quotient, volume, vertex, dividend, and hexagon (Sanders, 2007). One of the obstacles that make mathematical vocabulary difficult to learn is lack of opportunity (Paul & Sinha, 2010). This is because much of the vocabulary used in mathematics classroom is rarely encountered in everyday life. In addition, mathematics teachers often neglect meaningful vocabulary instruction.

Also, many terms have meanings in the realm of mathematics that differ from their meanings in everyday usage (Njoroge, 2003). Without appropriate vocabulary instruction, students are likely to experience difficulties and interference in the learning of concepts for which they have background knowledge that appears unrelated to mathematics. According to Solano-Flores and Trumbull (2003), the abstract nature of mathematical vocabulary is another factor contributing to difficulty in learning mathematical vocabulary. This is because many mathematical words represent concepts and not objects. Words such as quotient, fraction, and factor describe concepts but have no unique unambiguous representations in the real world. An integral part of learning mathematics is using vocabulary to communicate mathematics ideas; to explain, conjure and defend one's ideas orally and writing about mathematics (NCTM, 1989). Students need to know the meaning of mathematics vocabulary words whether written or spoken in order to understand and communicate mathematics ideas. According to Sanders (2007), terms, phrases, and symbols are essential in communicating mathematical ideas; and becoming fluent with them is vital for children's mathematical learning. Research reveals that the knowledge of mathematics vocabulary directly affects achievement in arithmetic, particularly problem-solving (Staley, 2005). Riordain & D'onoghue, J. (2009) indicated that vocabulary knowledge is strongly related to overall academic achievement in school. Although students may excel in computation, their ability to apply their mathematics skills will be hindered if they do not understand the vocabulary required to master content and are able to apply in future situations. Thus teaching vocabulary in the mathematics content area is a critical element of effective instruction.

Research Hypotheses

The study will be guided by four (4) null hypotheses:

HO1: There is no significant difference between scores on vocabulary assessments for form two students taught Mathematical vocabulary and those not taught Mathematical vocabulary.

HO2: There is no significant difference between students' gender and performance in Mathematical Vocabulary Test.

HO3: There is no significant difference between mathematics performance for Form two students taught mathematics vocabulary and those not taught mathematical vocabulary.

HO4: There is no significant difference between students' gender and scores in mathematics

Methodology

The study design will be quasi-experimental design. The notational paradigm of the design can be summarized as shown below:

Experimental Group	R	01	X	02
Control group	R	01		02

(R: Random Assignment, X: Treatment, O: Observation)

The study will be carried out in two County Schools in Kahuro District of Murang'a County: One Boys and One Girls School. It will target all 1450 students of the two County Schools. A sample of 208 Form two (II) students will be selected for the study. Out of the three (3) Form Two (2) classes, simple random technique will be used to choose two. Six mathematics teachers handling the Form Two Classes will also be included in the study.

The study will employ four (4) instruments namely: Students' Vocabulary Test (SVT), Students' Vocabulary Dictionary (SVD), Students Mathematics Achievement Test (SMAT) and Mathematics Teachers Questionnaire (MTQ) to collect both qualitative and quantitative data.

Since the Students' vocabulary Test (SMVT) and Students' Mathematics Achievement Test (SMAT) items will have dichotomous scores with varied levels of difficulty, their reliability coefficient will be determined using Kuder-Richardson (KR-Formula 20) estimates. The reliability of the non-dichotomous score tool, MTQ will be determined using the Cronbach coefficient formula adapted from Sattler (1988:27). The drafted instruments will be piloted in the two schools. They will be piloted in one of the three Form Two (2) classes. This class will not be used in the main study. The twenty (20) students from the class will be randomly selected and SMVT & SMAT will be administered to them.

Actual administration of the experiment will take the following steps:

Step 1: Pre-test of the 104 Form Two (II) students in each school on understanding Mathematics vocabulary words derived from form one syllabus. This will involve administration of SMVT.

Step 2: Teaching mathematics vocabulary using various strategies to the experimental group for a period of four (4) weeks. Lesson plan for teaching mathematical vocabulary will be developed by the teacher with collaboration with the researchers and experts in mathematical education from Kenyatta University.

Step 3: It will involve Post-testing students on knowledge of form two (2) mathematics vocabulary words. This will involve the administration of SMVT

Step 4: It will involve administration of the Students' Mathematics Achievement Test (SMAT) to both Control and Experimental groups.

Quantitative approach will be used to analyse the student t-test. Paired t-test will be used to determine if there is any significant mean difference in students' performance in Students' Vocabulary Test and Mathematics achievement scores between (i) the control and experimental groups (ii) pre-test and post-test (iii) between Genders. The statistical significance of the results will then be examined at $\alpha=0.05$ statistical confidence level.

Qualitative analysis will consider the inferences that will be made from the opinions of the respondents. This analysis will be narratively presented and where possible presented in tabular form. The lesson plan will be analysed and a prototype for teaching mathematical vocabulary will be developed.

References

Miller, D. L. (1993). Making the connection with language. Arithmetic Teacher, 40(6) 311-16.

Monroe, E. E., & Pendergrass, M. R. (2002). Effects of mathematical vocabulary instruction on fourth grade students. Reading Improvement, 32, 120–132.

National Council of Teachers of Mathematics. (1989). Curriculum and Evaluation Standards for School Mathematics. Reston. NCTM.

Njoroge, B. (2003). The Relationship between mathematical Language and Students' Performance in Mathematics in Nairobi Province, Kenya, Unpublished M.Ed Thesis, Kenyatta University, Nairobi.

Paul, M. & Sinha, A. (2010). Effect of proficiency in English on the performance of B. Tech students in-group discussion. In African Journal of Business Management vol. 4(8)

Riordain, M. N., & O'Donoghue, J. (2009). The relationship between performance on mathematical word problems and language proficiency for students learning through the medium of Irish. Education Stud. Math. 71; 43-64

Sanders, S. P. (2007). Embedded strategies in mathematics vocabulary instruction: A quasi-experimental study. Published PhD dissertation. Clemson University.

Sattler, J.M. (1988). Assessment of Children, 3th ed. San Diego: Jerome M Sattler Publisher.

Solano-Flores, G, & Trumbull, E. (2003). Examining language in context: The need for new research and practice paradigms in the testing of English-language learners Educational Researcher, 32(2), 3-13.

Staley, L.E (2005). The effects of English language proficiency on students' performance on standardized test of mathematics achievement. Published PhD dissertation. Los Angeles: University of California.

CHOOSING AND ADAPTING AN INSTRUCTIONAL DESIGN MODEL FOR M LEARNING

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Abstract

There is need for instructional design theories to provide guidance for "… the use of new information technology tools" (Reigeluth and Frick's, 1999; Shiffman, 1995). The main purpose of an instructional design model is to maximize the value of the instruction provided to the learner. The main reason being that pedagogical needs must drive the choice of instructional technology to be used in teaching and learning and not the other way round (Chizmar & Walbert, 1999). Instructional designs offer several benefits: Firstly, compared with a human instructor, technology is less adaptive. Once a plan of integration is implemented, it is less likely to change and since the learners' reactions do not matter, the instructional design plays an important role in bridging pedagogy and technology. Secondly, the instructional design plays a key role in content organization, teaching strategies and the choice of the medium to be used by educators. Thirdly, it provides consistency between various courses developed by instructors/designers. Fourthly, it provides the most effective way to present content to the learners by focusing on the learners' past experiences. In addition, instructional design used ensures that the quality of the course offered covers all the phases of good development. Finally, the instructional design model gives a precise structure to the student's approach towards course materials and creates a transparent process that can be tracked and utilized by the experiences of developers (Chaudry & Rahman 2010).The introduction of mobile learning technology in

Africa has shown a positive indication towards achieving the EFA goals (UNESCO, 2012). From the literature reviewed so far, there is no evidence of an instructional design model guiding m-learning programs that have been initiated in Africa. Instructors have continued to use traditional instructional methods with new technologies. In this paper, we describe results of review of journals from 39 publishing e-databases, the results of which contribute to our understanding of how to adapt existing instructional design models to the specificities of m-learning and different teaching domains. In conclusion we argue that the task of choosing and adapting an Instructional design model require a well thought evaluation benchmark that is inclusive of pertinent specifics that go along with the nature of differentiated mobile devices and user preferences.

Keywords: Mobile learning, Mobile technology, Mobile learner, Instruction Design

Research Problem

While pedagogical needs must drive the choice of instructional technology to be used in teaching and learning (Chizmar & Walbert, 1999), in the recent development of mobile learning, there are few well-developed associated methodologies for delivering courseware. Mobile Learning System designers have therefore turned to the adaptation and partial automation of instructional design models that were originally developed for traditional "face-to-face" or web 2.0 commonly referred as e-learning. These methods assume specific media for the materials to be presented and a specific delivery system for their presentation. The question therefore arises as to what needs to be considered when choosing an instructional design method developed for a given technology and delivery systems such as face-to-face or e-learning in order for the quality of learning to be reasonably maintained?

Research Objective

This paper seeks to provide a framework or a benchmark that can guide the choice of an instructional design model for m-learning.

Introduction

Information Communication and Technologies (ICTs) are providing a window of opportunities for educational institutions to complement and support the teaching and learning process. E-learning and M-learning are examples of the use of these ICT-supported teaching and learning methods. While E-learning is gaining momentum faster in secondary and post-secondary institutions M-learning is relatively new. According to Omwenga, Instructional support is necessary to any technology that may be used as a learning tool and that all instructional activities need the support, which he grouped into three:

"Modelling: *Demonstrating to the learner how (and why) they should perform the activities necessary for the completion of some task or objectives.*

Coaching: *To intervene at critical points in the instruction in order to provide the learner with encouragement, diagnosis, directions and feedback.*

Scaffolding: *To adjust the task for the learner to match his/her level of performance. In the long run, the objective is to remove all support systems when the learner is ready to think on his/her own" (Omwenga E.I., 2004; UNESCO, 2012).*

Like E-learning, M-learning environments need to be designed to support the learners learning environment in order to have learning activities that promote learning.

Instructional Design Models

If training is needed it must be impacted in a systematic way. Instructional models guide on the way to combine instructional strategies in order to produce a course of instruction. It also gives structure and meaning to an instructional design problem for the purposes of production of instruction. It is the entire process of analysis of learning needs and goals and the development of a delivery system to meet the teaching and learning needs (Chaudry & Rahman, 2010).

A good model can be determined within the context of use and like any other product

"A model should be judged by how it mediates the designer's intention, and how effectively it shifts focus away from itself toward the object of the design activity" (Martin Ryder, 2012).

Some Popular Existing Instructional Designs

Dick and Carey Model

The design model uses a systems approach for designing instruction. The approach to designing instruction is similar to that of software engineering methods. One of the limitations of this model is that behavior is not considered. Some critics feel that the systems approach is too focused on specific objectives to be successfully applied to the development of instruction, which supports higher-level thinking and the active construction of knowledge by learners. However, advocates of the systems approach dispute this, and believe the systems approach can be effectively employed to set appropriate goals and construct learning environments that facilitate the attainment of those goals (Merrill, Li, & Jones, 1990).

Kemp Instructional Design Model

The Jerold Kemp instructional design method and model defines nine different components of an instructional design and at the same time adopts a continuous implementation and evaluation model. The model is particularly useful for developing instructional programs that blend technology, pedagogy and content to deliver effective, inclusive (reliable) and efficient learning. According to McGriff, Kemp identifies nine key elements: Identify instructional problems; Examine learner characteristics; Identify subject content; State instructional objectives for the learner; Sequence content within each instructional unit for logical learning; Design instructional strategies so that each learner can master the objectives; Plan the instructional message and delivery; Develop evaluation instruments to assess objectives; Select resources to support instruction and learning activities.

ADDIE Instructional Design Model

The ADDIE instructional design model is the generic process traditionally used by instructional designer. It has five phases: - Analysis, Design, Development, Implementation, and Evaluation. It is an Instructional Systems Design (ISD) model. Most of the current instructional design models are spin-offs or variations of the ADDIE instructional design model; one commonly accepted improvement to this model is the use of rapid prototyping.

Gagne's 9 Events of Instruction

Robert Gagne is considered to be the foremost contributor to the systematic approach to instructional design and training. Gagne and his followers are known as behaviorists, and their focus is on the outcomes (or behaviors) resulting from training. He created a nine-step process called the events of instruction, which correlate to and address the conditions of learning namely: Gain attention; Inform learner of objectives; Stimulate recall of prior learning; Present stimulus material; Provide learner guidance; Elicit performance; Provide feedback; Assess performance; Enhance retention transfer.

Bloom's Learning Taxonomy

In 1956, Benjamin Bloom headed a group of educational psychologists who developed a classification of levels of intellectual behavior important in learning. Bloom found that over 95 % of the test questions students encounter require them to think only at the lowest possible level...the recall of information. He identified six levels within the cognitive domain: ***Knowledge; Comprehension; Application; Analysis; Synthesis and Evaluation.***

Rationale for Instructional Design in M-Learning or any Technology

The several benefits instructional design offers are; first, compared with a human instructor, technology is less adaptive and once a plan of integration is implemented, it is less likely to change. The learners' reactions do not matter. Instructional design plays an important role in bridging pedagogy and technology. Secondly, the content has to be well organized and strategies for teaching via the chosen medium. Instructional design helps educators to make the best use of technology. Thirdly, it provides consistency between various courses developed by various instructors/designers. Fourthly, it focuses on the most effective way to present content to the learners beginning with the learner and the learner's experience in mind. Fifth is that the quality of the course offered is ensured to cover all the phases of good development. Finally, instructional design gives structure to the student's process of working through course material and creates a transparent process that can be tracked and utilized by the experiences of developers (Chaudry. M. A & Rahman. F., 2010).

Methodology

The purpose of this research paper was to discover common grounds and similarities along with differences, inconsistencies or contradictions within the domain of Instructional design in the context of mobile learning. We wanted to generalize findings from a prospect for patterns and gaps in the research field and the best method chosen to do this was a review of literature (Tranfield et al. 2003). Although literature review is limited to a snapshot and critical report of the current publications, it is extended by a comparative analysis of various existing works.

The basis of this paper is an exhaustive literature review of journals. The paper offers a survey of mobile learning and or instructional design models' articles based on a systematic review of publications. We scanned 625 papers of mobile learning and or Instructional design papers of journals.

Each publication was scrutinized for Mobile Learning and or instructional design model. All Mobile Learning publication that focused on frameworks, infrastructure and content delivery were thoroughly screened. The following search criteria were used:

- Existence of M-Learning system;
- Existence of Instructional Design Model(s);
- Educational-oriented user systems.

Data Collection and Sampling Method

The research focused on collecting abstracts and full papers from 39 journal databases (Africa Journals Online (AJOL); AGORA; ALUKA; American Institute Of Physics Journals; American Physical; Society Aps; Annual Reviews; Caliber: Journals Of The University Of California Press; Cambridge ; university Press; Chicago Journals Online; Cochrane Library; Directory Of Open Access Journals (DOAJ); EBSCO Host; Emerald Publishing; Expanded Academic ASAP; Geological Society; http://elibproxy.anu.ac.ke:2048/login?url=http://scholar.google.com http://elibproxy.anu.ac.ke:2048/login?url=http://infotrac.galegroup.com/itweb/nazerene?db=hwrchttp://elibproxy.anu.ac.ke:2048/login?url=http://www.who.int/hinari/en/http://elibproxy.anu.ac.ke:2048/login?url=http://www.ingentaconnect.com/content/beechInstitute Of Electrical; And Electronics Engineers; Institute Of Physics (IOP) Publishing; JSTOR; http://elibproxy.anu.ac.ke:2048/login?url=http://www.liebertonline.comhttp://elibproxy.anu.ac.ke:2048/login?url=http://www.minabs.comhttp://elibproxy.anu.ac.ke:2048/login?url=http://www.nap.edu/info/faq_dc_pdf.htmlNature Publishing Group Journals; http://elibproxy.anu.ac.ke:2048/login?url=http://www.opticsinfobase.orgOxford Journals; Pal Grave Macmillan Journals; http://elibproxy.anu.ac.ke:2048/login?url=http://muse.jhu.edu Royal Society For

Chemistry-RSC Journals ; Archive; Royal Society For Chemistry-RSC Journals Online; Royal Society Journals Online; Sage Journals; Online; Springer; Symposium Journals; Wiley Inter-science; http://elibproxy.anu.ac.ke:2048/login?url=http://www.worldbank.org/elibraryEbrary Collection; Taylor & Francis eBooks; Academic Journals; African Journals Archive; Bangladesh Journals Online (BanglaJOL); http://elibproxy.anu.ac.ke:2048/login?url=http://www.biomedcentral.comSri Lanka Journals ; Online(SLJOL); Virginia Tech Electronic Library; http://elibproxy.anu.ac.ke:2048/login?url=http://www.bookboon.com/Taylor & Francis; CSIR Research Space; University of Stellebosch, SA.). 215 papers were randomly sampled, 76 papers and abstracts were obtained through a search criteria using the keywords M-Learning system, Mobile Learning, Instructional Designs and Educational-oriented users. Those papers that did not have the keywords were eliminated while those found to have the key words were thoroughly screened. The lenses for screening were obtained by considering the following: Did the research paper suggest an Instructional Design Model was used? If used did it address ways of identifying

4. Learner readiness?
5. Instructor readiness?
6. Support for instructor to deliver a course?
7. Support student learning process?
8. Availability and accessibility of information?
9. Engage students in learning-related activities in diverse physical locations?
10. Enable quick content delivery?

11. Provide evaluation criteria?

12. Solutions to barriers of learning?

13. Feedbacks?

Results and Analysis

The Current Status of Academic Research on m-Learning

Most of the recent research on mobile learning has a bias on accessibility, usability and delivery of content through mobile devices and only a few discuss instructional designs. According to Castells et al (2007), the application *of "mobile technology for achieving better learning outcomes and alignment between learner/teacher expectations and the generation of new skills in response to societies' needs is still scarce."* This paper results totally agree with Castells.

Some researchers like Christensen (1995), view mobile technology as "disruptive technologies". In his paper, *Disruptive Technologies:* Catching the Wave, he has documented some failures in m-learning as contributed by managers of good companies' failure to use the mobile technology or ignoring it. However, some research has shown that institutions that chose to use m-learning found that their various expectations were not fully met and some of their failure of those projects was due to errors made by people and institutions in the process of implementing the innovations and not the weaknesses or inadequacies in the technologies. Christensen (1997), "Megatrends," (2007). Some of these errors were choice of instructional design model.

Journal	2013			2012			2011		
	Volume	Total articles	observed	Volume	Total articles	observed	Volume	Total articles	observed
International Journal of Teaching and Learning in Higher Education (IJTLHE	-	-	-	24(3)	13	0	23(3)	13	0
	-	-	-	24(2)	16	0	23(2)	13	3
	-	-	-	24(1)	14	0	23(1)	15	7
	-	-	-						
British Journal of Educational Technology	-	-	-	43(6)	32	2	42(6)	34	3
	-	-	-	43(5)	18	7	42(5)	30	2
	44(4)	15	4	43(4)	30	6	42(4)	28	1
	44(3)	25	3	43(3)	28	2	42(3)	21	0
	44(2)	27	2	43(2)	25	1	42(2)	25	1
	44(1)	27	5	43(1)	32	3	42(1)	28	3
Journal of Education and Practice	4(12)	27	0	3(16)	31	2	2(12)	3	0
	4(11)	28	0	3(15)	23	0	2(11)	4	0
	4(10)	26	0	3(14)	26	1	2(10)	6	1
International Institute for Science, Technology and Education	4(9)	22	0	3(13)	21	0	2(9)	6	0
	4(8)	28	0	3(12)	26	0	2(8)	6	1
	4(7)	27	1	3(11)	8	0	2(7)	9	0
	4(6)	29	1	3(10)	12	0	2(6)	10	0
	4(5)	24	1	3(9)	24	1	2(5)	11	1
	4(4)	35	0	3(8)	33	0	2(4)	21	0
	4(3)	24	0	3(7)	21	2	2(3)	16	0
	4(2)	22	0	3(6)	13	0	2(2)	8	0
	4(1)	22	2	3(5)	9	1	2(1)	4	0
		408	19		412	28		270	13
		4.7%			6.8%			4.8%	

Figure 1: Results of three educational technology related journals

Between January 2010 and July 2013, each year records less than 10% of the total published work. In 2013, 2012, 2011, and 2010 only 4.7%, 6.8%, 4.8% and 9.0% articles featured having issues of mobile learning or instructional design issues respectively. Majority of the papers reviewed focused on the following areas:

- Emerging technologies: Mobile learning was one of the emerging technologies used for teaching and learning. All researchers focused in this area concur that mobile learning has not yet been widely embraced but there is increased use of mobile technologies especially in the developing world;
- The use of mobile technologies has the potential to transform the teacher-learner relationship;
- A pedagogical framework for integrating technology is not fully developed and many learning environments of mobile learning are adapting IDM for web 2.0 technologies.
- Learner experiences of learning with mobile technologies focusing on altitude, acceptability, adoption and usability.
- Architectural designs for designing mobile learning tools

After screening some of the papers, some technical barriers in delivering mobile activities in the learning context were identified. Most research that has been carried out identifies these barriers as: issues of ownership; the price of mobile Internet; the device battery life too short, the screen size too small. However, many users have high expectations for the m-learning and are indicative of success despite these barriers.

Out of all the papers reviewed, none seriously focused on instructional design modeling but acknowledged that it is a key issue to be researched further.

Rajasingham, (2011), strongly acknowledges *that "Staff development in adapting course/instructional design and online teaching techniques for m-learning are critical." and "Instruction for conventional e-learning must be redesigned for m-learning for deep learning to take place."*

Conclusion

The ultimate goal of an instructor to a learner is to deliver instructions to guide learning. The choice of technological tool(s) and instructional design model by the instructor is to aid or support the delivery of instructions to the learner. The choice needs to be guided so that a good fit may be achieved for the intended learning outcomes (ILO) to be realized. This paper outlines ten things to consider when choosing an instructional design model to be used with a Mobile Learning tool:

1. Learner readiness;
2. Instructor readiness;
3. Support for instructor to deliver a course;
4. Support student learning process;
5. Availability and accessibility of information;
6. Engage students in learning-related activities in diverse physical locations;
7. Enable quick content delivery;
8. Provide evaluation criteria;
9. Solutions to barriers of learning and
10. Feedbacks.

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References

Christensen, C. (1995), Disruptive Technologies: Catching the Wave, Harvard Business Review.

Christensen, C. (1997). Innovator's Dilemma: When New Technologies Cause Great Firms to Fail, Harvard Business Press, Cambridge, Mass, USA.

Chaudry. M. A & Rahman, F., (2010). A critical Review of Instructional Design Process of Distance Learning System. Turkish Online Journal of Distance Education –TOJDE July 2010. ISSN 1302-6488 Volume: 11 Number: 3 Article 11.

Chizmar, J. F., & Walbert, M. S. (1999). Web-based learning environments guided by principles of good teaching practice. Journal of Economic Education, 30, 248-264.

Gagne, R. M., Briggs, L. J., & Wagner, W. W. (1992). Principles of instructional design. New York: Harcourt Brace Jovanovich College Publishers.

M. Castells,M. Fernandez-Ard´evol, J. Qui, and A. She, Mobile Communication and Society, MIT Press, Cambridge, Mass, USA, 2007.

"Megatrends," (2007), http://www.ericsson.com/ericsson/corpinfo/programs/the role of mobile learning in european education/products/wp/socrates m learning wp4.pdf.

Omwenga, E., Waema, T., & Wagacha, P. (June 2004). A model for introducing and implementing e-learning for delivery of educational content within the African context. African Journal of Sciences and Technology 5(1) 35-48. Rajasingham L., Corporation Education Research International. Hindawi Publishing.Volume 2011, Article ID 528495.

Reigeluth, C. M. & Frick, T. W. (1999). Formative research: Methodology for creating and improvingdesign theories. In C. M. Reigeluth (Ed.) Instructional-design theories and models (Volume II) A new paradigm of

instructional theory (pp. 633 –652). Mahwah,
NJ: Lawrence Erlbaum Associates.

Schiffman, S. S. (1995). Instructional systems design: Five views of the field. In G.J. Anglin (Ed.), Instructional technology: Past, present and future. (2nd ed., Pp. 131-142). Englewood, CO: Libraries Unlimited, Inc.

UNESCO, 2012, Mobile learning support for teachers 2012 Africa and middle east [online] Available: http://www.unesco.org

THE RIGHT TO INCLUSIVE EDUCATION FOR STUDENTS WITH DISABILITIES IN KENYA

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Abstract

This article explores the current inclusive education system in Kenya, and how those practices relate to Article 24 of the United Nations' Convention on the Rights of Persons with Disabilities (CRPD). Local laws and international instruments are presented to shed light on the extent to which students with disabilities have a right to inclusive education in Kenya. Inclusive education is in its nascent stage in Kenya, and many barriers currently exist in the development of an inclusive education system. Such barriers include: poverty, child labor, natural disasters, HIV/AIDS, gender, ethnicity, access to healthcare, access to food, and availability of clean drinking water. In order for Kenya to develop an inclusive education system in accordance with the CRPD, the author proposes the following: development of a country/region-centered plan, implementation of inclusion reports, development of an inclusive network for schools throughout Kenya, and clarification of ambiguous language and terms within Article 24 of the CRPD, as applied to Kenyan laws and policies.

Keywords: inclusive education, disability, Kenya, Convention on the Rights of Persons with Disabilities, Education For All, Millennium Development Goals

The Right to Inclusive Education for Students with Disabilities in Kenya

In 2006, the UN adopted the Convention on the Rights of Persons with Disabilities (CRPD). The instrument became open for signatures in March 2007. Article 24 of the CRPD specifically states that "persons with disabilities are not excluded from the general education system on the basis of disability, and that children with disabilities are not excluded from free and compulsory primary education, or from secondary education, on the basis of disability" (United Nations, 2006, p. 15). This goal has not yet been realized in Kenya, but there is reason to believe that inclusive education can succeed.

The Kenyan Constitution of 1963 prohibited discrimination, but not on the basis of disability. The document has since been replaced by the 2010 Constitution, which includes a specific statement affording all Kenyans with disabilities the right to education when it states:

> A person with any disability is entitled to access educational institutions and facilities for persons with disabilities that are integrated [emphasis added] into society to the extent compatible with the interests of the person (Constitution of Kenya, 2010, p. 37).

If *all* Kenyans are entitled to the essential vales of human rights, and equality, then it follows that all Kenyans with disabilities should be entitled to an equal compulsory and free education alongside their peers without disabilities.

In addition to Kenyan domestic law, the Kenyan government has signed and ratified numerous treaties and declarations over the past few decades. Once international treaties are ratified, the state cannot enforce the new legislation until parliament enacts a relevant law. If discrepancies exist between the treaties and the domestic law, reservations are made within the instruments. To date, several instruments have been adopted by the international community to address the rights of children and adults with disabilities in regards to education. These instruments include: the Convention on the Rights of the Child (CRC) in1989, the World Conference on Education for All (EFA) (1990), the Salamanca Statement (1994), the Dakar Framework for Action (2000), the Convention on the Rights of Persons with Disabilities (CRPD) (2006), and the United Nations Summit on the Millennium Development Goals (MDGs) (2010). Since Kenya has ratified these treaties and appears to support these international instruments and statements, all children and adults with disabilities in Kenya are guaranteed equal rights and a compulsory education, including access to an inclusive education system. However, the government has yet to implement this mandate.

The World Health Organization (2011) reports that there are currently over one billion individuals with disabilities worldwide. Of those billion individuals, 80 percent live on the continent of Africa (UNESCO, 2005). According to the Kenya Ministry of Education (2008), there were up to one million children with and without disabilities who were not accessing any type of formal schooling. The Ministry of Education (2008) cites poverty, gender disparities, ineffective inclusive education guidelines, and poorly trained teachers as causes of this lack of access to education. Though many students with disabilities may attend residential special schools, their right to live with their families in their own communities is being violated (UNICEF, 2013). Many people with disabilities are simply entirely denied access to the education system. This is a far cry from compulsory, inclusive education for all.

History of Education in Kenya

Prior to colonization by the British, the transmission of indigenous knowledge was the main focus of education in Kenya (Kinuthia, 2009). During British colonial rule, a Western style of education was implemented, primarily by missionaries, and backed by the British government (Bunyi, 1999; Ntarangwi, 2003; Strayer, 1973).

Kenya gained independence in 1963, and adopted a British-modeled 7-4-2-3 system of education until 1984. The system provided seven years of primary education, four years of lower secondary school, followed by two years of upper secondary school, culminating into three years of higher education (Buchmann, 1999). With the collapse of colonialism, there was a need for Kenyans to fill the employment positions formerly held by British workers.

As response to this need, the Kenyan government expanded educational opportunities to its citizens (Ntarangwi, 2003).

In order to stimulate education growth after Kenya gained independence, President Jomo Kenyatta shifted the source of educational support from local communities and non-governmental organizations (NGOs), and created a government-funded system of "Harambee" schools (Oketch & Rolleston, 2007). The Harambee schools were expensive and failed to deliver a quality education across Kenya; and in 1988, they were absorbed by local school districts (Amutabi, 2003). Prior to this, in 1984, the government shifted from the 7-4-2-3-education system, to an American-based 8-4-4 system (Ministry of Education, 2008).

In the 8-4-4 system students attend eight years of primary school, four years of secondary school, and four years of university ("Education System," 2012). The Ministry of Education is the governmental body that monitors the education system, and is mandated by law to provide a "compulsory free primary education" for all children in Kenya ("Education System," 2012). Students have a range of school options depending on their financial situation. The government or a variety of local organizations fund public primary and secondary schools. Many of the private schooling options in Kenya follow the British model and International Baccalaureate programs (Kinuthia, 2009).

The Ministry of Education, Science and Technology (MoEST) is responsible for education in Kenya, including early childhood, primary, special, and secondary education programs. The MoEST also implements teacher education, on-going teacher trainings, and university and adult education programs (Ministry of Education, 2008). The mission of the MoEST is to attain the Education for All initiatives by 2015 (Ministry of Education, 2008).

According to the Office of the High Commissioner on Human Rights (OHCHR) Kenya State Party Report (2011), there are 1,882 public primary and secondary schools where inclusive education is provided on some level. Within these public schools, there are 50,744 students with disabilities who attend primary schools. Of those learners with disabilities, 24,000 attend publically funded, segregated “special” schools (OHCHR, 2011). The percentage of students who transition from primary to secondary school is less than 50 percent, or about 350,000 students each year. The rates are lower for students who transition to higher education. These figures pertain only to students without disabilities, due to limited reporting on school attendance of students with disabilities (“Education System,” 2012). If the Kenyan government does not adjust how it funds schools, and trains teachers to include all students, the CRPD will share the fate of the Harambee schools.

Inclusive Education in Kenya

In Kenya today, inclusive education practices have begun to emerge (Ministry of Education, 2008). UNESCO’s Policy Guidelines on Inclusion in Education (2009) defines inclusive education as,

A process of strengthening the capacity of the education system to reach out to all learners.... As an overall principle, it should guide all education policies and practices, starting from the fact that education is a basic human right and the foundation for a more just and equal society (p. 8).

The Kenya Ministry of Education (2008) views inclusive education as “a fundamental right to every citizen and it is provided free of charge in primary and secondary schools to all learners in public schools” (p. ix). A year later, in the final draft of The National Special Needs Education Policy Framework, the Kenyan Ministry of Education (2009) further defines inclusive education as, “an approach in which learners with disabilities and special needs, regardless of age and disability, are provided with appropriate education within regular schools” (p. 5).

Though small pockets of inclusive practices are beginning to emerge throughout the country, there are still a staggering number of children with disabilities who are not attending school at all. The US State Department stated that the Kenya National Commission on Human Rights (KNCHR) reported that fewer than 10 percent of children with disabilities were enrolled in schools ("Country Reports," 2011). The Ministry of Education (2009) cites inappropriate infrastructure, inadequate facilities and equipment, the high cost of including students with disabilities in primary classrooms, and lack of teacher training as reasons why more students with disabilities are not enrolled in school. This failure to provide effective access to inclusive education for children with disabilities is a direct violation of domestic and international laws of Kenya, specifically Chapter Four of the Kenyan Constitution and Article 24 of the CRPD. Without a significant shift in approach to how free and compulsory education is provided in Kenya, international mandates set out by instruments like the CRPD will continue to clash with the socio-historic trends that have plagued the Kenyan education system.

Barriers to Inclusive Education in Kenya

In his chapter, "Legal Protection of Persons with Disabilities in Kenya: Human Rights Imperatives," Kithure Kindiki (2011) suggests that the focus needs to be on prevention of disability (through access to healthcare, food, water, etc.), and equalization of opportunities in education to promote more favorable outcomes for the future for children with disabilities. Gathogo Mukuria and Julie Korir (2012) agree that a shift in perspective is needed in order for children with disabilities to have more access to schools. They argue that the traditional African "disability as a curse" perspective needs to shift to a strength-based perspective if there is to be any substantial educational changes within Kenya (p. 3).

According to a UNESCO (2012) report, some barriers to education include tuition costs, child labor, proximity of schools, and stringent entrance examinations. Other barriers identified were poor teacher recruitment and training programs, especially to rural areas, monolingual curriculum, access to basic learning materials (e.g., text books, note books, pencils, drinking water, lunch), and the government's ability to provide for these financial responsibilities (UNESCO, 2012). A UNICEF report added "income poverty, exposure to child labour, conflict and natural disasters, location, migration and displacement, HIV/AIDS, disability, gender, ethnicity, language of instruction, religion and caste" as other hindrances to the education system (UNICEF, n.d., p. 1).

When discussing disability, particularly in countries considered part of the "developing world," one needs to acknowledge the intersections of many factors, including gender, sexuality, class, poverty, and nation, and how these factors affect people with disabilities and actually create higher rates of disability (Erevelles, 2011). The impact of these barriers on people with disabilities depends on the resources available and the physical environment within each country. Disability does not exist independently; it is a social construct perpetuated by barriers that exist within society (e.g., schools without ramps for wheelchairs, books that are not translated into Braille, etc.) (Kindiki, 2011). Other barriers that exist in Kenya that create and exacerbate social exclusion and suffering of people with disabilities include: poverty, child labor, natural disasters, HIV/AIDS, gender, ethnicity, access to healthcare, access to food, and availability of clean drinking water (UNESCO, n.d.).

The *USAID Executive Education Strategy* providing access to education aids in "transforming individuals from subjects to citizens" - allowing them to participate meaningfully in the political life of their countries" (USAID, 2011, p. 3). Not only does education promote active participation in cultural land familial life, but it also increases earnings, stimulates economic growth, decreases HIV/AIDS rates, and increases age-appropriate entry into schools (USAID, 2011). It similarly disrupts the cycle of poverty and exclusion as outlined by the UNICEF (2007). The factors influencing the prevalence of disabilities often intersect in their complexities, and mutually reinforce patterns of disadvantage and oppression. Without interrupting these cycles of oppression through education, changes in favor of an inclusive education system will remain illusory.

To help create more access to education for children with disabilities, a myriad of international governmental organizations have partnered with the Kenyan government. These organizations include the United Nations Educational, Scientific, and Cultural Organization (UNESCO), United Nations Children's Fund (UNICEF), the United Nations (UN), and the United States Agency for International Development (USAID). The focus of these organizations is to target barriers to education. Projects by these organizations include education awareness, the development of flexible curriculum for students and teachers, and the use of local materials in classrooms ("Addressing Exclusion," 2012).

Kenyan Laws on Education

Free Primary Education (2003)

With the implementation of Free Primary Education (FPE) in 2003, the Kenyan government aimed to increase student enrollment in schools throughout the country. Enrollment increased from 5.9 million to 7.2 million, but the schools did not have enough teachers, space, or infrastructure to handle this influx of students (Mukundi, 2004). The increased enrollment also meant students with a variety of disabilities had more access to schooling. The Ministry of Education (2009) states that, "These increased demands from parents and teachers overstretched the ministry's resources" (p. 14). Even with its limited success, the Ministry of Education (2009) cites FPE as a "key milestone towards achievement of the Education for All goals" of 2015 (p. 17).

Kenyan Constitution (2010)

Similar to earlier domestic documents, the revised Kenya Constitution of 2010 prohibits discrimination in Article 27, Section 4, which states:

> The State shall not discriminate directly or indirectly against any person on any ground, including race, sex, pregnancy, marital status, health status, ethnic or social origin, colour, age, disability, [emphasis added] religion, conscience, belief, culture, dress, language or birth. (p. 24)

This statement guarantees people with disabilities the same rights and opportunities as their non-disabled peers, including a free primary to education. Though a right to equality may include equal access to education for people with disabilities, it does not guarantee equal access to inclusive schools; transportation, modified curriculum, extra classroom support, highly trained teachers, and other such support that would help students with disabilities actually access their education.

International Obligations

Convention on the Rights of the Child (1989)

Kenya ratified the CRC in 1989. Among many other guarantees, Section 3 of Article 23 of the CRC provides that education "shall be provided free of charge," and that "the disabled child will have effective access to and [will receive] education," in order to help the child in "achieving the fullest possible social integration and individual development…" (United Nations, 1989, p. 11). Though access to resources is limited, Section 4 of Article 23 requires the government also to provide "access to information concerning methods of rehabilitation, education and vocational services…to widen their experience in these areas" (United Nations, 1989, p. 11). The CRC does specifically address education for people with disabilities; however, it does not specifically reference an inclusive education. Article 24 in the CRPD was written specifically to correct this omission.

World Declaration on Education for All (1990)

In 1990, the Kenyan government adopted the World Declaration on EFA in Jomtien, Thailand. The aim of this declaration was to make primary education available to all children, and to significantly reduce adult illiteracy (UNESCO, 1990). The declaration affirmed that access to education is a fundamental human right, and developed specific goals to meet basic learning needs by the year 2000. The goals included: universal access to education, educational equity, a focus on learning outcomes, expanding the scope of basic education, improving learning environments, and strengthening partnerships in education (UNESCO, 1990). These goals were not met by 2000, and served as the impetus of the Dakar Framework for Action (UNESCO, 2000).

Salamanca Statement (1994)

Kenya, along with 91 other governments and 25 international organizations, signed the Salamanca Statement in 1994, and began creating inclusive opportunities for individuals with disabilities around the globe (UNESCO, 1994). These countries agreed to adopt policies that promoted schools for all. This statement recognized the need for schools to become more inclusive around the world, and to create international policies that "celebrate differences, support learning, and respond to individual needs" (UNESCO, 1994, p. iii). The Salamanca Statement reiterates the right to education for all, calls for governments to make inclusive education the highest priority, and requires countries set up ongoing systems of monitoring and evaluation for such programs (UNESCO, 1994). The Salamanca Statement is a significant document in that it provides specific suggestions countries could adopt to support students with disabilities gain better access education. Although Kenya signed on to the Salamanca Statement, it (like many other countries) has yet to fully realize its goals.

Dakar Framework on EFA (2000)

Following the unmet goals of the World Conference on EFA in 1990, the Dakar Framework of 2000 called for the EFA 2000 assessment (UNESCO, 2000). This assessment required countries from six regions across the globe to assess the reasons behind the unmet goals set forth by EFA 1990, and to create a framework that reworks EFA goals to be achieved in 2015. At the time of drafting of the 2015 EFA goals, it was reported that more than 113 million children were not accessing primary education, and 880 million adults were illiterate (UNESCO, 2000). The goals developed in Dakar included: 1) expanding early childhood education, 2) ensuring all children, especially girls, have access to a free and compulsory education, 3) providing young people with access to appropriate learning and life skills programs, 4) increasing adult literacy by 50 percent, 5) achieving gender equity in education, and 6) improving all aspects of education (UNESCO, 2000). Kenya has an international responsibility to work toward these goals, even with the reality of limited resources.

Convention on the Rights of Persons with Disabilities (2006)

The drafting of the CRPD represents a groundbreaking shift in how people with disabilities are viewed around the globe. The United Nations "Convention in Brief" (n.d.) states the following about the CRPD:

> It takes to a new height the movement from viewing persons with disabilities as "objects" of charity, medical treatment and social protection towards viewing persons with disabilities as "subjects" with rights, who are capable of claiming those rights and making decisions for their lives based on their free and informed consent as well as being active members of society. (p. 1)
>
> http://www.un.org/disabilities/default.asp?id=150

With this statement, the CRPD outlines a progressive stance on the creation of sustainable international inclusive practices. A significant shift represented in the CRPD is that it does not reference a “basic” education, but instead recognizes the right to an inclusive education system for people with disabilities at all levels where many of the previous international instruments focused only on access to basic education (United Nations, 2006). The CRPD identifies education as a key agent of empowerment for people with disabilities, children with disabilities in this region of Africa would be “entrenched in structural inequalities”, that only serve to perpetuate the cycle of disability, illiteracy, and poverty (UNICEF, n.d. p. 1). Kenya signed the CRPD on March 30, 2007 and ratified it on May 19, 2008. Subsequently, Kenya has an international obligation to develop and implement a national plan to support people of all abilities within its borders.

Millennium Development Goals for 2015 (2010)

In 2000, 147 heads of state and government met in New York with the goal to halve extreme poverty by 2015 (United Nations, 2010). With the idea that extreme poverty limits access to many resources, including education, the summit developed eight MDGs: 1) eradicate extreme poverty and hunger, 2) achieve universal primary education, 3) promote gender equality, 4) reduce child mortality, 5) improve maternal health, 6) combat diseases like HIV/AIDS and malaria, 7) ensure environmental sustainability, and 8) facilitate global partnerships for development (United Nations, 2010).

Though noble in their objectives, the 2nd and 3rd MDGs require that all children have access to an education system. If we wish to put an end to gender disparity in primary and secondary education, we first need to examine how diversity and acceptance are celebrated (or not) and nurtured (or not) in classrooms around the world. These goals have world-changing implications, but are ineffective for any country unless realistic first steps are initiated to provide all children with access to education.

Discussion

Given these international treaties and instruments, as well as Kenya's own domestic laws, a number of things need to occur in order for Kenya to realize the goal of creating an inclusive education system as outlined by the CRPD. The current laws are not having an effect on the actual development of inclusive educational practices. The following is a discussion of the current state of inclusion in Kenya, a summary of an inclusive school project executed in Western Kenya, and steps the Kenyan government can take to implement Article 24 of the CRPD.

CRPD Reporting

The CRPD requires that ratifying states must submit country reports on their progress. The first report is due within two years of ratification and the next reports are due every four years thereafter. After ratifying the CRPD in 2008, Kenya submitted its State Party Report on August 31, 2011. The report outlines 286 guidelines for implementing the CRPD. Of these 286 guidelines, 18 are specific to Article 24 and the development of an inclusive education system (OHCHR, 2011).

Section 171 of the Kenya OHCHR State Party Report (2011) states that 39 percent of children with disabilities attended a mainstream preschool, with 37 percent of students with disabilities having received a primary education, and nine percent of young adults with disabilities attended secondary schools. These numbers, though challenging to confirm, contribute to the estimated 140 million school-aged children who are out of school (UNESCO, 2005). Regardless of the exact number of students receiving an inclusive education, it is beyond dispute that there remains an overwhelmingly large number of children in Kenya who are not receiving their constitutional right to a "quality," "inclusive" education.

According to the Kenya OHCHR State Party Report (2011), there are 1,882 primary and secondary schools that practice some form of inclusion. Within these schools 26,744 students with disabilities attend primary schools, and 24,000 attend segregated special schools. While it is unclear what types of disabilities are supported in these inclusive classrooms, and to what extent these students are receiving appropriate accommodations and modifications to meet their educational needs, it is encouraging that there are numerous schools in Kenya practicing some form of inclusion. If the number is accurate, there needs to be inclusion reports that document the types of disabilities supported in these classrooms, and how these schools develop, implement, and sustain these inclusive practices. In short, an inclusive network is needed to connect these schools so these learning communities can share inclusive successes and challenges, and learn how to further develop an inclusive education system with severely limited resources.

Funding for Education Assessment and Resource Centres (EARC) has "seen a significant increase in their budgetary allocation in the last two years," from KES 98,000,000 (~$1.15 million USD) to KES 420,000,000 (~$4.9 million USD) (OHCHR, 2011, pg. 38). Section 174 of the report provides that the government allocates KES 153,363, 776 (~$1.80 million USD) for 50,744 students with disabilities. That leaves approximately KES 265,000,000 (~$3.1 million USD) that can be allocated to develop a more inclusive education system.

Collaborating at a local level with multidisciplinary teams (e.g., EARC, teachers, parents, students, community members) to develop, implement, and sustain an improved inclusive education system is essential for Kenya to become more compliant with Article 24 of the CRPD (2006). Without buy-in from communities of practice (e.g., students, teachers, administrators, parents, community members), including NGOs and community-based organizations (CBOs), unrealistic mandates handed down from bureaucrats will be ineffective.

In Section 175, OHCHR State Party Report discusses the "importance of special needs education in human capital development" and states, "if [emphasis added] enforced it would empower those most likely to be marginalized to participate in the mainstream education sector" (OHCHR, 2011, p. 37). If Kenya implemented the inclusive practices outlined in the CRPD, more children with disabilities would have access to a free and compulsory education. If the Kenya Institute of Special Education (KISE) had more access to government funding for teacher training and student assessment, they could develop and implement a more effective and sustainable inclusive education system (OHCHR, 2011). If Kenya allocated more than KES 3,020 (~$35.39 USD) annually per student with disabilities, then more students with disabilities would be included throughout their educational careers (OHCHR, 2011).

Personal Assessment of Inclusive Education in Kenya

From my personal experiences in Mbita District in Western Kenya in 2011, and from the data in the Kenya OHCHR State Party Report, I know there are pockets of inclusive education that currently exist in Kenya. While there, I learned first-hand that the EARC, KISE, teachers, parents, students, and community members have invested in, and are supportive of the development of better inclusive practices. There is buy-in from stakeholders even though the Kenyan education system is operating under seemingly boundless barriers to inclusive education. Small steps are being taken throughout the country to be more in alignment with Article 24 of the CRPD. Even though the Ministry of Education receives roughly KES 367 million (~$4.3 million USD) per year, inclusion is happening on a basic level in certain parts of the country (OHCHR, 2011). To further facilitate the development of an inclusive education system, a realistic inclusive education plan needs to be set up by each province, with input from local governments, teachers, parents, students, and community members. However, this will not happen on a large scale in Kenya if realistic goals are not set within each district, and shared with an inclusive network of schools throughout the country.

While working with the Ministry of Education in Mbita District, we organized a focus group of nine local special education and general education teacher leaders to discuss the inclusive strengths and challenges within the Kenyan education system. We initiated a "country-centered plan" based on the researched principles of a person-centered plan. A person-centered plan, when used within a special education framework, puts the individual with a disability at the center of the strength-based planning process. Though there are many approaches to person-centered planning, the format I adapted to conduct the country-centered plan in Kenya was the MAPs process (Falvey, Forest, Pearpoint, & Rosenberg, 1997). I chose this approach to "develop closer co-operation between central and local government, schools, communities, and families to facilitate ownership, sustainability, and accessibility" for students with disabilities as outlined by the Dakar Framework (2000, p. 27).

The MAPs Process (originally McGill Action Planning, also known as Making Action Plans) was developed by Falvey, Forest, Pearpoint, and Rosenberg (1997) and was designed to look at a person's history, who the person is, the dream, the nightmare, the strengths, the needs, and the plan of action. I adapted the MAPs Process and applied it in a country/region-specific way. I asked the following questions: What are the current strengths of the Kenya education system? What are the challenges? What is the short-term plan of action? What is the long-term plan of action? At the end of our meeting, we had a roadmap of action, and everyone at the meeting had a role to play. This process exposed the extremely complex global issues impacting the development of an inclusive education system in Kenya. This region-specific process is one strategy I propose that needs to be adopted on a countrywide level to increase compliance with Article 24 of the CRPD.

Strengths of the Kenyan Education System

Kenyan teachers felt there were well-trained teachers in local schools, and that most schools received at least the minimum required support from the government. Teachers reported that a few students with physical disabilities were already fully included in certain schools. While attending primary schools, many students with physical and intellectual disabilities lived in the adjoining “special” schools. This proximity and access led some teachers to report that students with and without disabilities supported each other daily at school. This peer-to-peer support and mentoring is evidence of Article 24 Section 3(a) of the CRPD (2006) in action.

The existence of an EARC that ensures students with disabilities have basic access to education is an example of compliance with Articles 1 and 4 in the World Declaration on Education for All (1990) and Article 24 Section 1 of the CRPD (2006). When the EARC identifies and assesses students with disabilities, they are typically placed in a residential “special school” that fits the needs of their disability. These “special” schools can include “Schools for the Physically Handicapped,” “Schools for the Mentally Retarded,” “Schools for the Deaf,” and a generalized catchall label of a basic “Special School.” These schools in Mbita District typically share a physical space with a primary school. This physical proximity of the schools provides access for students with physical disabilities to the neighboring primary school. In Mbita District, students with multiple and intellectual impairments are not typically included in primary school settings. Though the placement of children with disabilities in residential “special” schools is an inclusive education, some of these placements result in a very small minority of students being fully included in primary schools. This is a positive step towards the development of an inclusive education system. These small inclusive successes are crucial, and need to be used as catalyst for further inclusive change.

Challenges within the Kenyan Education System

During our country-centered plan, Kenyan teachers at the forum reported challenges to basic education including: funding for food, access to clean water, HIV/AIDS, malaria, poverty, and access to basic healthcare services in schools. The specific barriers to an inclusive education system that were identified were: lack of transportation services for students and teachers, minimal government funding, a high need for early assessment/intervention services, a need for basic access to information about disabilities, inaccessible schools, lack of mobility equipment and services, negative attitudes toward disabilities, irrelevant, scarce, and outdated learning materials, a need for ability and diversity awareness, and a lack of teachers who are qualified to teach diverse learners in special education and general education classrooms. These barriers are consistent with those discussed in the Ministry of Education (2009) report on special education in Kenya.

The barriers to developing an inclusive education system as defined by the CRPD are complex and interrelated. How can resources be allocated to inclusive educational practices for children with disabilities when all students need consistent access to food and clean water? How can awareness about the rights of people with disabilities be increased when students and their families are struggling, literally, to survive?

The Action Plan

With massive barriers to the development of an inclusive education system, establishing realistic first steps is crucial. At the teacher forum in Mbita District, a schedule was set, and the work began. I collaborated with over 50 teachers, and roughly 1,000 students in a two-week period. One week was spent collaborating with teachers at each school and discussing site-specific inclusive issues, while the other week was focused on working directly with students addressing diversity and facilitating discussions on ability awareness. Each Friday was dedicated to grant writing seminars aimed at procuring funds from NGOs to initiate necessary projects within each school. At the school for the Deaf, a community forum was held on the value of community inclusion, Deaf culture, and post-secondary employment opportunities for Deaf students.

The plan of action that was implemented in 2011 is an example of what is needed throughout Kenya in order to create a more effective inclusive education system. Schools, families, and community members need to come together to plan and implement even the smallest of changes in order to create a larger change in the future. This grassroots approach to inclusive education on a national scale is necessary in order for students with disabilities to gain sustainable access to a quality inclusive education system in Kenya.

The CRPD and Implications for the Kenyan Government

Aside from a grassroots approach to inclusive change, the Kenyan government needs to evaluate and further define and clarify certain phrases in the CRPD, as applied to Kenyan law. When Section 1 of Article 24 calls for “an inclusive education system,” it does not require inclusive classrooms (See Appendix A for how to implement Article 24 of the CRPD in Kenya). Due to the existence of “inclusive” and “special” classrooms, the Kenyan government needs to provide a rationale for developing “special” programs, and to outline a plan on integrating students in these programs into the general education system. This plan needs to include information on reasonable accommodation and supports that will be provided in the general education classroom, and how that support will be maintained and replicated in other schools.

Section 1(a) of Article 24 promises the “full development of human potential” (United Nations, 2006, p. 13). Section 1(b) of Article 24 guarantees “the development” of “persons with disabilities…to their fullest potential” (United Nations, 2006, p. 13). Section 1(c) of Article 24 guarantees the right to “participate effectively” in society (United Nations, 2006, p. 13). This use of ambiguous language is open for (mis)interpretation of the strengths of people with disabilities, and requires further definition and clarification by the Kenyan government to communicate inclusive objectives effectively (See Appendix A for how to implement Article 24 of the CRPD in Kenya).

This use of vague language is evidenced again in Article 24 Section 2(a) where people with disabilities are not to be “excluded from a general education system” and “not excluded from free and compulsory education” (United Nations, 2006, p. 13). What is the difference between the two distinctions? What constitutes exclusion from each? Clarification is also needed in Article 24 Section 2(b) when the CRPD ensures that people with disabilities “can access an inclusive, quality and free primary education…on equal basis as others in the communities in which they live” (United Nations, 2006, p. 13). What does it mean to receive an equal education? Does an equal education exist for people without disabilities? What implication does that have for people with disabilities (See Appendix B for how to implement Article 24 of the CRPD in Kenya)? Details of how to implement “full and equal participation” in schools in Kenya, and a clearer definition of “augmentative and alternative modes” of communication are provided in Appendix B (see Table B2) (United Nations, 2006, p. 13).

Conclusion

In order for Kenya to comply with Article 24 of the CRPD, a shift in perspective on how to define an inclusive education system is necessary. It is impossible to build inclusive communities without gathering input and value from stakeholders in local communities. This emphasis on stakeholder collaboration is echoed in the Ministry of Education (2009) special education report when it states, “Partners and/ or stakeholders need to be guided by a comprehensive policy framework to ensure effective coordination and implementation of special needs education programmes” (p. 46). This means everyone invested in changing Kenya’s education system needs to take an active role at the local level. Students, parents, teachers, administrators, and government officials need to collaborate together within their local communities and identify the strengths and barriers of their local educational systems. A plan of action is needed, building on inclusive strengths and removing barriers to inclusion. All stakeholders need roles to play, and need to be held accountable. Pockets of existing inclusive education systems need to be connected, and to network in order to share successes and challenges to creating more inclusive communities. None of this will be possible without increased governmental funding for inclusive education programs. The goals for inclusive education in Article 24 of the CRPD are attainable, but realistic starting points need to be regionally relevant and maintained through the interdependence of invested stakeholders within the community of practice.

References

Amutabi, M. N. (2003). Political interference in the running of education in post independence Kenya: A critical retrospection. International Journal of Educational Development, 23, 127-144. Retrieved from http://dx.doi.org/10.1016/S0738-0593(01)00055-4

Buchmann, C. (1999). The state and schooling in Kenya: Historical developments and current challenges. Africa Today, 46(1), 95-117. Retrieved from http://muse.jhu.edu/journals/at/summary/v046/46.1buchmann.html

Bunyi, G. (1999). Rethinking the place of African indigenous languages in African education. International Journal of Educational Development, 19, 337-350. Retrieved from http://dx.doi.org/10.1016/S0738-0593(99)00034-6

The Constitution of Kenya. (1963). The constitution of Kenya. Retrieved from http://www.unesco.org/new/fileadmin/MULTIMEDIA/HQ/CI/WPFD2009/pdf/Kenyan_constitution_amended_2008.pdf

The Constitution of Kenya (2010). The constitution of Kenya. Retrieved from http://www.kenya-information-guide.com/support files/the_constitution_of_kenya.pdf

Education System: Official Site of the Embassy of the Republic of Kenya, Moscow. (2012). Education system: Official site of the embassy of the Republic of Kenya, Moscow. Retrieved from http://www.en.kenemb.ru/education_system.html

Erevelles, N. (2011). Disability and difference in global contexts: Enabling a transformative body politic. New York: Palgrave Macmillan.

Falvey, M. A., Forest, M., Pearpoint, J., & Rosenberg, R. (1997). All my life's a circle: Using the tools: Circles, MAPS & PATHs (2nd ed.). Toronto: Inclusion Press.

Kindiki, K. (2011). Legal protection of persons with disabilities in Kenya: Human rights imperatives. In Rioux, M. H., Basser, M. L., & Jones, M. (Eds.), Critical perspectives on human rights and disability law. (309-340). Leiden: Martinus Nijhoff.

Kinuthia, W. (2009, April 1). Educational development in Kenya and the role of information and communication technology. International Journal of Education and Development using ICT [Online], 5 (2). Retrieved from http://ijedict.dec.uwi.edu/viewarticle.php?id=740&layout=html

Ministry of Education. (2008). The development of education: National report of Kenya. Retrieved from
http://www.ibe.unesco.org/National_Reports/ICE_2008/kenya_NR08.pdf

Ministry of Education (2009). The national special needs education policy framework. Retrieved from http://www.education.go.ke/Documents.aspx?docID=527

Mukundi, E. (2004). Education for all: A framework for addressing the persisting illusion for the Kenyan context. Journal of Educational Development, 24, 231-240.

Mukuria, G., & Korir, J. (2006, March 26). Education for Children With Emotional and Behavioral Disorders in Kenya: Problems and Prospects- Education News. Retrieved from http://www.redorbit.com/news/education/436674/education_for_children_with_emotional_and_behavioral_disorders_in_kenya/

Ntarangwi, M. (2003). The challenges of education and development in post-colonial Kenya. Africa Development, 28 (3 and 4), 211-228. Retrieved from http://www.ajol.info/index.php/ad/article/view/22183.

Office of the High Commissioner on Human Rights (OCHR) (2011). United nations convention on the rights of persons with disability Kenya state party report. Retrieved from www2.ohchr.org/SPdocs/CRPD/futuresession/CRPD.C.KEN.1_en.doc

Oketch, M. & Rolleston, C. (2007). Policies on free primary and secondary education in East Africa: Retrospect and prospect. Review of Research in Education, 31 (131-158). Retrieved from http://rre.sagepub.com/content/31/1/131.full.pdf+html

Strayer, R. W. (1973). The making of mission schools in Kenya: A microcosmic perspective. Comparative Education Review, 17(3), 313-330. Retrieved from http://www.jstor.org/stable/pdfplus/1186971.pdf?acceptTC=true

United Nations (1989). Convention on the rights of the child. Paris: UN. Retrieved from http://sithi.org/admin/upload/law/Convention%20on%20the%20Rights%20of%20the%20Child.ENG.pdf

United Nations (2006). Convention on the rights of persons with disabilities. Retrieved from http://www.un.org/disabilities/convention/conventionfull.shtml

United Nations (2010). Millennium development goals report, New York, New York.

New York: UN. Retrieved from http://www.un.org/en/mdg/summit2010/pdf/MDG%20Report%202010%20En%20r15%20-low%20res%2020100615%20-.pdf

United Nations Children's Fund (UNICEF) (n.d.). Basic education and gender equality. Retrieved from http://www.unicef.org/education/bege_61627.html?p=printme

United Nations Children's Fund (2007). Promoting the rights of children with disabilities. Innocenti Digest No. 13, UNICEF Innocenti Research Centre. Florence: UNICEF. Retrieved from http://www.un.org/esa/socdev/unyin/documents/children_disability_rights.pdf

United Nations Children's Fund (UNICEF) (2013). The state of the world's children 2013. New York: UNICEF. Retrieved from http://www.unicef.org/sowc2013/files/SWCR2013_ENG_Lo_res_24_Apr_2013.pdf

United Nations Educational, Scientific and Cultural Organization (UNESCO) (2012). Addressing exclusion in education: A guide to assessing education systems towards more inclusive and just societies. Paris: UN. Retrieved from http://unesdoc.unesco.org/images/0021/002170/217073e.pdf

United Nations Educational, Scientific and Cultural Organization (UNESCO) (2000). The Dakar framework for action, Dakar, Senegal. Paris: UN. Retrieved from http://unesdoc.unesco.org/images/0012/001211/121147e.pdf

United Nations Educational, Scientific and Cultural Organization (UNESCO) (n.d.). EAtlas of out-of-school children. Retrieved from http://www.app.collinsindicate.com/uis-atlas-out-of-school-children/en-us

United Nations Educational, Scientific and Cultural Organization (UNESCO) (2005).

Guidelines for inclusion: Ensuring access to education for all. Retrieved from http://unesdoc.unesco.org/images/0014/001402/140224e.pdf

United Nations Educational, Scientific and Cultural Organization (UNESCO) (2009). Policy guidelines on inclusion in education. Retrieved from http://unesdoc.unesco.org/images/0017/001778/177849e.pdf

United Nations Educational, Scientific and Cultural Organization (UNESCO) (n.d.). UNESCO: Education for all: Knowledge sharing- Flagship initiatives. Retrieved from http://www.unesco.org/education/efa/know_sharing/flagship_initiatives/disability_last_version.shtml

United Nations Educational, Scientific and Cultural Organization (UNESCO) (1990). World conference on education for all. Jomtien, Thailand. Paris: UN. Retrieved from http://unesdoc.unesco.org/images/0009/000975/097552e.pdf

United Nations Educational, Scientific and Cultural Organization (UNESCO) (1994). World conference on special needs, Salamanca Spain. Paris: UN. Retrieved from http://www.unesco.org/education/pdf/SALAMA_E.PDF

United Nations Enable (n.d.). Convention on the rights of persons with disabilities: Convention in brief. Retrieved from http://www.un.org/disabilities/default.asp?id=150

United States Agency for International Development (USAID) (2011). USAID education strategy. Washington D.C.: USAID. Retrieved from http://pdf.usaid.gov/pdf_docs/pdacq946.pdf

World Health Organization (WHO) (2011). WHO world report on disability. Malta: WHO. Retrieved from http://whqlibdoc.who.int/publications/2011/9789240685215_eng.pdf

Appendix A

Table A1

Language of Article 24 of the CRPD	Steps Toward Implementation
Art. 24 § 1- States Parties recognize the right of persons with disabilities to education. With a view to realizing this right without discrimination and on the basis of equal opportunity, States Parties shall ensure an inclusive education system at all levels and life long learning.	An inclusive education system includes all students in every classroom and provides whatever supports are needed to ensure the student's active participation and success.
Art. 24 § 1(a)- The full development of human potential and sense of dignity and self-worth, and the strengthening of respect for human rights, fundamental freedoms and human diversity.	Such decisions will be made with input from the student, and an interdisciplinary team.
Art. 24 § 1(b)- The development by persons with disabilities of their personality, talents and creativity, as well as their mental and physical abilities, to their fullest potential.	Potential is not a stagnant concept; a student's potential can increase with each new opportunity. Potential must be defined with input from the student, his or her family, and an interdisciplinary team of professionals.
Art. 24 § 1(c)- Enabling persons with disabilities to participate effectively in a free society.	Effective participation must include activities that are meaningful and relevant to each student. Such activities must be defined with input from the student, his or her family, and an interdisciplinary team of professionals.

How to Implement Article 24 Section 1 of the CRPD in Kenya

Appendix B

Language of Article 24 of the CRPD	**Steps Toward Implementation**
Art. 24 § 2(a)- Persons with disabilities are not excluded from the general education system on the basis of disability, and that children with disabilities are ***not excluded*** from free and compulsory primary education, or from secondary education, on the basis of disability.	Supports will be provided, as outlined by the student and an interdisciplinary team, at the school the student would attend in the absence of impairment.
Art. 24 § 2(b)- Persons with disabilities can access an inclusive, quality and free primary education and secondary education on an ***equal basis*** with others in the communities in which they live.	Equal basis means the education the student would receive in the neighborhood school in the absence of impairment.
Art. 24 § 2(c)- ***Reasonable accommodation*** of the individual's requirements is provided.	Reasonable accommodation is decided upon with input from the student and the interdisciplinary support team.
Art. 24 § 2(e)- Effective individualized support measures are provided in environments that maximize academic and social development, consistent with the goal of ***full inclusion***.	Full inclusion means active and equal membership in a classroom where the student would be educated in the absence of impairment.

Table B1

How to Implement Article 24 Section 2 of the CRPD in Kenya

Table B2

How to Implement Article 24 Section 3 of the CRPD in Kenya

Language of Article 24 of the CRPD	Steps Toward Implementation
Art. 24 § 3- States Parties shall enable persons with disabilities to learn life and social development skills to facilitate their full and equal participation in education and as members of the community.	Full and equal participation means that students are given access to educational and community-based opportunities they would otherwise receive in the absence of impairment.
Art. 24 § 3(a)- Facilitating the learning of Braille, alternative script, augmentative and alternative modes, means and formats of communication and orientation and mobility skills, and facilitating peer support and mentoring.	Augmentative and alternative modes of communication are decided upon with input from the student and the interdisciplinary support team.

MOTIVATION: ETHICAL, MORAL AND RELIGIOUS PERSPECTIVES

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Abstract

The authors examine several examples of the concept ‘motivation’ from ethical, moral and religious perspectives. They conclude that the Bible contains innumerable verses, which give motivation not only to biblical characters, but to every member of the human race. Motivation is given in the principles of love, honesty, integrity, compassion, mercy, call, tasks, missions, innovations and various responses. Teachers should emulate biblical motivation principles to achieve maximum results. The authors continue to argue that motivation is not one directional phenomenon. But rather it is an interactive situation: between the teacher and leaner; the learner and the teacher; the leaner and the resources; the leaner and the environment; the leaner and his/her peer group; the peer group and the leaner; and the teacher’s interactions with the entire class of learners under his/her charge. “Motivation” should be seen as a “universal aspect of life”. It culminates into the role model and personal character of both parties to moral obligations and professionalism. The process of learning at all levels, and in every situation, enhances motivation through lower and higher order questions, which reinforce learning by providing thought provoking challenges. The leaner may be asked or ask one self either lower or higher order questions. The result is either enhanced or reduced motivation. The authors conclude by cautioning educators that unless learning programs are very carefully planned and executed, modern technology, good as it may be in enhancing motivation, is likely to produce robots rather than creative and self-directed thinkers.

Introduction

This paper entitled: **“Motivation: Ethical, Moral and Religious Perspectives”** examines several examples of the concept ‘motivation’ from ethical, moral and religious perspectives. The authors take the Holy Bible as a library of great fundamental values in one’s life. Genesis explains the beginning of many important realities: the universe, the earth, people, sin and God’s plan of salvation. It teaches us that the earth is well made and good. God creates and sustains all life (Life Application, Study Bible 2007:3). God created the world and people as an expression of His love, because He loves us. “Then God looked over all He had made, and He saw that it was very good!” (Genesis1: 31). ICT is good as an enabler, facilitator, enhancer and it helps the management of services, the management of institutions and systems. It is a support attainment of objectives. It may improve service delivery, it is a resource, which may facilitate learning, but it cannot replace the human teacher. It is deficient in human touch, because people are special to God and unique. Living God’s way makes life productive and fulfilling. The paper attempts to examine the nature of “motivation” with or without technology in ethical, moral and religious perspectives. Technology is taken as part of resources, which may or may not enrich “Motivation”. “Motivation” may be defined as an induced inner drive intrinsically or extrinsically, which causes an individual to act or perform tasks related to learning in order to achieve a set of goals or needs in any one area of human endeavor. There is intrinsic motivation and extrinsic motivation: motivation arising from one self and that, which is provided by external factors. The essence of motivation is that this urge makes an individual to act deliberately so as to achieve the desired target(s). The concept of “motivation” should not be construed in the narrow terms of limited classroom management and behavior. This is because learning takes place at every stage of human growth and development. This internalized drive may be spurred not only by a teacher, but also by environmental factors and /or even the self. “Motivation” should therefore be examined within all related areas of life. Thus, some people may have an inner drive to act ethically, morally and religiously. Some others may acquire and develop tendencies of maladjusted or deviant behavior depending on the kind of motivation they may have received.

The concept of motivation was expressed by Confucius (C. 450 B.C.) as follows:

"Tell me, and I will forget. Show me, and I may remember. Involve me, and I will understand." These inner urge, desires, wishes, loves activate and move an individual to work, sustain and maintain pace of hard work so as to achieve set goals and objectives. The Macmillan English Dictionary for Advanced Learners (2nd Edition, 2007:997) defines "motivation" as "a feeling of enthusiasm and of interest that makes one determined to do something: the DRIVE or a reason for doing something". Kithinji C.T. (2007:82) defines "motivation" as "a strong reason or will to do something. Motivation is manifested in an individual as a deep desire and an urge to direct energy in one direction to the exclusion of others for the purpose of learning or the realization of a goal or accomplishing a task." Consequently we can safely say that "motivation" is the key to behavior change; that motivation involves and revolves around a person's desire to perform and succeed.

Biblical Ethics and Morals

There are two levels of "Ethics" and "Morals," the first is the cultural level as derived from etymology/roots of the two words. The second, is purely Biblical, which is God centered (Marshall, I.H. 1996: 343-346). In either case there is a set of principles that people should use to decide what is right and what is wrong; there is a general principle or belief which affects the way people behave (Michael Rundell, et.al. 2007:500). "Morals" appertain to the principles of right and wrong behaviors that may be generally accepted by a society (Michael Rundell.at.al. 2007:971). Whereas, there is a cultural influence in our behavior, we should not blindly follow majority opinion or conform to customary behavior. The Scriptures encourage us to start with God and His requirements, not with man and his habits, when we look for moral guidelines (Marshall .I. H., et.al. 1996:343). We should realize that "motivation" in Biblical terms, includes the following ideas: (Marshall, 1998:343-346):

1. That the standards of goodness are personal in the light of God’s Guidance (Mk.10: 18; Rom. 12:2; Ex.33: 19; Ex 34: 6f).

2. That the source of moral knowledge is revelation from God (Rom.2: 18) either through the scriptures or any other means that God may choose to use, which we should obey.

3. Moral teaching is phrased as command, not statement. (Prov. 5:1 ff.).

4. That the basic ethical demand is to imitate God (Kv.11: 44f); Lk.6: 36; Mt.5:48; Heb.1:3; 1 Cor.11:1; Eph. 5:1f) because He is our Creator and Father.

5. That religion and ethics are inseparable because they are directed to Godly living (Mt. 5:3ff; Ex. 20:2; Mt.5: 43ff; 1Cor. 6: 18ff; 2 Cor. 8:7ff; Phil 2:4ff) because ethics and morals are aspects of pure religion (James 1:27).

Learning

“Learning” may be defined as a process by which an individual acquires, develops and retains knowledge, skills, values and attitudes (Muindi D.M., 2007:13). Learning should not be attributed to the teaching processes only, but it should be assessed and evaluated in terms of experiences during human natural growth and development. This is because every stage of an individual’s growth and development offers its own unique lessons from which the individual learns and adjusts behavior.

Learning is a life-long process, which cannot be limited to classroom situations and interactions but rather, transcends all aspects of one’s life. To illustrate this drive, let us consider a biblical motivational example: The call of Abram-God promises a nation to Abram (Genesis 12:1-9). “The Lord had said to Abram, ‘Leave your native country, your relatives, and your father’s family and go to the land that I will show you. I will make you into a great nation. I will bless you and make you famous, and you will be a blessing to others. I will bless those who bless you and curse those who treat you with contempt. All the families on earth will be blessed through you." Abraham was motivated to evacuate his birthplace, Ur to Haram and finally to Canaan. God's call makes "motivation" a religious, moral and ethical duty, an obligation, a drive, a desire, an urge and an inner purpose, which leads one to achieve desired goals.

Thomas L. Good (2006: 223-249) discusses research and theory with implications of classroom management. This discussion alludes to "motivation." Winne (2001 noted that "motivation" relates to SMART:

1. Searching –defining the task(s).
2. Monitoring – setting goals and plans for their attainment.
3. Assembling –doing work or enacting plans
4. Rehearsing and Translating - making changes to information in earlier phases of monitoring and doing work at hand.

Biblical Motivational Approach

This approach may be referred to as SMART. That is, "motivation" calls for operations, stimulus action and effects on behavior in our classroom management. In the above quoted call of Abram by God, we detect the following related aspects of motivation namely:

1. *"Leave your native country, your relatives and your father's family."* This sets and arranges the physical environment within which Abram had to act. It goes further, *"go to the land that I will show you"* which reinforces the searching and monitoring aspects of motivation or stimulus action in order to achieve the set goals.

2. God established rules and procedures for Abram to enact His plans and to translate them into a reality.

In order for God to maintain and sustain Abram's focus, attention to His command and to constantly engage him in the activities which would achieve the goals, God promises Abram a great nation, blessings, fame and blessings to his neighbors.

God directed Abram to a socialization level by referring to the actions Abram had to take which would influence his personal and social life, including moral and civil behavior and attitudes to:

a) Articulation of ideas.

b) Communication of expectations.

c) Some modeling, teaching and reinforcing desirable personal attributes and behavior.

d) The promises embedded counseling behavior modification and social adjustments.

5. By implication, God spelt out positive disciplinary interventions. Abram had to take actions to elicit and compel him to establish closer personal relationship with God, and to conform to a set of promised expectations in order to satisfy the special needs pronounced in those promises of his call. He had to comply with instructions to benefit him and humanity. God allowed minimal non-cohesive disciplinary strategies, which reveal moral reasoning, pro-social orientations and involvement in a problem behavior. It was not that easy for Abram to obey God, but by faith.

6. By Abram's call God gives us a pattern of accountability which includes both informal aspects and formal activities; which are Abram: oriented with semi- formal aspects; which are God-oriented in the promises; and which have aspects that show external motivation, test–oriented and attainment–oriented.

Religious Principles

Motivational thrives under the principles of love, commitment, integrity, authenticity, honesty, moral, ethical and religious principles. God must be the center of a teacher's life. Regular worship helps us to remember what God desires for us personally and for learners under our charge. This motivates us to obey Him. Our activities are futile unless God is in them (Ps. 127). Hard work honors God (Prov. 31:10-29). The American Heritage Dictionary of the English Language describes "motivation" as a drive: "to stimulate to action, provide with an incentive and inducement especially for action" (1954:856). We should be compassionate, ready to forgive, ready to heal coupled with acceptance of even the deviant leaner so as to motivate him/her to reform (Mt.23: 37; Luke.19: 41f.). Individuals are loved by God under the new covenant (Gal. 2: 20) through response to His love which involves fellowship in the people of God (1 Pet. 2:9f). Love is a religious duty: first, towards God (Mt. 9:22; Mk.4:40); and second, towards our fellow men (Lk.10:25-37; Mt.5:44, Lk.6: 27). Learners under our charge are our neighbors who should be loved. Mercy, kindness, honesty, goodness, solidarity, and loving-kindness, are all expressions of love, which should motivate the learners under our charge. We must endeavor to see them succeed in what they do because:

1. Because we want to imitate God's love (Mt. 5:43, 45; Eph.5:2; 1 Jn. 4:11).
2. Because we see the individual learner as one for whom Christ died (Rom.14: 15; 1 Cor.8:11).
3. Because we see in the individual learner Christ Himself (Mt. 25:40). I Jn. 3:1 -24 clearly discusses how and why God is love; and how we should express our living as children of God; then it proceeds to describe how we should love one another. This description connotes and denotes the nature of motivation, which emanates

from love. Love must be understood as a pure desire to serve others without carnal inclinations. Love emanates from pure and holy intensions to benefit others.

The Qualities of a Teacher

The calls of Noah, Joseph, Moses, Elijah, and all the other prophets, including the New Testament personalities: Peter, John, James, Paul and others reflect similar motivation characteristics. The main common denominator is: God-centeredness. If only educators put God first, learners would always be motivated positively. A teacher is called to servant-hood to nurture children, the youth and adults. A teacher should have qualities clearly described in 1 Tim.3: 1-7. “Now the overseer is to be above reproach, faithful to his wife, temperate, self–controlled, respectable, hospitable, able to teach, not given to drunkenness, not violent but gentle, not quarrelsome, not a lover of money. He must manage his own family well and see that his children obey him, and he must do so in a manner worthy of full respect. …He must also have a good reputation with outsiders, so that we will not fall into disgrace and into the devil’s trap.”

Multidirectional Motivation

Motivation provides avenues for reciprocity and multidirectional effects on the providers and the receivers as well. When the servant teacher has provided motivation to his/her learners, the resultant behavior, the success and/or shortcomings of the learners in turn motivate not only the teacher, but also help the learners achieve better results from the set goals. For this reason, the teacher sets goals and objectives, either long-term, medium-term, or short-term objectives. The short term objectives should be clear, concise, specific, behavioral, measurable and they provide the level of performance; they also show prevailing conditions and give a time frame (Maundu, 2007:30). The teacher derives pleasure and gratification purely from the learners’ achievement of set goals. The learners develop positive self-image of themselves after achieving the set objectives. Thus, both parties are beneficiaries and are motivated. Both the teacher and the learners come to love and appreciate whatever resources and technology may be used to aid acquisition of knowledge and skills; then, values and attitudes are entrenched or modified as the result of the success or failure. The peer group, or the group of learners under instruction, also reciprocate among themselves and appreciate their teacher. The result is that all parties: the learner, the teacher, the peer group and the class are re-motivated to face new challenges of learning. Thus motivation becomes a multi-directional reality, which touches all the parties involved. It helps to shape personal character and conduct of each party with the added advantage for the teacher to become a role model to the learners. His/her moral character and obligations become more conscious. These qualities are manifested in his/her subsequent behavior. The learners pick his/her characteristics to become better and useful citizens.

Institutional Motivation

An institution should be “salt of the earth” and “light of the world”, “a town built on a hill which cannot be hidden” (Mt.5: 13-16). Each institution or system endeavors to motivate its subjects. We propose to use two examples, namely: the Republic of Kenya and Kenyatta University, which are close to our hearts:

The Republic of Kenya

In order to motivate her citizens to create a successful nation, the Republic of Kenya has enacted The Constitution of Kenya 2010. It is the Supreme Law of the Land. Right from its preamble, all through from chapter one to eighteen, including the subsequent Six Schedules and Subsidiary Legislation, are intended to be a motivation to the contemporary and future generations of Kenya. They set goals and standards, which citizens ought to exercise, maintain, sustain and perpetuate.

The Vision 2030 provides motivations to improve the economy to make Kenya a middle economic power.

The new Government has created fewer Ministries in an effort not only to comply with constitutional requirements, but also to motivate her citizens to keep the pace of progress towards the achievement of a powerful modern state. The list of 18 ministries, which were unveiled the day earlier, appeared in the Daily Nation on Friday, April 19, 2013 as follows:

The 18 Ministries Unveiled Yesterday:

1. Ministry of Interior and Coordination of National Government.
2. Ministry of Devolution and Planning.
3. Defense.
4. Foreign Affairs.
5. Education (which will have the Department of Education and Department of Science and Technology).
6. The National Treasury.
7. Health
8. Transport and Infrastructure (which will have the Department of Transport Services and Department of Infrastructure).
9. The Environment, Water and Natural Resources.
10. Land, Housing and Urban Development.
11. Information, Communication and Technology (ICT).

12. Sports, Culture and the Arts.
13. Labor, Social Security and Services.
14. Energy and Petroleum.
15. Agriculture, Livestock and Fisheries (under which are the Department of Agriculture, Department of Livestock and Department of Fisheries).
16. Industrialization and Enterprise Development.
17. Commerce and Tourism (which has the Department of Commerce and Department of Tourism).
18. Mining

The structure also contains the Office of the Attorney General and Department of Justice.

d) One of the major duties of the Ministry of Education (Department of Education & Department of Science and Technology) is to ensure that the aims of education are achieved. Maundu (2007:31) states that in Kenya, the aims of education are that education should:

1. Foster nationalism, patriotism and promote national unity.
2. Promote the social, economic, technological and industrial needs for national development.
3. Promote individual development and self-fulfillment.
4. Promote sound moral and religious values.
5. Promote social equality and responsibility.
6. Promote respect for and development of Kenya's rich and varied cultures.

7. Promote international consciousness and foster positive attitudes towards other nations.

8. Promote positive attitudes towards good health and environmental protection.

It is no wonder that the Constitution of Kenya 2010 has spelt out all the above objectives in its various Articles. Whereas we look at them as aims or objectives as good guidelines for motivation, we should appreciate the fact that these statements of intent give directions to motivate learners at various levels of their learning experiences.

Kenyatta University

Kenyatta University provides motivation to every member of its community in various ways. Without going into details suffice it to state that:

a) Its administrative structure provides motivation to all those who interact with Kenyatta University be it outsiders or insiders.

b) Its Vision, Mission, Identity and Philosophy Statements give direction and motivation to the entire Kenyatta University Community, which statements also attract the outsiders to endeavor to be part of Kenyatta University system.

c) The various advertisement, documents, publications and posters made available to Kenyatta University community help to create educational and social environments which provide motivation to the various groups within its community and beyond.

d) It's thirteen (13) Schools, with sixty one (61) departments, the Institute of Open Distance and e-Learning (Odel), the Institutional Based Programs, the various support Centers and Directorates make a strong body which spurs and sustains motivation for learners and those who would like to join Kenyatta University.

e) The physical developments are yet another strong motivational factor. The use of technology in its various departments characterizes the ongoing building constructions and equipping of these facilities. All these elements reveal the extent to which Kenyatta University authorities have gone to create motivation to achieve the set education goals. The only question, which remains is how best the various institutional actors take advantage of these opportunities to motivate others to achieve the ideals of Kenyatta University. Students, the Lecturers, Professors and the entire Force of Non-teaching Staff have a duty to propagate the ideals of Kenyatta University.

Motivation Analysis of Systems

1. **It is known that there is no system that is absolutely perfect.** Nevertheless, actors in each case ought to do their very best to ensure that the community is highly motivated to achieve the set institutional goals.

There is no system that does not experience an entropy at some stages of its existence. There are individuals who will always oppose and fight the system whether it is open or closed. The more open a system is, the more it opens it-self to some destructive criticisms. Nevertheless, many more people appreciate it because it indicates democratic inclinations. The more closed a system is, the more rebels are likely to be motivated because of its autocratic and dictatorial practices. Nevertheless, there must be classroom motivation, institutional motivation, community motivation, innovative motivation, as well as adequate provisions to meet the possible challenges of motivation without which little may be achieved.

The **following characteristics** are important for motivation to thrive so that the institution may be a successful story (Watson & Battistick, 2006: 253-276):

Every actor within the institution must endeavor to create and promote a just community.

Every institutional actor ought to promote ideals for moral and a constructivist community.

Every actor should work to create a community of learners. ***"My people are being destroyed for lack of knowledge"*** (Hosea 4:6). Knowledge is power! But motivation creates prerequisites for the acquisition of knowledge, skills, values and attitudes.

Every institutional actor must strive to create a democratic community.

Every institutional actor should create, promote and perpetuate a caring and welfare community.

There must be consistency management and cooperative discipline to ensure that the institution steers its course to success.

2. The institutional framework must:

a) Promote a positive development view of all those members who make its institutional community.

b) Have a view of students as embedded in their respective social content.

c) Should view the community as relational individuals wishing to succeed in life.

d) Promote curriculum as an integrated and student centered mechanism for success.

e) Exercise minimal and non- coercive disciplinary strategies to help the errant members to reform for better.

f) Promote the common set of classroom activities in each department to develop success character of that institution.

3. The institutional community and citizens at large should:

a) Make a difference in promoting attendance and retention of knowledge, skills, positive values and attitudes so that the majority can achieve the highest goals.

b) Promote and sustain academic engagement through motivation, aspirations and achievements, which are partly manifested during each graduation day. Parents and friends enthusiastically flock into Kenyatta University with great excitement to celebrate achievements of their loved ones. This enthusiastic throng reveals how well Kenyatta University has motivated the public. It is an added public advertisement.

c) Develop a commitment to democratic decision–making values, which encourage participation and creation of institutional identity.

d) Promote, develop and perpetuate moral reasoning by nurturing pro-social orientations, which reflect ethical, moral and religious dispositions necessary for growth and development.

e) Develop just and friendly approach to problem behaviors of learners with a view of enhancing the welfare for all who associate themselves with the institution.

4. **The institutional community should not:**

Allow excess conformity with the culture, which can hinder intellectual and physical developments of individual members and the corporate body.

5. Promote the creation of groups, which can be used to disrupt progress.

6. Exercise and underemphasize the academic achievement to be attained.

7. The institution must be cautious of the following impediments:

a) Time that may be poorly planned.

b) Negative beliefs about learners.

c) Negative competition among the actors, especially in respect to power and control.

d) Common institutional practices and conditions, which do not promote institutional identity.

e) Inertia – a situation in which things do not change for a long time; and which promotes a lack of innovation and progress for the institution to achieve higher levels of development.

f) Lack of increased staff mobility by way of promotions and deserved remuneration.

Conclusion

We wish to conclude with what Martha Carlton (2003) seems to recommend:

1. That development of motivation is vital by letting the learners to explore and discover for themselves, so as to take personal responsibility in the affairs of the institution.

2. That rewarding learners helps to enhance motivation to set higher standards of achievements.

3. That when the **Course** has real value, motivation is increased in order to gain the promise.

4. That when the teacher helps the leaner to perform better, motivation is sustained and reactivated to keep the pace of hard work.

5. That when the teacher sets clear expectations, learners are highly motivated to reach at the top.

6. That the feedback about the quality of learner's efforts helps the teacher to correct learners who seem to go a stray so as to enhance and rekindle motivation.

Finally, “motivation” helps to perpetuate a system. It rejuvenates a system, whether human or institutional, at the appropriate moment. The question is how the actors should provide appropriate motivation to ensure that the system is kept alive, vigilant, and vigorous and determined to achieve the set goals. The use of technology is highly commendable. However, it may be expensive at times. It may also develop tendencies of dependence, which may easily curtail thinking. Thus causing many actors to act like robots with no reasoning effort. Motivation will be best promoted and exercised if and when each actor will cautiously follow Biblical principles of placing God at the center of every activity. *“Do to others whatever you would like them to do to you. This is the essence of all that is taught in the law and the prophets” (Mt.7: 12). “Seek the Kingdom of God above all else, and live righteously, and He will give you everything you need” (Mt. 6:33). Technology is a vital part of development, which will never replace the human teachers' roles of developing ethical, moral and religious values, virtues, and attitudes of the learner. It is possible to develop mechanical characteristics in learners with technology on one hand, but the human touch develops a holistic transformation of learners.*

References

Carolyn M. Evertson, Carol S. Weinstein, eds. (2006), *Handbook of Classroom Management. Research, Practice and Contemporary Issues,* Routledge, Taylor & Francis Group, New York PP. 223-249,253-276,299.

Daily Nation Newspaper, Friday, April 19, 2013. *Life Application Study Bible*, *NL T*, Tyndal House Publishers, Inc. Carol Steam, Illinois, 2nd Edition.

Marshall I.H. et.al. (1982), *New Bible Dictionary,* Inter- varsity Press Leicester, England 3rd Edition.

Martha Carlton (2003), *Early Childhood Motivation*. The National Association of School Psychologists, Southern Illinois University, Edwardsville, USA.

Michael Rundell et al. (2007), *Macmillan English Dictionary For Advanced Learners- International Student Editi*on, Macmillan Publishers Limited, London, U.K. 2nd Edition.

The Holy Bible, *NIV*. (2011) Biblical. Inc, Colorado Springs, USA, CO 80921-3696.

Twoli, N.W. et.al (2007), *Instructional Methods in Education-A Course Book For General Teaching Methods*, Kenya Institute of Education, Nairobi.

William Morris, et al. (1954), *The American Heritage Dictionary Of The English Language*, American Heritage Publishing Co., Inc. U.S.A

AN ANALYSIS OF SOCIAL PRESENCE OF ONLINE FACILITATORS IN ONE UNIVERSITY COMMON UNIT

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Abstract

The integration of technology with traditional modes of teaching is not a new phenomenon in higher education; however, there is a growing push for the use of Internet based and other technologies that allow for more learner-learner and learner-instructor interactions. Effective higher order learning, both in online and face-to-face environments, is said to result mainly from the interaction of the social, teaching and cognitive presence of this community of inquiry. Studies, though, indicate that social presence is the most crucial determinant of perceived learning, learning outcome and satisfaction with the mode of instruction. Effective communication plays a major role in enhancing social presence and a sense of community in online learning contexts. This paper examines how the facilitators (lecturers) model this presence through their style of communication in opening statements of selected online postings across semesters in one university common unit. Some reasons for the inconsistencies noted are given as class size and training on the part of the facilitators and suggestions given for improving communication

Introduction

The scene in higher education has continued to alter, with a push towards more student- centered learning as opposed to the traditional lecture mode of delivery whose concentration is information delivery. Internet based and mobile technologies are seen as rich avenues that can help actualize this move. This has led to the rising number of courses being offered either fully online or through a blend of face-to-face and online modes. The forces behind this shift are many, but key among them is the emergence of a global knowledge economy that calls for learning that is geared towards addressing economic and other societal needs mainly through problem solving, creativity and team working. Also, the demographics of the student population are more diverse with mature working students constituting a significant proportion. Furthermore, the rate of enrollment in most universities far outstrips that of infrastructure development. The online mode allows more economical use of infrastructure by fleeing space previously used by one course in the face-to-face settings for use by other courses within a week (Rovai & Jordan, 2004: 4). Online teaching and learning, however, pose many technological, pedagogical and social challenges to both the students and the instructors. Unfortunately, institutions tend to focus more on technological issues than the other areas when launching online courses (Shu-Fang & Aust, 2008: 478; Roman, Kelsey, & Lin, 2010). One of the consequences of such an approach is the transfer of pedagogical approaches applied in face-to-face interactions to the online environment in spite of the latter being a "peculiar environment" (Anderson, 2004: 273; Redmond, 2011: 1051). Secondly, there is inefficient utilization of the tools available in the learning management systems and other technologies (Precel, Eshet-Alkalai, & Alberton, 2009; Betts, 2009). As Bajjaly (2005) says, "To deliver a quality course online, today's instructor needs effective interpersonal communication and facilitation skills in addition to subject-area expertise."

Learning and teaching are basically social processes, whose success is hinged significantly on the quality of interactions in the communication spaces, may they be physical or virtual. In the face-to-face settings, it is possible for the facilitator to walk into a lecture hall armed with expertise in the content area and not competent enough in the pedagogical approaches of teaching and learning and still deliver, because the dynamics of the context that include nonverbal, verbal and physical cues, help the communication to flow. However, this is not the case with online environments, where both the facilitator and the learners depend mainly on textual (verbal) communication without the benefit of social cues, and this makes it difficult for the sender and receiver to interpret and understand the messages relayed effectively. As a result some learners in technology mediated classes (TCS) experience low motivation, boredom, loneliness and social isolation all of which can affect the quality of learning and relationships formed (Weiss, 2003: 48; Rovai, 2001; Precel, Eshet-Alkalai, & Alberton, 2009). According to Weiss (2003) online learners are likely to feel as if they are communicating with "hardware – piles of metal and circuits" and not human beings. However, a study by Swan (2002: 43) shows that the students in technology mediated courses can reduce this distance by using text-based, verbal immediacy behaviors and in this particular study, the more the affective channels narrowed, the more immediacy behaviors were employed in order to establish equilibrium in the social presence. Thus the perception, competence and the skills of the communication partners determine the quality and quality of social presence in the learning environment.

Definition of Social Presence

Social presence theory can be traced back to communication research by Mehrabian (1969. There are many definitions of social presence, each with different emphasis. For example, Short, Williams, & Christie (1976:19) define it as the "degree of salience of the other person in the (mediated) interaction and the consequent salience of the interpersonal relationships," "the degree to which a person is perceived as a 'real person' in mediated communication" Gunawardena and Zittle (1997); " the ability of learners to project themselves socially and emotionally in a community of inquiry" (Rourke, 2001) or as Swan & Shi (2005) say, it is "the ability of participants in a community of [learning] to project themselves socially and emotionally as 'real' people through the medium of communication being used..." Although there is no agreed upon interpretation of social presence, what is clear is that it is a critical element of any communication medium (Richardson, 2003). Furthermore, social presence is the foundation of the sense of community in learning environments (Spurgin & Childless, 2009). Promoting social presence in online classrooms, is therefore, one of the competencies that an online facilitator should possess.

Promoting Social Presence in Online Classes

Both learners and facilitators in online technology mediated classes need to engage in behaviors that reduce any perceived distance between them without which the whole experience will not be fruitful or fulfilling. When social presence is high, the learning environment is seen as warm, collegial, and approachable (Aragon, 2003). Most online communication is verbal and so the selection and use of words matter a lot. As (O'Sullivan, Hunt, & Lippert, 2004) observe, "When these social cues transmitted nonverbally are filtered out of messages, the emotional content is also stripped" and there is need to re-build this element in the virtual classrooms. Behavior that helps narrow or eliminate any distance is referred to as immediacy.

Immediacy can be promoted by the use of good communication practices, such as using less formal style and avoiding paralinguistic elements that are deemed negative in online netiquette. For example, one should avoid heavy use of capital letters, which is usually taken as a form of shouting or exaggerating emotions and use the right tone in the verbal communication. (See figure one for some indicators.

Figure 1: Some Verbal Immediacy Indicators (Adapted from M. Kucuk, 2009)

[Affective Indicators	Definitions
Paralanguage (PL)	Features of text outside formal syntax used to convey emotion (i.e., emoticons, punctuation, capitalization)
Emotion (EM)	Use of descriptive words that indicate feelings (i.e., love, hate, sad)
Value (VL)	Expressing personal values, beliefs and attitudes
Humor (HM)	Use of humor-teasing, cajoling, understatement, irony, sarcasm
Self-disclosure (SD)	Sharing personal information, expressing vulnerability
Cohesive Indicators	
Greeting & Salutation (GS)	Greetings and closures (i.e., hi, hello)
Vocatives (VO)	Addressing people by name
Group Reference (GR)	Referring to the group as we, us, our
Social Sharing (SS)	Phatic, sharing information unrelated to the course
Course Reflection (CR)	Reflection on the course itself

According to Wikipedia (2003), the way messages are posted and interpreted by others shows the degree of social presence. One has to be careful with text-based communication because of the high likelihood of being misinterpreted since in many instances there are no nonverbal or physical cues to enhance understanding. As Kelly (2009:2) says: “An instructor’s “digital” personality can influence student achievement, retention or completion, and satisfaction with courses. Whether or not you make a conscious effort to project your personality into your online courses, students draw inferences about you through whatever information about you is available to them.” One's words and content are, therefore, a representation of who he/she is (Study Guides, 2013). Studies indicate that students learn better from teachers who are warm, friendly, immediate, approachable, affiliate and encourage appropriate relationships (Andersen & Andersen as cited in O'Sullivan, Hunt, & Lippert, 2004). However, there are indications that students and facilitators give little thought to what they post online without realizing that they are leaving indelible marks behind (Kucuk, 2009).

Facilitator Postings

One way of gauging whether the facilitator has shifted the paradigm is by examining the quality of the communication in the online postings (For details of the indicators refer to figure 1). It is important to present oneself as approachable by adopting a less formal tone (Poe & Stassen, n.d: 31). Tone is a product of word choice, sentence structure and the order of information in those sentences (Betts, 2009). Out of 100 posts, 70 % begins with content related information and no salutation or group reference. Compare the following examples:

A

This is not a group assignment!

You are supposed to meet your --Lecturer on---

This is just a reminder to what I had already told you sometimes back

This task is to be carried out individually

B

Dear group members----

I am glad we have come this far this semester.

Hello all. I hope you are getting on well

Hi, if you have problems submitting your references, kindly do so here.

While group A sounds blunt and dry, B is welcoming, and warm and displaying features which are relevant for establishing a comfortable learning environment. The students usually mirror what goes on between them and their facilitators in their interactions. It is necessary for the facilitator to model the kind of communication he/she expects in online interactions (Scollins-Mantha, 2008). Only 16 % of the postings have direct or implied salutations although one would have expected the facilitators to replicate what happens at the beginning of lectures in face-to-face situations by first of all trying to establish the right atmosphere for the interactions through greetings and exchanging any other relevant social niceties.

Another observed phenomenon is the use of paralinguistic features usually considered inappropriate in online netiquette. 26 % of the postings are either all in caps. The readability of information in caps is difficult to decipher and also can be interpreted as an expression of negative emotions. Exclamation marks, too, seem to imply displeasure and so should be used sparingly in online postings.

University Common Unit (UCU): Background

The academic communication skills course, which is offered to all undergraduates, was launched in 1990 in all Kenyan public universities. The mode of delivery was face-face until May 2011, when it was moved fully online at Kenyatta University using the Moodle learning management system. Following constant review and consultations, the blended mode was adopted in September the same year because of the course's skills orientation and project process approach. This meant one hour for face-to-face sessions and two hours per week online.

Facilitator preparation was geared mainly towards addressing technical aspects and the focus has not changed much since. Although all the facilitators, both permanent (tenured) and part-time adjuncts) have education orientation, it cannot be assumed that the pedagogical skills learnt at undergraduate level are sufficient to address higher education and specifically online needs. Although the university has started a program to address this deficit in 2013, it is not clear how much of the training content will address e-learning issues. If online learning is "perceived as complementary to lecture-based courses, pedagogical approaches are adopted that fit the traditional, frontal teaching and learning process" and "consequently online courses do not employ pedagogical approaches that fit online learning (Percel, Eshet-Alkalai, & Alberton, (2009; Redmond, 2011:1051). There are challenges in transiting from face-to-face to online instruction and facilitators' systematic training in compatible online pedagogy (Rovei & Jordan, 2003:11). As Smith (2005) says, "... it is not reasonable to expect experienced face-to-face faculty to magically begin to function well in the online environment" without guidance.

One other challenge to effective online interactions is class size. Rovai (2001) suggests a student-instructor ratio of no higher than 30:1 and he argues that a larger class than this is bound to affect the amount [and also quality] of the social presence between the students and the facilitator. In a June 2013 online polling of academic staff from several universities (Bart, 2013) there was a mention of large classes as and heavier course load (which tend to go together) as sources of stress.

Conclusion

Social presence as discussed is one of the pillars of online interactions. Building it into the online courses and maintaining it therefore, cannot be overemphasized. It is not obvious, however, that facilitators are able to do this without technical and pedagogical support, which should be ongoing. One of the areas that need addressing in the preparation of online facilitators is the quality and quantity of their communication since they help the student to figure out and apply appropriate communications. The analysis of the postings against figure 1 reveal a wide gap in what the facilitators are doing and what they need to do to make online learning environments fruitful and pleasureable. Both the facilitators and the students require guidance into online netiquette and other aspects that are relevant to that environment. Finally, class sizes need to be harmonized to ensure quality in online courses.

References

Abedan, B., Daneshgar, F., & D'Ambra. (2010, September). Underlying factors of sense of community in asynchronous computer supported collaborative learning environments. MERLOT Journal of Online Learning and Teaching 6 (3), 585-596.

Anderson, T., Rourke, L., Garrison, D.R., & Archer, W. (2001, September). Assessing teaching presence in a computer conferencing context. JALN, 3(2), 1-17.

Anderson, T. & Elloumi, F (Eds). (2004). Theory and Practice of Online Teaching. Athabasca: Athabasca University. www.atahabasacu.ca

Aragon, S.R. (2003, Winter). Creating social presence in online environments. New Directions for Adult and Continuing Education, 100, 57-68.

Baker, C. (2010, Jan). The Impact of Instructor Immediacy and Presence for Online Student Affective Learning, Cognition, and Motivation The Journal of Educators Online, 7(1), 1-30.

Bajjaly, S.T. (2005). Enhancing student/faculty communications in online courses. Online Journal of Learning administration, 8(3). www.westga.edu/~distance/jmain11.html

Bart, M. (2013, June). Half of faculty say their job is more difficult today than five years ago. Faculty Focus. http://www.facultyfocus.com/articles/teaching-careerss/half-of-faculty-say- their-job-is-more-difficult-today-than-five-years-ago/

Betts, K. (2009, Summer). Lost in translation: Importance of effective communication in online education. Online Journal of Distance Learning Administration, 12(2).

Bozkaya, M. & Erdem A, I. (2007, October). The relationship between teacher immediacy behaviors and learners' perceptions of social presence and satisfaction in Open and Distance Education: the case of Anadolu University Open Education Faculty. The Turkish Online Journal of Educational Technology, 6 (4),72-78.

Building Community Online (n.d). http://www.ctlonlinecommunity.project.mnscu.edu/index.asp

Delaney, J., Jonson, A., Johnson, T. & Treslan, D. (2010). Students' perceptions of effective teaching in higher education. 26th Annual Conference on Distance Teaching and Learning. http://www.uwex.edu/disted/conference

Finley, D. (2000, Fall). Communication issues in the online classroom. http://academic.pgcc.edu/~dfinley/communicationissuesonline.htm

Garnham, C. & Kaleta, R. (2002, March). Introduction to hybrid courses. Teaching with Technology Today, 8(6). Grant Agreement number: 2001 - 3453 /001 - 001 EDU-ELEARN

Gunawardena, C. N., and Zittle, F. J. (1997). Social Presence as a Predictor of Satisfaction within a Computer-Mediated Conferencing Environment. The American Journal of Distance Education, 11(3), 8–26.

Gunawardena, C. N., Nolla, A. C., Wilson, P. L., Lopez-Islas, J. R., Ramirez-Angel, N., and Megchun-Alpizar, R. M. (2001). "A Cross-Cultural Study of Group Process and Development in Online Conferences. Distance Education, 22(1), 85–121.

Heiner, M., Schneckenberg, D., & Wildt, J. (2001). Online pedagogy – Innovative teaching and learning strategies in ICT – Environments: Background paper of the CEVU workgroup online pedagogy. Grant Agreement number: 2001 - 3453 /001 - 001 EDU-ELEARN, 1-21. Regional Focus Issue: Bridge over Troublerton

Hess, K, Falkofske, J., & Young, C.B. (2010, June). Syllabus template for online course success. In Rob Kelly(Ed.), 11 Strategies for Managing Your Online Courses. Faculty Focus Special Report, pp. 3-6. www.FacultyFocus.com

Kelly, R. (2009, January). Instructor's personality: An essential online course component. Online Cl@ssroom, 2&5. www.magnapubs.com/newsletter/story/2727/

Kreijns, K.; Kirschner, P.A.; & Jochems, W. (2003). Identifying the pitfalls for social interaction in computer-supported collaborative learning environments: a review of the research. Computers in Human Behavior, 19, 335-353 www.elsevier.com/locate/comphumbeh

Kucuk, M. (2009, April). Teacher immediacy behaviors and participation in computer mediated communication. Turkish Online Journal of Distance Education-TOJDE 10 (2), Article 13. http://tojde.anadolu.edu.tr/tojde34/articles/article_13.htm

Landsberger, J. (2013). Netiquette: E-Guides on social interaction and communicating electronically. The Online Learning Series.

McInnerney, J. M. and Roberts, T. S. (2002). Online learning and effective communication. In S. McNamara and E. Stacey (Eds), Untangling the Web: Establishing Learning Links. Proceedings ASET Conference 2002. Melbourne, 7-10 July. http://www.aset.org.au/confs/2002/mcinnerney.html

Mndernach, B.J., Donnelli, E., Dailey, A., & Schulte, M. (2005, Fall). A faculty evaluation model for online instructors mentoring and evaluation. Online Journal of Distan e Learnng Administration Content, 13(3). www.westa.edu/~distance/ojdla/fall83/mandernach83.htm

O'Sullivan, P.B., Hunt, S.K., & Lippert, L.R. (2004). Mediated immediacy: A language of affiliation in a technological age. Journal of Social Psychology, 23(4), 464-490.

Precel, K., Eshet-Alkalai, Y., & Alberton, Y. ((2009, April). Pedagogical and Design Aspects of a Blended Learning Course. International Review of Research in Open and Distance Learning, 10(2), 1-16.

Redmond, P. (2011, Dec.). From face-to-face teaching to online teaching: Pedagogical transitions. Proceedings asciliteHabart 2011: Changing demands, changing directions, 4-7 December, Habart, Tasmania Australia, 2050-2060.

Richardson, J. & Swan, K. (2003, Feb.). Examining social presence in online courses in relation to students' perceived learning and satisfaction. JALN, 7(1), 68-88.

Roman, T., Kelesy, K., & Lin, H. (2010, Winter). Enhancing online education through instructor skill development in higher education. Online Journal of Distance Learning Administration, 13(4).

Rourke, L., Anderson, T., Garrison, D.R., & Archer, W. (2001). Assessing Social Presence In Asynchronous Text-based Computer. Journal of Distance Education, 14(2). http://cade.athabascau.ca/vol14.2/rourke_et_al.htm

Rudick, R. & O'Flahavan, L. (2007). Set the tone in E-Mail: How you say it is as important as what you say. http://www.hodu.com/email-tone.shtml

Short, J., Williams, E., & Christie, B. (1976). The social psychology of telecommunications. London: John Wiley and Sons.

Shu-Fang, N. & Aust, R. (2007). Examining teacher verbal immediacy and sense of community in online classes. International Journal on E-Lerning,7(3), 477-498.

Smith, T.C. (2005, July). Fifty-one competencies for online instruction. Journal of Educators Online, 2(2), 1-18. http://www.thejeo.com/Ted%20Smith%20Final.pdf

Spurgi, D.G. % Childless, M.D. (2008, Winter). Effects of university and departmental community on online learners. http://www.educause.edu/ero/article/effects-university-and-departmental-community-online-learners

Stemler, S. (2001). An overview of content analysis. Practical Assessment, Research & Evaluation, 7(17). Retrieved June 29, 2013 from http://PAREonline.net/getvn.asp?v=7&n=17

Study Guide and Strategies (2013). E-Guides on social interaction and communicating electronically. http://www.studygs.net/netiquette.htm

Swan, K. (2002). Building learning communities in online courses: the importance of interaction. Education Communication & Information, 2 (1), 23-49.

Swan, K. & Shih, L.F. (2005). On the nature of and development of social presence in online course discussions. Journal of asynchronous learning networks, 9(3), 115-136).

Tsai, I. C., Kim, B., Liu, P.-J., Goggins, S. P., Kumalasari, C., & Laffey, J. M. (2008). Building a model explaining the social nature of online learning. Educational Technology & Society, 11(3), 198–215.

Twigg, C. (2000). Who owns online courses and course materials? Intellectual property policies for a new learning environment: The Piano Player Scenario. The National Center for Academic Transformation. Retrieved from http://www.thencat.org/Monographs/Mono2.pdf

Wang, H. (2010, February). Eight ways to increase social presence in your online classes.

Weiss, R.E. (2003). Humanizing online communicatin. New Directions for Teaching and Learning, 84, 47-51.

WHY EVALUATE ONLINE COURSES DIFFERENTLY THAN FACE-TO-FACE

COURSES? http://www.wnmu.edu/facdev/files/Why_Evaluate.pdf

UNIVERSITY LECTURERS' SUPPORT TO CREATIVE INNOVATIONS IN "JUA KALI" SECTORS INITIATIVE IN KENYA FOR INDUSTRIALIZATION BY 2030

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Abstract

The "Jua Kali" sectors' initiatives in creative innovations fulfill vision 2030 in Kenya. Despite the critical role played by 'Jua Kali' sector in appropriate technological production, their ideas, work and products have often been patented by other global companies, produced en-mass then sold back to the developing countries. This not withstanding, the role of the university TIVET staff in appraising creative innovations in 'Jua Kali' sector had not been fully exploited. The purpose of this study was to establish what 'Jua Kali' sector activities could appraise the 'Jua Kali' expertise and improve global competitiveness. The objective of the study was to find out what activities in 'Jua Kali' sector could be carried out by university lecturers in appraising the 'Jua Kali' expertise to improve global competitiveness. The research used a descriptive survey design. Data was collected by interviewing 'Jua Kali' artisans, non-governmental initiatives (NGI), as well as officers from Kenya Industrial Estates (KIE). A checklist was used to confirm the data obtained from 'Jua Kali' artisans, NGI technicians and KIE officers. The study results were aimed at informing policy decisions on appraising the 'Jua Kali' competitiveness of their goods and services. The results revealed that the participation of the university TIVET personnel in 'Jua Kali' industries appraised the expertise as a mitigation strategy to loss of creative

innovations, mentoring of students, improve dissemination of practical knowledge, skills, attitudes, relevant applications for job creation and to encourage life-long learning.

Key words: Jua Kali, appraisal expertise, and creative innovations

Background to the Study

The subject of discussion in Kenya, Africa and world over in the recent past (in June-July, 2013) has revolved around providing relevant TIVET training and industrial experience to reduce youth unemployment (Kamau, 2013; NCST 2012 and UNESCO, 2013). The UNESCO (June-September, 2013) e-forum and the association of consultative engineering of Kenya (ACEK) discussions on relevant TIVET training identified the role of technical institutions-based incubation-centers for skills development and nurturing of creative innovations as well as reduction of youth unemployment (UNESCO, 2013 & Wainaina, 2013). However, economic blocks such as European Union (EU), African Union (AU) and the East African Community (EAC) recognized the role of 'Jua Kali' in providing relevant and specific employable skills training for the youth. In particular, the EU appreciated the role of the informal sector in providing lifelong TIVET training for the hard to reach groups (UNESCO, 2013). The hard to reach groups in need for alternative mode of training in TIVET were listed by e-forum, UNESCO (2013) as: youth in rural areas, people with challenges and young women. Yet, 'Jua Kali' sector which is able to provide training for the youth irrespective of their gender, mental or physical abilities has not been given due attention. In the global arena, training in 'Jua Kali' (informal sector) particularly in the UK has high careers happy index of 65% compared to academically trained work force at 58%. The career happy index of those in plumbing, hair dressing, gardening and electricians can be associated with 'Jua Kali' training experiences (UNESCO, 2013).

The youth constitute the largest population proportion but their unemployment is alarmingly high (ILO, 2010). In South Africa, youth form 60% of the total work force, yet youth unemployment is over 78% of all unemployment (ILO 2010). Similarly the youth form over 30% of the total population in Kenya, yet the youth unemployment is high at 73% (Mureithi, 2008). The global causes of youth unemployment include lack of access to relevant technical, industrial, vocational and entrepreneurship training (TIVET) (UNESCO, 2013). Germany aimed at reducing youth unemployment through providing skills in green technology rich in alternative sources of energy targeting to offer 170,000 jobs (ILO, 2010). Indian and Chinese home-based industrial production, which used hand-held tools where learners produced for the market were a notch higher. To meet energy needs, China planned to triple her wind power generation by 2010 so as to become the largest wind power producer by 2020 (Wu, 2011 and Kerre, 2010) based on wind power plants built from locally produced parts. Particularly, Chinese TIVET instructions were rich in preparation for 21st century employability skills development based on use of practical and occupational for agricultural skills training and innovations. Besides, village production centers in China aims at encouraging informal industries viable to raise foreign exchange. Consequently, Chinese industries produced cement, synthetic fibers, plastics, paper and paperboard; bicycles, motor vehicles and television receivers, and pharmaceuticals (Maclean, 2007). The competence-based training in Indian TIVET institutions find guidance from national vocational training system (NVTS) that encourage on-the-job and enterprise-based training through informal sector (UNESCO, 2013). Hence, the role of the informal sector in terms of providing opportunities for youth employment and raising revolved funds for investment in self-employment can not be overemphasized.

According to Session Paper Number 1 of 2005 on education and training as well as Kenyan vision 2030 describes key role of TIVET in Kenya in provision of relevant as well as critical skills and competencies for local and global competitiveness of goods and service (GoK, 2009). Despite the critical role played by TIVET training in developing the youth with locally and globally competitive knowledge and skills, graduates have been accused of lacking in relevant knowledge and skills witnessed especially in construction industry (Okoth, 2013). Challenges causing low quality of Kenyan TIVET training were summarized by Kerre, (2010) as indicated below:

> Institutions lack sufficient and modern training equipment and facilities to effectively prepare trainees for direct occupation entry or further education and training, TIVET trainers subsequently lack the pre-requisite experience and technical competence to prepare youth for dynamic 21st Century (p.31).

Those challenges pointed to inefficiency of training resources that contributed to low competence among students. Other challenges summarized by Kenya Institute of Education (KIE, 2009) in Kenyan TIVET in Kerre (2010) were:

> Inflexible and outdated TIVET curricular, mismatch between skills learnt and skills demanded by industries, inadequate mechanism for quality assurance, inadequate physical facilities for training as well as lack of modern equipment, inadequate and expensive training materials and text books, low participation of the industry, private sector in curriculum design and development (p.32).

That report indicated a great skill competence gap in industries. However, the report did not suggest the specific skills gaps that can be met through collaboration with 'Jua Kali' sector. Similarly, a report by Ngerechi (2003) indicated that TIVET courses in Kenya placed greater emphasis on theory and certification rather than skills acquisition and proficiency. The solution suggested is based on TIVET training and industrial linkage (Kerre, 2011 and Okoth, 2013). Yet, the role of 'Jua Kali' in bridging the gap in TIVET training and industrial linkages has not been fully exploited.

Problem

The problem in this study is that over 40% of the primary school graduates do not progress to secondary schools while less that 60% of the form four levers make it to universities. These are the personnel in 'Jua Kali' sector. They face challenges such as insufficient training, inadequate equipment and facilities. The situation is compounded by mentors' inadequate pre-requisite experience and technical competence to prepare youth for dynamic 21st Century global market. This translates into mass wastage of 'Jua Kali' artisans training opportunities. Formal TIVET training offers inadequate opportunities for training to youth who are out of formal institutions. There is untapped potential of 'Jua Kali' as a significant source of labor market intelligence. Hence, there is need for university TIVET staff to appraise 'Jua Kali' sector creative innovations to attain global competitiveness of goods and services in Kenya and world over.

Literature

UNESCO (2013) e-forum observed that although TVET institutions are doing a good job in ensuring that the youths are well trained and have the necessary trade skills in readiness for the job market, they are turned away by their would-be-employers because they lack employability skills. Hence, employability skills need to be developed. However UNESCO (2013) study did not suggest the role of 'Jua Kali' in developing employable skills. 'Jua Kali' sector in Kenya was observed to contribute to over 90% of the creative innovations. Gatonye and Mathenge (2009) observed that,

> Although universities have proven the most prolific in publishing research papers, with 194% growth in the last five years, it is the informal sector, which leads in patenting of practical innovations. The Permanent Secretary Ministry of Trade and Industry, Prof. Lonyangapuo, said that out of 10 patents registered since 2001, none were from local universities. Out of the 50 expected patents in the next 3 years, he said that most of them would come from 'Jua Kali' sector (p. 3).

That meant that although formal technical institutions get more research funding than 'Jua Kali' sector, their creative innovations were more prominent than in formal institutions of training. The instructors in formal technical institutions could mentor their students in 'Jua Kali' sector and develop on-the-job technical and vocational employability skills needed as well as encourage competitiveness of their creative innovations.

'Jua Kali' sector develops a pool of skilled labor for current and future needs. The sector increases savings and investments for local Kenyans as a result reducing poverty (Momanyi, 2008). By the year 2000, 'Jua Kali' sector employed 4.1 million people in Kenya and was observed to have potential for growth (ILO, 2010). By the year 2002, 1.1 million people depended on informal associations and groups for financing their businesses (UNESCO, 2013). Besides, formal TIVET training does not offer sufficient opportunities for training of youth out of school. 'Jua Kali' sector that offers on-the-job training for the youth out of formal schools falls short of globally competitive skills. 'Jua Kali' artisans are interested in attaining technical and vocational skills but their desire is that they are not taken away from their sheds (Momanyi, 2008). Momanyi also indicated that 'Jua Kali' artisans prefer taking their training as they do their work. Again learning for artisan in their sheds is preferred to formal education because of the learning environment.

Methodology and Resources

The research used a descriptive survey design. Data was collected by interviewing 'Jua Kali' artisans, personnel from non-governmental initiatives (NGI) as well as officers from Kenya Industrial Estates (KIE). A checklist was used to confirm the data obtained from 'Jua Kali' artisans, NGI technicians and KIE officers. Photographs were taken to reinforce the research findings. Descriptive statistics were used for data analysis. The research findings were summarized in objective research questions.

Results and Discussion

The study results were summarized and discussed under the following research questions.

Question one: ***What are some of the African heritage products with their global market equivalent?***

The purpose of Table 1 was to illustrate the African rich heritage products prepared by the jua kali artisans in the past but the ideas were taken, improved and patented elsewhere.

Table1: African products and their global market equivalent

African heritage products	Global market equivalent
Bee propolis	Forever bee propolis (supplement for mothers)
Kiondo	Chondo patented by Japan
Kikoi	Kikoi patented by Japan
African toys	Patented toys
Artistic seatsmade from twigs	Plastics equivalent
Beans bags for cat and rat game	Patented bean bags
Mubara used by mau mau scouts	Modern conveyor belts wheels
David Macharia's Radio station and robotics*	Robot teachers Automated teller machines
M-pesa concept	Mobile phone money transfer
ATM-door (Nakuru-early 2000)	ATM doors, lighting systems
Thukurui (aloe vera) medicinal extracts	Aloe Vera products from forever products
Rukuri (honey coated meat pieces)	Honey coated peanuts, cashew nuts etc.

*Sauti ya Unjiru, in the early 1980s

The purpose of Plate 1 was to illustrate the African rich heritage made from bees' products prepared by the jua kali artisans.

Uses of bee products;

Bee propolis-glue for joining pieces of wood, higher alternative value is anti-biotic for protecting human from illness, wax-making candles, chewing gum, and chewing honey combs make honey sweet and delight to the heart while, honey-tea sweetner and medicinal value

Plate 1: Bee keeping products (bee propolis-dark and candles-yellow)

The current study results indicated in Table 1 and Plate 1 and GoK (2013) concurred that the great potential that has existed among the African heritage creative innovations being patented elsewhere since the idea of patenting has been foreign to Africans in the continent. Hence, the loss of ideas used in African Heritage can be curtailed by the university TIVET lecturers' appraisal as a mitigation strategy.

Question two: What is the role of 'Jua Kali'sector in complementing formal TIVET training?

The purpose of Plate 2 was to illustrate the role of 'Jua Kali' in training people who are physically challenged

From Plate 1, six months after this wheel chair was sighted by researchers at Kenya industrial estate (KIE) the user was followed and found to have started own business in leather making. The investor (who had been mentored in 'Jua Kali' sector) said that he had got funding from his trainer to start his business besides being allowed to use trainer's machines to saw complicated patterns.

Plate 2: Improvised wheelchair used by a leather making apprentice at KIE

The results in Plate 2 and (UNESCO 2013) concurred that ‘Jua Kalis’ role in training hard to reach groups such as youth in the rural areas, persons with challenges and street families can be appraised by university TIVET lecturers.

Question one: Why do ‘Jua Kali’ artisans prefer on-site training to formal training in TIVET institutions?

The purpose of Table 2 was to indicate the reasons why ‘Jua Kali’ artisans prefer on-site to formal TIVET training in institutions (away from their sheds).

Table 2: Reason for not going for training away from ‘Jua Kali’ sheds

Reason	Frequency	Percentage
Employers do not allow them to attend training	3	5.00
Feel they already have needed skills	8	13.33
Time constraints	19	31.67
Opportunity cost	16	26.67
Lack of interest	9	15. 00
Language barrier	5	8.33
Total	60	100.00

The results in Table 2 indicated that language barrier lead to lack of interest. The current study and Momanyi (2008) and Mureithi (2008) concurred that employed ‘Jua Kali’ staff fail to access training because of time constraints and lack of permission from employers to attend formal education. The current study and NCST (2012) concurred that the university TIVET lecturers’ appraisal to ‘Jua Kali’ training complete competence-based training and assessment (CBTA) for quality assurance of their goods and services.

The purpose of Plate 3 was to illustrate the potential in ‘Jua Kali’ sector in providing support services to mobile phone industry and technical training to the youth.

Plate 3: Phone repair shed (artisan with his apprentice)

The current study and UNESCO (2013) concurred that 'Jua Kali' sector can be appraised by university TIVET lecturers to support the repair and maintenance of mobile phones among other modern ICT technology related products useful in e-learning and mobile phone-elephant surveillance set for bio-diversity conservation and reduction of elephant human conflicts. The current study and Nyantino (2009) agreed that mobile phone learning is a key to lifelong-learning. Further more, house and gargets mobile phone-surveillance, mobile phone-tea making set-up, M-Pesa for distance transaction, M-Shwari for saving and accessing funds for investments needed by the youth, social interaction for national integration, market exhibition plat-form for their goods and services on-line need appraisal.

The purpose of Table 3 was to indicate the role of 'Jua Kali' sector in complementing formal training of TIVET students

Table 3: Role of 'Jua Kali'sector in complementing formal TIVET training

Role	Frequency	Percentage
On-the-job-training	3	4.62
Work-study programs (raise cash while studying).	9	13.84
Working with modern equipment and facilities in production	6	9.23
Use of ICT for problem diagnostic procedures	12	18.46
Problem-solving skills	12	18.46
Development of customer-based skills and experience	10	15.38
Assessment by industrial supervisors on quality and standards	5	7.69
Interpersonal and intercultural skills.	8	12.31
Total	65	99.99

Question three: What activities can be carried out by TIVET instructors in 'Jua Kali'

Activities in Jua Kali;

University exhibitions marketing, working with colored salts for alternative decorations, use of appropriate technology and engineering equipments and facilities in 'Jua Kali', site providing space for mulberry tree and silk worms farming, improve patterns and quality of material texture, Creation of websites for on-line market exhibitions of goods and services, guidance of financial sourcing and pricing, customer care, supply chain

Plate 3: Weaving to make decorated silk products in 'Jua Kali' sector

Question four: What quality and standard activities can be carried out in 'Jua Kali'?

Quality and standards activities;

Finishing, durability,

Global market competitiveness, Market attractiveness, promotion, variety, eco-friendliness (Bio-degradable), money value, reliability,

Validity, efficiency, continual improvement, customer driven products, patenting, Kenya Bureau of standards (KEBS) stickers), legislations and

Plate 4: Finishing of dry banana leaves and wood products

The current study and Liti & Munguti (2002) and NCST (2012) agreed that Jua kali sector's products have attained in niche in the agricultural and manufacturing industries. However, the finishing needs to be appraised by lecturers' participation.

Conclusion

The great potential that has existed among the African heritage creative innovations being patented elsewhere has led to Africa's underdevelopment. Hence, the loss of ideas used in communities' heritage can be curtailed by the university TIVET lecturers' appraisal as a mitigation strategy in Kenya and world over.

There is evidence that mentoring and training of hard to reach groups such as youth in the rural areas, persons with challenges, street families, personnel in jua kali sector and households in the urban informal settlements to improve their creative innovations global competitiveness can be appraised by university TIVET lecturers.

Lecturers' appraisal to 'Jua Kali' through training on competence-based training and assessment (CBTA) for quality assurance of their goods and services is necessary and urgent.

'Jua Kali' sector can be appraised by lecturers repair, maintenance and operations (RMO) support to mobile phones and ICT technology industry promote e-learning and mobile phone-elephant surveillance for bio-diversity conservation, reduction of human-elephants conflicts. Also security can be improved through jua kali creative innovations through mobile phone surveillance as well as improving communities lifestyles using mobile phone-tea making set-up, M-Pesa for distance transaction, M-Shwari for saving and accessing funds for investments needed by the youth, social interaction for national integration, market exhibition plat-form for their goods and services on-line need appraisal.

'Jua Kali' artisans' role in complementing formal TIVET training can act as an impetus to induce participation of lecturers in the 'Jua Kali' activities. The roles include; on-the-job-training, work study programs, use of ICT for problem diagnostic procedures, assessment by industrial supervisors on quality, standards and generic skills such as cross-cultural customers relations.

Quality and standard activities can be carried out by lecturers in 'Jua Kali' sector to appraise products' (i.e. finishing, durability, global market competitiveness, market attractiveness, promotion, variety, eco-friendliness, money value, reliability, validity, efficiency, continual improvement, customer driven, patenting, Kenya Bureau of standards (KEBS), legislations and policy documents among others. Therefore, university TIVET lecturers have a role in appraising 'Jua Kali' sector for continual improvement towards global market competitiveness of creative innovative goods and services. Their role can bring nearer realization of Kenyan vision 2030 and developing countries rapid industrialization.

The study recommended further research on the role of community support of 'Jua Kali' creative innovative goods and services by providing resources and market for jua kali products.

Reference

Gatonye, G. & Mathenge, O. (2009, July 23). Good morning teacher robot: Japan may soon roll out first human-like tutors to take over classrooms. Nairobi: Daily Nation, (p. 3).

GoK, Minitsry of Industrialization (2012). Kenyan delegates in one village one Programme in Kenya (OVOP). OVOP News. Nairobi. June-December 2012, Vol. 4:1-8.

GoK, Ministry of Higher Education Science and Technology (MoHEST, 2010), Handbook for accreditation of TIVET institutions. Directorate of Technical Accreditation, Quality and Assurance

GoK, MoHST (2005), Strategic Plan 2007-2012. Government Press

International Labor Organization (ILO) (2010, September 29-30). Teachers and trainers for future- technical and vocational education and training: report for discussion at global dialogue forum on vocational education and training. ILO Sectoral Activities programmes. [Electronic version]. Library media connection

Kamau, M. (2013, July 3rd). High school dropout makes a killing in quail rearing venture. Nairobi. The Standard. p. 32.

Kerre, B.W. (2010, March 25th). Technical and Vocational Education and Training (TVET): A Strategy for National Sustainable Development Inaugural Lecture 9 Series No. 1, 2010. Eldoret, Kenya. Moi University Press.

Kerre, B.W. (2011). TVET Education for Green society and Economy- the development of TVET educators in Africa: Good practices emerging challenges in UNESCO-center for technical vocational training, preparing TVET Educators for the Next Generation, Conference (EDUCON, 2011), Report, December, 12-13, 2011, Corus Kuala Lampur, Malaysia, Department of polytechnic education, ministry of higher education (DPE-MOHE) Malaysia.

Karingi S. and B. Wanjala (2005), The tax reform experience of Kenya, UNU-WIDER Research paper No. 2005/67, Helsinki: United Nations University World Institute for Development Economics Research

Liti, D. & Munguti J. (2002). Ponds and aquaculture CRSP Jua Kali. In Aqua-news. Available: http://pdacrsp.orst.edu. Retrieved on 2013, 15th June

Maclean, R. (2007). Vocational and higher education issues, concerns and prospects. Bonn. International centre for technical and vocational education and training. Germany.

Momanyi, C. (2008). Benefits of non-formal education to jua kali's artisans: a study of the informal sector business institute (ISBI), Nairobi, Kenya, Unpublished Thesis, Kenya, Kenyatta University.

Mureithi, G.W. (2008).Technical, vocational education and training in Africa: has it lost its significance? Eldoret, Moi University, Kenya.

National Council of Science and Technology (NCST) (2012, June). The World of science, technology and innovation: Nairobi. A news letter of NCST, Kenya, issue 18,

Ngerechi J. B. (2003, August 6). Technical and Vocational Education and Training in Kenya. A paper presented in Conference on the Reform of Technical Regulatory Instruments for Quality Assurance of TVET and Vocational Education and Training (TVET). Gaborone. Botswana.

Nyantino, J. (2009, June 2). 'Use mobile phones as teaching aids' Nairobi. Daily Nation, p. 11.

Obonyo, E.A. (2011). Developing Global Scientists and Engineers: Engineering and

Sustainable Building Systems. Quality Education for Societal Transformation, Paper presented at the International Conference on Education, Kenyatta University Conference Centre, Nairobi, 20 – 22 July,
Nairobi, Kenyatta University and Syracuse University.

Okoth, D. (2013, July 3rd). How disparities in higher education blur Vision 2030. Nairobi. The Standard. p. 18.

UNESCO (2013). UNESCO-UNEVOC e-forum Visual-Conference on Youth-Labour market information and skills forecasting. Final Report. Bonn. International Center for technical and vocational education and training. June- September 2013

UNESCO (2013). World data on Education. Education, Kenya. Geneva. UNESCO-IBE, 2013, vol. 2.

Wainaina, E. (2013, July 3rd). University enrolls chopper boy at incubation center to brush upon skills. Nairobi. The Standard. p. 31

Wu, R.T.Y (2003) A comparative study of the trends in career and technical education among European countries, the united states and the republic of china. Ann Arbor, Michigan: national association of industrial and technical teacher educator, 40 (3): 63-79

A MODEL FOR PRE-SERVICE TRAINING ON ICT-INTEGRATION IN TEACHING AND LEARNING AT SECONDARY SCHOOL LEVEL

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Abstract

Integration of Information Communication Technology (ICT) in teaching and learning has become a global focus in classroom instruction. This is due to the facilitation ICT brings in concept development through motivating learning environments. The motivation is enlisted by wide use of resources and active learner engagement. It is therefore, useful to prepare teachers to be conversant and versatile in the use of ICT tools and appropriate pedagogical skills. The Ministry of Education, Kenya, has indeed embraced and promoted ICT integration in teaching and learning through a guiding policy, provision of ICT equipment through the Economic Stimulus Programme, production of DVDs and the establishment of a National ICT Innovation and Integration Centre. Consequently, it is imperative that teacher trainee institutions in Kenya (and many developing countries) equip pre-service trainees with ICT integration knowledge and skills. This paper presents a model that could be used in various teacher trainee institutions to prepare pre-service teachers for effective implementation of ICT integration strategies. It highlights the key steps that should be emphasized such as training workshops, Peer Teaching, Classroom Practice in trial schools, 3-months full blown Teaching Practice with Observation, Final Feedback workshop, Report writing and Dissemination. The challenges attached to this model are also discussed.

Introduction

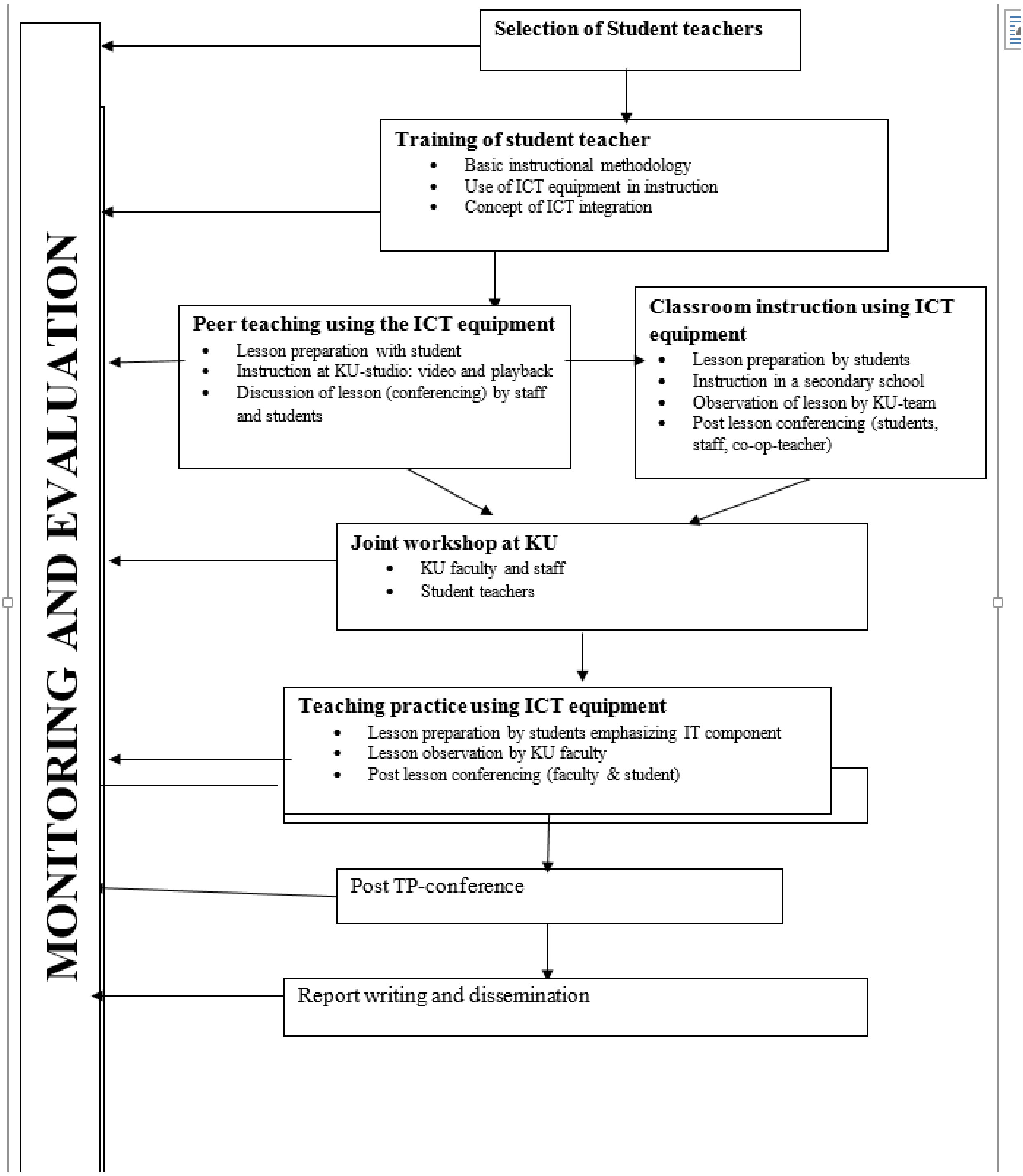
Integration of Information Communication Technology (ICT) in teaching and learning has become a global focus in classroom instruction. This is due to the facilitation ICT brings in concept development through motivating learning environments. Research has also shown that use of ICT in instruction enhances student performance (Nyaga, Twoli & Maundu, 2013). However, there is a wide contention globally that technology use can improve student learning in schools. This is supported by a number of educational researchers and institutions (Elshof 2007; 2000; ISTE 2000) who have been committed to supporting student learning through the effective use of technologies in schools. While use of technology in developed countries can claim to improve student performance, this link is not very clear in developing countries, because of minimal research work in this area detailing the interface between efficient school administration and effective role that ICT plays in teaching and learning. Furthermore, ICT use in instruction has not been as extensively implemented as might be found in such fields mainly due to the costs involved. Indeed, many developing countries including Kenya are just beginning to embrace technology in teaching. This push is mainly based on the global impressions associated with the use of technology. Considering that most reports are positive, this is convincing enough to stimulate developing countries to follow suit. This conviction has made the Kenyan government to step up its initiative towards use of computers in schools, with the major emphasis in secondary schools. This is being done through the Economic Stimulus Program (ESP) and the National ICT Innovation and Integration Centre. The former provides the ICT infrastructure to selected public secondary schools and builds capacity of teachers with basic ICT competency skills and knowledge. The latter provides “guidance and support to schools and field offices in their efforts to develop and implement ICT driven programme activities and integration processes” (www.ni3c.net). The organized use of technology has been along two fronts: first, direct push by the Ministry of Education Science and Technology which trains teachers and supplies basic ICT resources and second by encouraging well wishers or NGOs to support some sections of the process. This combined effort has made Kenya to slowly but surely begin to embrace some ‘surface’ technology in teaching.

The provisional reports by the Ministry of Education, Science and Technology and other support groups like the Centre for Mathematics, Science and Technology in Africa

(CEMASTEA) have shown indications of some positive effects of the use of ICT instruction and performance, particularly in the Sciences and Mathematics which are traditionally labeled as 'difficult' with regard to concept development. While technology can improve concept development in a learning process, questions are beginning to emerge about whether teachers are prepared to effectively integrate technology in their classrooms. We view integration as instances in which teachers and /or learners use technology as a tool to support the learning process. These tools facilitate in motivating students to construct their own knowledge, develop conceptual understanding and improve their communication and higher cognitive skills (www.glencoe.com/sec /teaching today; Maundu & Githinji, 2009).

Many initiatives around the world have been advanced in order to develop skills related to technology integration (Uebbing (1995). The common underlying strategy is to train teachers using a process model which guides teachers on basic technical and instructional integration skills in a practical setting such as in workshops and practicum (Teaching Practice). This model was preferred in our (Kenyatta University) training because of its step-wise approach. We start by providing an overview of the design of the model used for Mathematics and Science pre-service teachers. But why Mathematics and Science? When handling this area it involves not just handling content but also the processes. This makes the two subject areas difficult for many learners yet so vital for national development.

Fig1. The model for Pre-Service Training in ICT Integration



The model emphasizes the following as the key stages.

- Selection of 3rd year student teachers in Mathematics and Science
- Training the student teachers on basic skills of ICT integration.
- Guiding student teachers on the preparation of lesson plans and their use in short term teaching (peer teaching) and long-term teaching (nearby schools).

- Assisting student teachers on the use of ICT while on Teaching Practice.
- Getting some formative and summative feedback from student teachers at various stages.
- Writing a comprehensive report of the training process.

The Training Process

A phased or process approach was used in the training of the pre-service teachers at Kenyatta University. A phased approach is when the training focuses on a specific knowledge or skill at a time (Middleton, 2008)

The third-year Mathematics and Science education students formed the population of the pre-service teachers. This selection was suitable in a number of ways. This is the time when Subject Methods are taught, thus giving lecturers an opportunity to integrate ICT as they consider other aspects such as planning. Again, at this level, most students will have acquired basic computer skills such as word processing, which can support ICT-integration skills. Indeed we found that most students were quite knowledgeable with the basic IT skills by the time they joined this programme.

The Concept of Integration

The first task in the training programme as per the model was to train on the basic skills on IT (Fig 1.). This was done in workshops where demonstrations and hands-on approaches were used. Students were given folders with key information and space for making notes. Pre-service teachers were taken through basic technological skills, equipment and facilities. Common resources e.g. videos, calculators, probe kits were frequently demonstrated in the training.

Each session took approximately 2hrs; we had four sessions for this purpose. One skill that proved quite a challenge to pre-service teachers was planning for integration, and specifically writing a lesson plan, which integrates conventional and ICT components. To assist pre-service teachers to cope with this challenge we went a full length to explore what integration of ICT in the curriculum really means. We made them feel confident to answer the question ‘what is integration of technology in teaching and learning? Several definitions were offered but we found the one given by CEIR-TECT (2002) to be more fitting. They define integration of technology as ‘the use of technology by teachers and students to enhance teaching and learning to support existing curricular goals and objectives. This definition makes it clear that technology integration is not about computer classes which focus on teaching students about technology. Technology integration is about regular classroom teachers using the different technologies to support the learning of all students within and across the curriculum areas.

A number of modes of integration were emphasized in the training process. The following were the main areas:

- **For concept development:** this is when a certain concept is developed step by step using conventional approach and also supported by technology. Large concepts like, bonding, force, or respiration can integrate technology to boost conceptualization. The process of approach would be: first the teacher gives the background (basics): followed by a clip of technology e.g. a simulation to reinforce key points. The teacher then moves to the next sub-concept and so on.

- **For concept introduction:** A brief clip can be used to stimulate learners to start thinking or raise their curiosity in expectation or readiness for detailed learning.

- **For concept conclusion or summary:** There are clips or DVDs which are brief and focus on summing up key points in the concept.

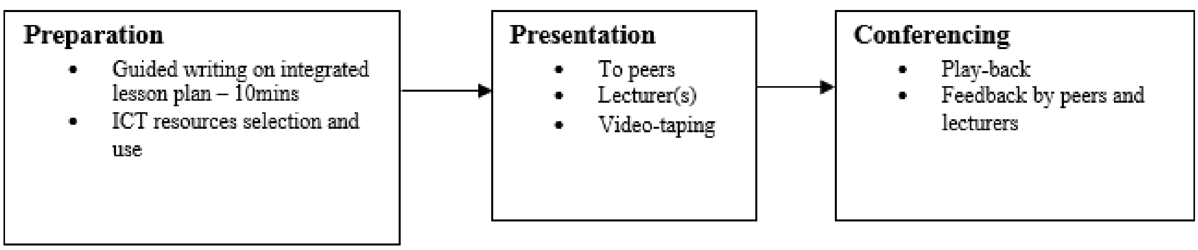
- **For revision:** Students are guided to answer questions in the DVDs; listen or review areas not clearly understood.

- **For concept consolidation** by guiding learners to search around new areas on the Internet.

True integration of technology in teaching and learning is a slow process, time consuming and requires substantial levels of support and encouragement for teachers and educators in general. The pre-service teachers attested to this as they went through the training process. This statement is also supported by programmes such as, *Apple Classroom of Tomorrow* (Dwyer et al 1991) who have experienced that *'success in ICT–integration requires a steady and persistent spirit.'* They estimate that full integration takes *three to five years* in technology–rich environments and it may take a lot longer in technology–poor countries.

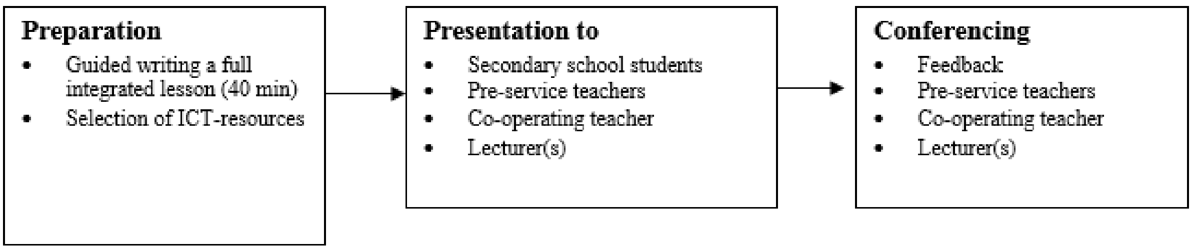
Teaching integrated lessons

After getting the basics on integration the next sessions were arranged to give pre-service teachers opportunities to focus on *putting theory into practice*. This was done in two stages. The first stage required them to *write brief (10-mins) lesson plans for integrated lessons* and use them to teach their peers. These sessions were to reinforce the *art of integration* in planning and presentation. They also gave opportunity to pre-service teachers to practice basic technology skills. During presentation, the presenter was video-taped and there was play-back to allow for conferencing. The process can be represented as:



This stage helped in the clarification of a number of issues and caused a lot of excitement among pre-service teachers, an indication perhaps that they were enjoying and managing the skills of integration.

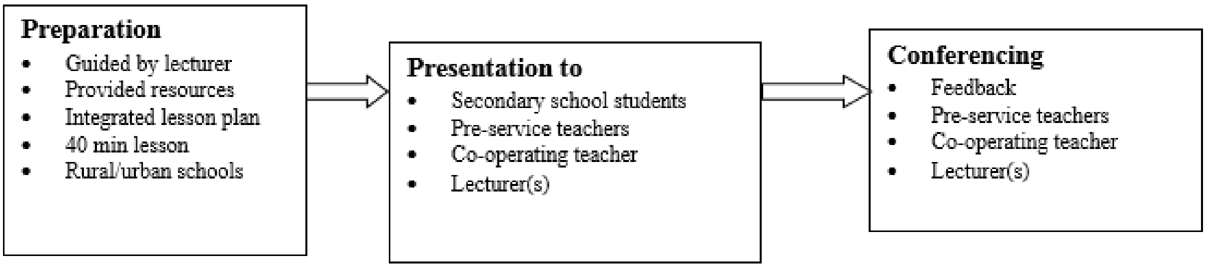
The other teaching experience using integrated IT-lessons was by getting pre-service teachers manage a full school-lesson of forty (40) minutes. After a number of peers teaching sessions it was arranged that they go a step higher, to *a real lesson* and *real learners*. This meant arranging with nearby schools for full lessons. This gave an opportunity to pre-service teachers to test various modes of integration. This can be presented as:



This exposure was demanding but useful in stretching pre-service teachers to the real school situation. This is also the stage we started experiencing preparedness of some schools in accommodating technology integration.

The last serious stage in the training was a follow-up during practicum or teaching practice (TP). Pre-service students go for a three-month practicum in various schools in the country. Here was an opportunity for more exposure to a cross-section of schools.

Lecturers were able to go to selected practicum schools to work with pre-service teachers. Being aware that some schools may not have the resources, the lecturers were ready to go with the basic IT resources, which included a laptop, a projector and some DVDs. This can be represented as:



There was some interesting observation when interacting with urban and rural schools. One outstanding difference lies in the back-up assistance by school administration or communities. Schools in technology-rich environment like the urban ones had a huge advantage over those deep in the rural areas that are in economically disadvantaged areas. There were greater barriers in rural schools which included:

- Lack of electric power or they have power but no sockets
- Small or crowded classrooms–difficult to get the projection range
- Walls having dark colours and
- Noise in the environment

These posed real challenges but with some innovation, we managed for instance when a teacher offered a white sheet to serve the role of a projection screen…and it worked!

The Teaching Practice experience completed the active cycle of our pre-service training in ICT-Integration in learning Mathematics and Science. After the practicum or teaching practice, we had a session with the teachers to give a comprehensive evaluation to the programme. The following stood out as the main values and concerns.

- One needs basic skills in computer technology for fast facilitation and accurate manipulation of the instruments. This ensures proper time management and proper use of resources.

- Basic resources are key, especially a laptop, projector and some DVDs. If possible some internet connection

- Support from the school administration or community for material and inspirational purposes is important.

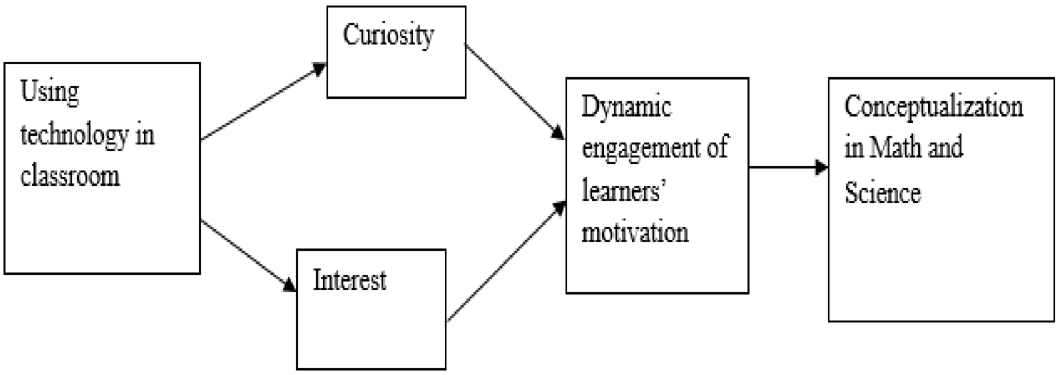
- ICT integration is a slow process and one has to exercise a lot of patience as it takes quite a lot of time and can at times be frustrating.

The impression of most pre-service teachers was that ICT-integration is a valuable experience to learners and to be effective, support from all stakeholders is vital. They report that they were able to act as ‘good ambassadors’ in some cases when they activated dormant ICT-equipment in schools and turned them into tools of active classroom instruction.

The Learning Process in a Technology Pervasive Environment

Going by classroom observations when teachers used technology, one gets definite impressions. The immediate observations are that learners are curious, interested or motivated, and as a result they get involved in learning or as some scholars would put it, ‘learners get engaged in the learning process.’ This relationship has been affirmed by some scholars (Hidi and Renninger 2006) who argue that integrating ICT in instruction triggers a process whose end result is dynamic engagement which is responsible for *conceptualization* leading to improved *performance or achievement* (fig. 2).

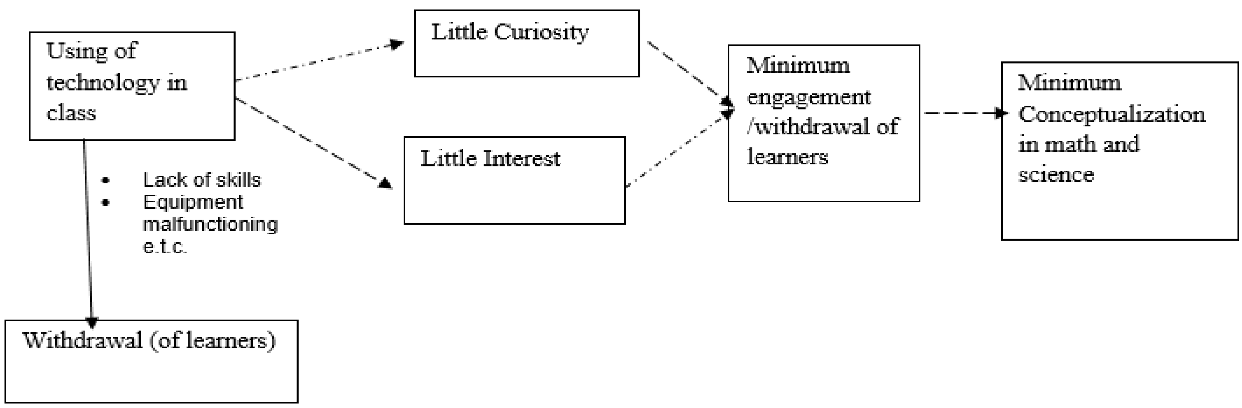
Fig 2: Effects of Using Technology in a Classroom



Dynamic *engagement* is key if learning has to result in conceptualization. Engagement can be *participative, affective or cognitive* and all these are effective if the learning is on-task related mode (Reeves, 2006).

The process in fig. 2 is likely to be realized in a *perfect situation* where everything is working well. In situations where a teacher is technologically alert and exhibits excellent skills and there are no hold-ups or fumbling with equipment. But what is the likely reaction in a class where the teacher or the equipment is not functioning properly in that this causes breaks or some sort of indecisions? This will trigger some reaction from learners and such a reaction is likely to be in a form of a *loss of interest or curiosity*. Let us consider that technology in schools ranges along a continuum from total immersion (when all is alright) to *avoidance or withdrawal* (fig.3).

Fig 3. Effect of Malfunctioning Technology in a Classroom



The main causes of learner withdrawal are when the teacher lacks the skills to handle equipment or equipment does not work well or at all. This just kills the curiosity, interest and of course there is no engagement, resulting in the concept not learnt. This explains why in the KU training of ICT integration emphasis was laid on ensuring that *basic skills* are attained and kept abreast with the new technology. Although there is no documentation on wider effects of withdrawal, one cannot help to suspect that this affects teachers too. Those teachers who frequently face IT problems in class are likely to start limiting their use and if this persists, they can have complete withdrawal and hence give up all together.

Conclusion

As in any other profession or school, teachers and administration need a vision to help them towards achieving their goals. One such vision should be to promote technology as a tool in their operations. Success of technology implementation depends not only on how well technical components are planned but, more importantly on how well the training of teachers is carried out and sustained.

No doubt that matters or operations to do with technology can be expensive and this may give partial explanation to why many developing countries are struggling to make entry in this domain. Those who have made entry in the technology world will assert that, although it is expensive to establish, the yields are hefty. For schools and teachers, these yields are in the form of achieving the goals of education and excelling in knowledge and skills which are key in national development. Getting started has been the problem for most institutions and for many some bold decisions are required. Drawing up a vision in the use of technology in the classroom can be a useful start. As Black (1983) once put it:

A vision without a task is only a dream

A task without a vision is mere drudgery

A vision with a task can change the world.

For the success in ICT-training, some form of support is crucial. In our case we were fortunate in getting a lot of support and encouragement from our institution and also some outside sponsors. The institution gave a lot of technical support while the sponsors (HP /ISTE) provided the basic resources and funds for general operation. As it is often said, you cannot train in a void. The funding is key and this raises the importance of writing proposals.

Teamwork was a huge advantage when working on this programme. We are effectively five members representing Mathematics and the three science areas are mainly Biology, Chemistry and Physics. We shared the ICT-strengths and lifted our weaknesses, a process which boosted the programme. Where necessary we reached out to the ministry of education for consultations.

Recommendations

We wish to end our report with some recommendations. This model was perhaps a pioneer model in the region and we therefore recommend that other institutions try it out and let us compare notes for purposes of bringing improvement in Pre-service Teacher Education. As a supplementary recommendation, we would urge those in other subjects other than Science and Mathematics to try out the model to determine what fits and what may require modifications.

Our limited observation revealed that the use of ICT brings improvement in conceptualization and achievement. We recommend that a more focused research using cross-sectional and longitudinal designs be carried out to determine the range of contribution the use of ICT brings to conceptualization.

Harmonization of training procedure is useful especially if these activities are done by different bodies. In such a case, development of a standard training manual will give a guide to all the parties involved. Such a manual can be constructed in partnership with the Ministry of Education, Science and Technology. We appreciate the initiative by the ministry for the first general draft of the manual (MoE 2013). This effort can be improved by going discipline wise.

References

Arnone, M.P., Small, R.V. Channcey, S.A. & Mckenna Hp (2011): Curiosity, Interest, and Engagement in Technology-Pervasive Learning Environments: A New Research Agenda. Educ. Tech Research Dev.59, 181-198

Black, I. (1983): The Role of Computer Technology in Re-Structuring Schools. Phi-Delta Kappan 73, p. 28-37.

Elshof, (2007): Moving Beyond 'Artifactual Knowledge': Emergent Ideas for the 21st Century Technology' Education. Teaching and Learning Technological Literacy in the Classroom, p-176-181

Hidi, S. Renninger, K.A. (2006): The Four-Phase Model of Interest Development, Educational Psychologist, 41(2) 11-127.

Maundu J. & Githinji A (2009). "Youth Employment in Kenya: Employability Skills for Socio-economic Development". A paper presented at the 1st International Conference on Education held at Kenyatta University, Kenya.

Middleton H. (2008): Problem Solving in Technology Education as an Approach to Education for Sustainable Development. On Line Publication.

Moe (2013): ICT –Integration in Teaching and Learning: A Manual for Teachers and School Administrators. Ministry of Education, Jogoo House, Nairobi.

Nyaga J., Twoli N. & Maundu J. (2013). "Enhancement of Science Performance through Computer Assisted Instruction among selected Secondary School learners in Kenya." A paper presented at the 3rd International Conference on Education at Kenyatta University (10th to 12th July, 2013).

Reeves, J. (2006): Extrinsic Rewards and Inner Motivation. Research, Practice and Contemporary Issues: Pp 645-664).

Republic of Kenya (2009). Kenya Economic Stimulus Program. en.wikipedia.org

Republic of Kenya, Ministry of Education (2011). The National ICT Innovation and Integration Centre. www.ni3c.net

SEIR-TEC (2010): Southeast and Islands Regional Technology in Education Consortium Greensboro, WC

Technology Integration Strategies: Teaching today (2013). www.glencoe.com/sec/teaching

Uebbing, S.J. (1995): Planning for Technology. Executive Educator, 17, p21-23.

The training programme was made possible by the sponsorship of the Hp Computer Company.

INTEGRATING LEARNING TECHNOLOGY INTO THE CLASSROOM: THE IMPORTANCE OF PRE-SERVICE TEACHERS' AND LECTURERS' PERCEPTIONS

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Abstract

Teachers' perceptions and approaches, and consequently, the learning contexts they provide are known to influence students' perceptions. Successful integration of learning technologies leading to enhanced learning outcomes is unlikely unless teachers perceive and use technology as an integrated part of a student-centered approach to teaching. There was a concern in the Islamic University in Uganda Female Campus (IUIU-FC) that most lecturers do not know how to integrate learning technologies in their lectures. This implied that most students are likely to graduate as teachers without learning how to integrate technology into their teaching. Therefore, this study investigated the perception of Bachelor of Arts/Education students and their lecturers about learning technologies. A total of 56 students and 11 lecturers participated in the study. The instrument of data collection was a structured questionnaire. Data was analyzed using content analysis and descriptive statistics. The study found out that only 14 students (25%) and 6 lecturers (54%) had the right perception of the things that constitute learning technologies. The study concluded that both pre-service teachers and their lecturers generally lack the appropriate perceptions necessary for successful integration of learning technology into their teaching. Therefore, training in teaching and learning technologies for the lecturers and students is recommended.

Keywords: Learning technology; Innovation adoption; Teacher-training.

Introduction

The integration of learning technology into high school classroom is being promoted and supported worldwide. Underlying the promotion and support are claims that successful integration will lead to enhanced learning outcomes [1]. Teachers' perceptions and approaches, and consequently, the learning contexts they provide are known to influence students' perceptions. Successful integration of learning technologies leading to enhanced learning outcomes is unlikely unless teachers perceive and use technology as an integrated part of a student centered/conceptual change teaching approach. It is only through students' perceiving learning technologies as part of learning context that independent learning will be encouraged and deep, learning approaches enhanced.

There is substantial evidence that, in the right hands and if used appropriately for specific purposes in specific contexts, technology can be an effective tool in supporting learning and teaching. However, it is now firmly established that it is critical to understand the ways in which technology is conceptualized to be of use in addressing the challenges of the developing world and the policy environment necessary for this to happen.

There was a concern in Islamic University in Uganda, Female Campus, (IUIU-FC) that most lecturers do not know how to integrate learning technologies in their lectures/classroom. This implied that most students are likely to graduate as teachers without learning how to integrate technology into their classroom. The purpose of the study was therefore to investigate the perceptions of Bachelor of Arts/Education (BAE) students and their lecturers about learning technologies.

The study was guided by two research questions:

How do BAE (1st, 2nd and 3rd year) students and their lecturers perceive learning technologies?

Are the perceptions consistent with the integration of learning technologies into the classroom in a manner likely to encourage enhanced learning outcome?

Literature review

Research into the impact of learning technologies on the quality of students' learning outcomes is limited and outdated according to [2]. A limiting factor has been the difficulty of defining and measuring enhanced learning outcomes attributable specifically to the use of learning technologies [3]. Recent research has avoided this difficulty and focused on investigating the requirements for successful integration of learning technologies into the classroom. The research is beginning to show that success requires understanding the complex interaction in classrooms between teachers, students and technology [2]. This understanding is currently incomplete [4] studied students perceptions of learning context that incorporated learning technologies. Students' perceptions were found to influence the success of integration, specifically the amount of technology used, the ways in which the technology was used, and teachers' and students expectations about learning.

The research into teachers' and students' perceptions of teaching and learning context established a series of systematic associations linking teachers' perception and approaches with students' perceptions learning approaches and outcome [5, 6, 7], An explanation of these associations is important to understand the significance of investigating teachers' perceptions of learning technologies. The associations are summarized diagrammatically in Figure 1.

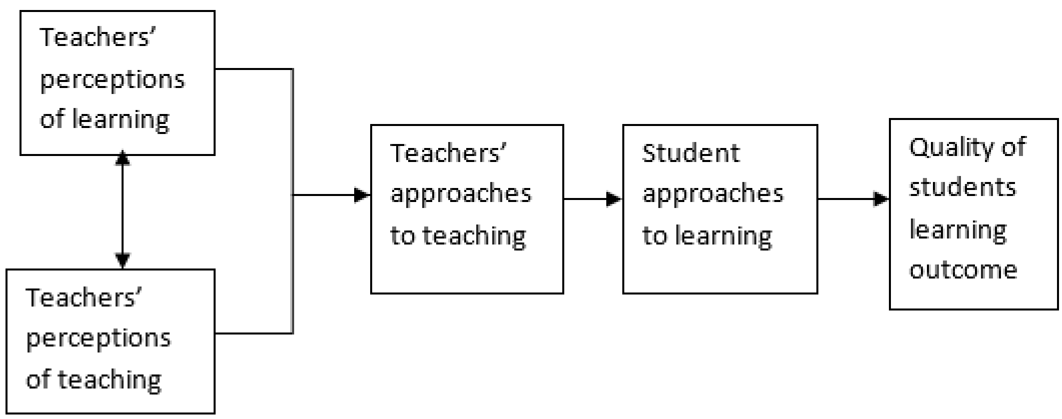

Figure 1. Teacher-student perceptions and the quality of the learning process

Teachers conceptualize and approach teaching in a limited number of differing qualitatively but related ways. Broadly, teachers who perceive learning as the accumulation of information are more likely to view teaching as the transfer of information. These kind of teachers are more likely to use a teacher centered approach where the teacher imparts information to students and uses assessment techniques which encourage and test rote learning. In contrast, teachers who view learning as conceptual changes are more likely to view teaching as facilitating conceptual change. These teachers are more likely to use a student centered teaching approach where independence in learning is encouraged through discussions, debate and questioning among students, and assessment which reveal conceptual change [9]. Students' approaches to learning are related to their approach to teaching [11]. Teachers who describe using a conceptual change/student focused teaching approach are more likely to be teaching students who report using deep approach to learning. Deep learning approaches have an intention to seek meaning in learning situations through linking aspects of the context. With deep learning approach, there is the possibility of the conceptual change and deeper understanding, which is assumed in this paper to constitute an enhanced learning outcome [8, 6 and 7]. In contrast, teachers who describe using an information transfer/teacher centered teaching approach are more likely to be teaching students who report using surface learning approaches. Surface learning approaches focus on memorizing aspects of the context in isolation with the intention of recalling the context in assessment situation. There is little intention to seek meaning in the context and little likelihood of significant conceptual change [10]. An explanation of the association between teacher and student approaches has been proposed and supported empirically by [9]. The learning context provided by a teacher is the practical implementation of the teacher's perception of learning and teaching, and approach of teaching. Students have been found to vary their learning approach in response to certain factors they perceive in the learning context. Students using deep learning approaches are more likely to value independence in learning approaches while students using surface learning approaches are more likely to have different values, and consequently different perceptions.

Methodology

The study used qualitative research strategy and case study design. Purposive sampling was used to select study participants. IUIU-FC is a less populated campus, where the students offering BAE were 56 in total. Hence all the students of BAE participated in the study. The lecturers who lecture pedagogy course to the BAE student were 11 in total and all of them participated in the study to obtain their perceptions about learning technologies. The instrument of data collection was a structured questionnaire which contained two sections A and B. Section A focused on "what constitutes a learning technology" and section B focused on "how the learning technologies enhance learning." The instrument was piloted among the few students in order to improve its reliability and validity. After improving its reliability and validity, the instrument was administered to the 56 students (1st, 2nd, and 3rd years) and the eleven lecturers who lecture pedagogy courses to the BAE students. The data collected was analyzed using content analysis to obtain the emerging themes, and descriptive statistics.

Results

Students' and Lecturers' Perception of Learning Technologies

Table 1: Showing the BAE student in IUIU–FC perceive learning technologies

	1st year	2nd year	3rd year
Anything which can be physically manipulated by the learner	04 (16.7%)	08 (44.4%)	02(14.3%)
Any mechanical or technical equipment	0 (0%)	01(5.7%)	06(42.8%)
Progressive pieces of mechanical or technical equipment	0 (0%)	05 (27.7%)	03(21.4%)
Computer related equipment i.e. something electronic	20 (83.3%)	04 (22.2%)	03(21.4%)
Total	24	18	14

From Table 1, it was observed that only 14 (25%) of BAE had the appropriate perception of what constitutes learning technologies that is, "anything which can be physically manipulated by the learner." Majority of students - 27 (51.8%) perceived learning technologies as a computer related equipment i.e. something electronic especially the first year students 20 (83.3%).

Table 2. Shows how the pedagogy course lecturers in IUIU – FC perceive learning technologies

	Number of lecturers	% of lecture
Anything which can be physically manipulated by the learner	06	54%
Any mechanical or technical equipment	02	18.2%
Progressive pieces of mechanical or technical equipment	01	9.1%
Computer related equipment i.e. something electronic	02	18.2
Total	11	100%

It was observed from the Table 2 above that 6 (54%) of the lecturers had the appropriate perception of what can constitute learning technology.

Examples of Learning Technologies

I. Anything which can be physically manipulated by the learner

a) Technical equipment

b) Computer

c) Mobile telephone

II. Any mechanical or technical equipment; no example was given by any student progressive process of mechanical or technical equipment

a) Computers

b) Radios

c) Projectors

d) Models

e) Electronic equipment

III. Computer related equipment i.e. something electronic

a) Projectors

b) Models

c) Mobile telephone

d) Lap tops

Generally the examples given by the students above indicated lack of appropriate knowledge of what constitutes learning technologies

This was because some students were unable to suggest any example of the choice they had selected.

The lecturers gave the following examples learning technologies

I. Anything which can be physically manipulated by the learner

a) Computer

b) Calculators

c) Maps

d) Real objects

e) Projectors

f) Radio cassette

g) Visual aids and

h) Mobile telephone

II. Any mechanical or technical equipment

a) Computer

b) Projectors

c) Cameras

III. Progressive pieces of mechanical equipment or technical equipment.

a) Computer and projector

IV. Computer related equipment i.e. something electronic

a) Computer

b) Radio

c) Mobile telephone

The students gave the following reasons why they thought the examples they gave were learning technologies.

a) They are among learning aids under communication technology

b) They can be physically manipulated

c) They are electronic

d) They help us in doing research (collection of data)

e) They are computer related

f) Computers are new scientific technology

g) Introduced to improve learning

h) They are used to send and receive exchange messages and information

i) We use electricity to operate them

j) They practically help the learner to acquire skills that help in the development of the society

k) They use electricity and they also need someone who has knowledge about them to operate them

l) They give information related to the teachers' ideas

m) They aid learning

n) They encourage one to do research and also learn things in the real world

o) They can be used physically to improve career standards of the learning and teaching process

p) They are electronic in nature

q) They can change the learner’s behavior.

r) They enable a learners to understand the content in the shortest time possible

s) They can be used by learners in their learning process

Lecturers gave the following reasons, why they thought the examples given were learning technologies

a) They help learning to take place in the simplest way possible

b) They help in providing better techniques of learning

c) Can help a learner to think and act

d) They motivate learners

e) They facilitate easy and faster learning

f) They are electronics

The students gave the following teaching aids that they would not call a learning technology; Chalk, Black-board, Text books, Chart, Realia, Radio, New paper, Lap top, Maps Graph

Impact of Learning Technologies on Learning

Table 3. Students’ perception on “How the learning technologies enhance learning “

Perception	1st year	2nd year	3rd year
Encouraging the seeking of meaning	0(0%)	0(0%)	0(0%)
Encouraging the development of better learning techniques and strategies	13 (54.17%)	08(44.4%)	01(7.1%)
Developing skills with and knowledge about the technologies	07 (29.17%)	07(38.17%)	05 (38.9%)
Assisting the learning process	01 (4.16%)	01(4.16%)	05 (35.7%)
Allow quicker, better presentation of more up-to-date expensive information	03 (12.5%)	02(11%)	03 (21.5%)
Total	24	18	14

Note: From table 3 above, none (00%) of the students perceived learning technology as "Encouraging seeking of meaning" which is the desired perception for successful integration of technology into the classroom. Majority of students, (22, 39.3%) perceived how learning technologies enhance learning as "encouraging the development of better learning techniques and strategies".

Table 4. Lecturers' perceptions on "How learning technology enhances learning"

Perception	n	%
Encouraging the seeking of meaning	00	00%
Encouraging the development of better learning techniques and strategies	03	27.3%
Developing skills with and knowledge about the technologies	03	27.3%
Assisting the learning process	03	27.3%
Allow quicker, better presentation of more up-to-date expansive information	02	18.18%
Total	11	100%

From Table 4 above, none of the lecturers had the appropriate perception of how the learning technology enhanced learning that is encouraging seeking of learning.

Discussion, Conclusion and Recommendations

The study revealed that few students (25%) and some lecturers (54%) had the appropriate perception of what constitutes learning technology, that is, “anything which can be physically manipulated by the learner.” This finding has an implication for the successful integration of learning technology into the classroom by the lecturers, and also on the pre-service teachers’ future integration of learning technology into their classrooms when they become regular teachers.

According to [11], students’ approaches to learning are related to their approaches to teaching. Teachers who describe using a conceptual change/student focused teaching approach are more likely to be teaching students who report using deep approach to learning. Hence considering the fact that 46% of lecturers had perceptions of learning technology which were not appropriate, it implied that they influenced the pre-service teachers they trained accordingly.

The study also revealed that none of the students and lecturers had the appropriate perception of how the learning technology enhances learning. This has a lot of implication to successful integration of learning technology into the classrooms/ lectures. Much as university management may purchase the necessary learning technologies for the university, most lecturers are unlikely to utilize them effectively. And also, the pre-service teachers are likely to graduate without the appropriate perception required for successful integration of learning technologies into their classrooms.

The study concluded that, the pre-service teacher (BAE students) and their lecturers generally lack the appropriate perceptions necessary for successful integration of learning technology into the classroom.

The study recommended that:

Lecturers in IUIU-FC for curriculum and instruction courses should be trained in learning technologies to improve their perception and practice. This will go a long way to improve the quality of teachers produced by IUIU – FC

Further research on the perception of in service teachers about learning technologies should be conducted, so that more knowledge on the best way to integrated learning technologies into the classroom by secondary School teachers is generated.

References

DOE (Department of Education) (1998). Learning technologies: Teacher capabilities guide. Melbourne, Australia: Community information service.

Honey, M., Culp, K. M., & Carrigg, F. (2000). Perspectives on technology and education research; Lessons from the past and present. Journal of Educational Computing Research,23(1),5-14

Mitchell, J., & Bluer, R. (1997). Aplanning model for innovation: New learning technologies. Report of the office of post compulsory education, training and employment, state training board, Victoria, Australia, http//www.otfe.vic.gov.au/planning/mode/.

Parr, J. M. (1999). Going to school the technological way: Co-constructed classrooms and student perceptions of learning with technology. Journal of educational computing research, 20(4), 365-377.

Biggs, J.B. (1999). Teaching for quality learning at university: What the student does. Buckingham, UK: Open University press.

Marton, F. & Saljo, R. (1976). On qualitative differences in learning. Outcome and process. British journal of educational psychology, 46, 4-11.

Prosser, M., & Millar, R. (1989). The how and what of learning physics. European journal of psychology in education, 4, 513-528.

Cope, C.J. (2000). Educationally critical aspects of the experience of learning about the concept of an information system. Unpublished dissertation, La Trobe univ, Australia, http://ironbark.bendigo.latrobe.edu.au/staff/cope/chris.cope.html.

Prosser, M., & Trigwell, K. (1999). Understanding learning and teaching: The experience in higher education. Philadelphia, PA. Society for research into higher education & Open University press.

Ramsden, P. (1988). Studying learning: Improving teaching in P. Ramsden (ed.), Improving learning. New perspectives (pp. 13-31). London: Kogan page.

Trigwell, K., Prosser, M., & Waterhouse, F. (1999). Relations between teachers' approaches to teaching and students' approaches to learning. Higher education, 37, 57-70.

COMPARING THE PERCEPTIONS OF TEACHERS IN HIGH AND LOW-SES CONTEXTS TOWARDS THE ROLE OF THE GRAPHING CALCULATOR IN MATHEMATICS INSTRUCTION

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This study investigates teachers' perceptions of the role of graphing calculators in the mathematics instruction of students from different SES schools. Findings showed that the nature of graphing calculator use was strongly influenced by the various contexts and that the low-SES school's respondents appeared not to involve their students in lessons that capitalized on the powerful characteristics of graphing calculators.

Introduction and Rationale

Race and socioeconomic status (SES) are equity factors, which have long been associated with the disparities and achievement gap, amongst students in mathematics. Although there has been a multiplicity of meanings of the term equity in relation to mathematics learning, the general consensus has been the acknowledgement of the existence of this achievement gap. Moreover, technology has been one of the tools recommended for achieving equity in the mathematics classroom. Compared to other forms of technology, however, the physical access to graphing calculators is high in general and issues pertaining to equity when using graphing calculators arise more from the experiential access; that is, the nature of graphing calculator use. This study investigates teachers' perceptions of the role of graphing calculators in mathematics instruction of students from different SES schools.

Perspectives and Frameworks

A sociocultural perspective enabled me to examine teachers' perceptions of graphing calculator use as a mediating tool to facilitate the mathematical learning of low-

SES and high-SES students situated within different sociocultural classroom and school contexts. According to sociocultural theory, learning is socially and culturally situated in contexts of everyday activities (Vygotsky, 1978; Wertsch, 1991) and is the result of a dynamic interaction between individuals, other people, and cultural artifacts or tools, all of which contribute to the social formation of the individual mind and lead to the realization of socially valued goals. These activities include the everyday cultural experiences that are subject to social conditions, such as SES.

The goal of this study was to learn about, and draw to the attention of mathematics educators, some of the potential red flags that stand in the pathway of ensuring not only the availability but also the appropriate use of graphing calculators that can in turn promote equitable mathematics education. The research questions that guided the study were:

1. What are the perceptions of teachers regarding the role of graphing calculators in the mathematics instruction of students with different SES? What are their perceptions of the local constraints pertaining to the use of graphing calculators?
2. What are the teachers' perceptions of the factors that influence their decisions regarding the use of graphing calculators in different SES contexts?

In addressing these questions, I compared the perception of the respondents, at both high- and low-SES schools, of the role or use of graphing calculators in mathematics instruction. In addition, I investigated how the situational context appeared to have enhanced or constrained the use of graphing calculators at both the high-SES and low-SES schools. Pertinent to this discussion and of prime importance is how the situational context appeared to have influenced the way the graphing calculator was used.

Data Collection

In this study, I used both quantitative and qualitative methodologies to investigate the research questions. The quantitative part comprised of a Likert scale survey instrument, while the qualitative component comprised of classroom observations and semi-structured interviews.

Results and Conclusion

The results of this study indicate that the participants' perception of the role of graphing calculators is dependent on the context within which it is used and that the low-SES school's respondents appeared not to involve their students in lessons that capitalized on the powerful characteristics of graphing calculators. In my analysis, I conceptualized a four-component framework, which helped to tease out the role of the situational context (see figure 1).

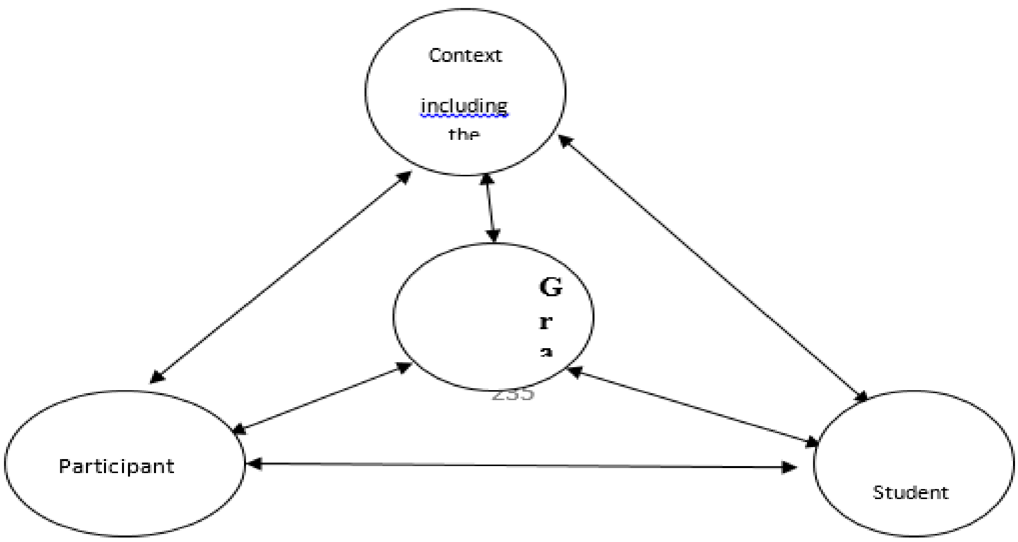

Figure 1. A Four-component Model of Mathematical Learning using a Graphing Calculator

Moreover, I assumed that the components of this framework are continuously in interaction with one another which implies that a change or perturbation in one of the components perturbates all the other components. The continuous interactions of the components of this framework suggest that equity issues in connection to the nature of graphing calculator should be an ongoing process that is continuously locating for strategies that will afford all students appropriate access and use of graphing calculators. This is important for the use of the graphing calculator, as a tool of educational reform, to achieve the NCTM's (2000) equity goal, rather than to end up exacerbating the already existing inequities between students of high-SES and low-SES schools.

References

National Council of Teachers of Mathematics (2000). Principles and standards for school mathematics. Reston, VA: Author.

Vygotsky, L. S. (1978). Mind in society: The development of higher psychological processes. Cambridge, MA: Harvard University Press.

Wertsch, J. (1991). Voices of the mind. Cambridge, England: Cambridge University Press.

WHY SO FEW WOMEN IN SCIENCE, TECHNOLOGY, ENGINEERING, AND MATHEMATICS (STEM)?

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Background of the Problem

There are several research studies conducted in the area of women's participation in Science, Technology, Engineering and Mathematics (STEM) fields. Since recent years, promoting women's participation in STEM has gained the attention of many countries, especially the most industrialized ones. One of the reasons is because STEM jobs are expected to drive global economy for the decades to come (Sonnert, Fox, & Adkins, 2007). This is because in an increasingly globalized world, scientific advancement and innovation are vitally important for maintaining national security, economic competitiveness, and quality of life for citizens (Ong, Wright, Espinosa, & Orfield, 2011). Therefore, scientific communities should benefit from greater diversity of participants irrespective of their gender or race/ethnicity (Rolin, 2008). However, most nations are facing a big challenge to improve recruitment and retention in STEM fields (Ong et.al. 2011). The United States consistently lags behind many developed countries in terms of quantity and quality of K–12 STEM education. Currently, only about 16 % of undergraduates in US institutions receive degrees in natural sciences and engineering, compared to 47% of undergraduates in China, 38% in South Korea, and 27% in France (Ong et.al. 2011).

For this and other reasons the area also attracts the attention of researchers. Leetaru (2010) stated that the National Engineering Education Delivery System, in collaboration with the Association for Computing Machinery's Committee on Women in Computing, has indexed nearly 900 articles since 1980 on the subject of women and computing. Feminists also showed much effort, which focused on getting more girls into science by providing them with early positive experiences and encouragement from teachers, counselors, and other adults (Brickhouse, 2001).

Historical Overview of Women's Representation in STEM

Most of the literature in the area of women in STEM shares the fact that the participation of women in the STEM has slowly increased in the past few decades. Yet, while the broader gender gap in college education has closed and women outnumber men in the ranks of the college-educated (Goldin et al, 2006, cited in Leetaru, 2010), women still lag significantly behind in STEM fields (Leetaru, 2010). When restricted to Engineering careers, women accounted for only 20% of all graduates in 2007. Gender disparities of more than 60% persist in undergraduate engineering enrollments and have recently worsened (Laefer, 2009).

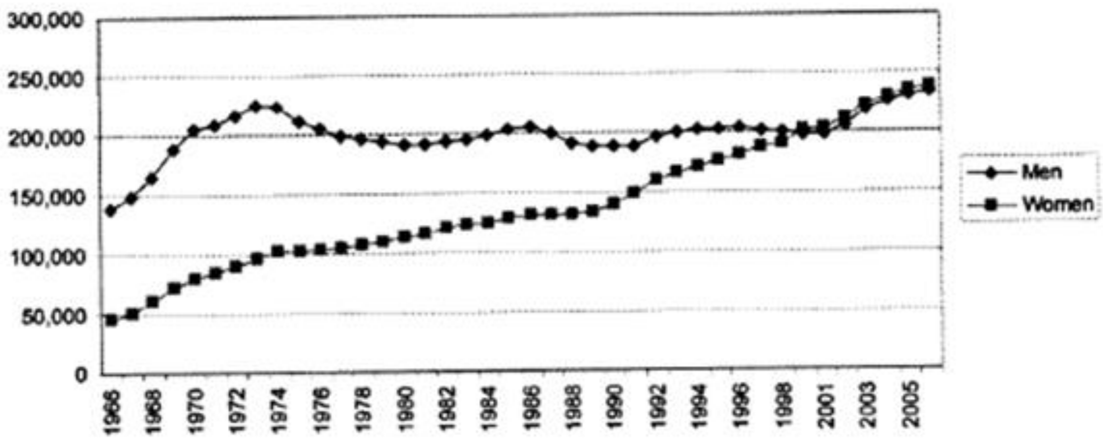

Fig. 1: Total number of baccalaureate degrees awarded annually in STEM fields 1966-2007 (NSF). Taken from Leetaru, 2010.

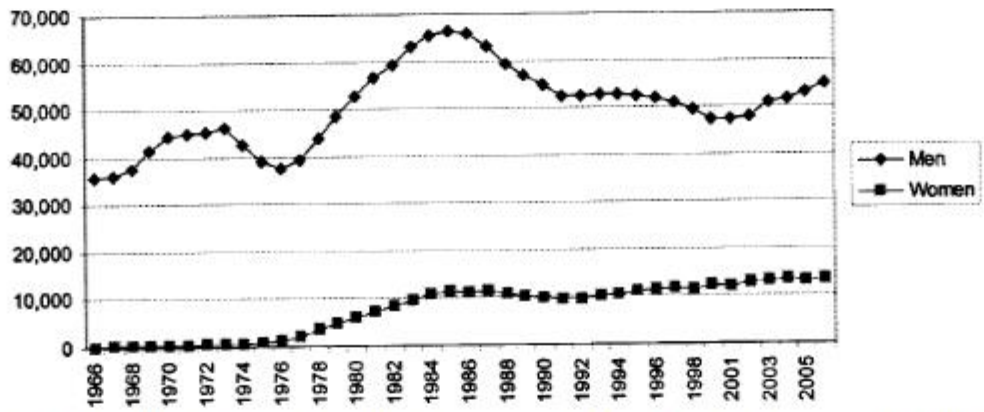

Fig. 2: Total number of baccalaureate degrees awarded annually in engineering fields 1966-2007 (NSF). Taken from Leetaru, 2010.

As can be seen in the figure, the persistent underrepresentation of women is not in all STEM fields. It rather is worse in some STEM fields like physical sciences and engineering. While women have exceeded men in college attendance and completion rates, women received only 19% of bachelor's degrees in engineering, 19% in computer science and 21 percent in physics in 2007 (NSB, 2010). In 2009, only about 12% of the math and engineering bachelor's degrees awarded nationwide went to women (Tsui, 2010).

In regard to high achievement of scientific innovation, there are only 11 women laureates in the fields of physics, chemistry, and physiology/medicine in more than a century, between 1901-2006 (Charyton, Elliott, Rahman, Woodard, & Dedios, 2011).

Currently it seems that much attention is given for STEM fields in most nations including the United States. President Obama's new STEM initiative, ''Educate to Innovate'' (The White House Office of the Press Secretary, 2009) which emphasizes the importance of STEM education and its improvement is one witness to this fact. Aligned with this new initiative, it has become even more important to determine the success of programs to improve student knowledge and participation in STEM (Tyler-Wood, Ellison, Lim, & Periathiruvadi, 2012). Teachers were rebuked to treat boys and girls the same, giving them equal opportunities to speak, to work with equipment, and to show what they know in response to difficult questions (Brickhouse, 2001).

Why so Few Women in STEM?

The question “why so few women in STEM?” has attracted significant volume of literature in the last few decades. Though some researchers share similar reasons for the underrepresentation of women in STEM, many factors have been identified as contributing to their persistent underrepresentation. Many believe that a greater number of female students would be attracted to join and be retained in STEM majors if those fields could more effectively tackle obstacles that hinder the progress of women (Tsui, 2010).

Questions have been raised for the underrepresentation of women in science related fields from different perspectives. Feminists have been particularly concerned with questions of authority in teaching, that is, how to deal with authority in teaching subject matter authored mostly by men (Brickhouse, 2001). Thus feminists have sought to develop pedagogies that change conventional hierarchies between teachers, students, and subject matter in such a way that teachers are only facilitators of learning. There is also considerable literature on science assessment and gender. Feminist researchers have studied how boys and girls respond to different forms of assessment and have described ways of making assessment fairer.

To better understand the barriers for women’s participation in STEM fields, I will categorize the challenges into two broader ways based on Xu’s (2008) classification as gender-based versus structural categories.

Gender-based Barriers

A persistent stereotype fueling the underrepresentation of women in STEM is the notion that women possess inferior math and science abilities although empirical evidence emerging in recent decades showed that men and women generally possess similar math and science abilities (Tsui, 2010). In addition, the historical male exclusivity of science and math related fields give women out sider values even if they become insiders in those institutions (Cantor, 2010). The other related problem is that being a numerical minority in work settings can activate gender stereotypes, which in turn pose a particular threat to the identity of women in STEM. When they try to grapple with the negative stereotype about their social identity, women experience a situational burden that interferes with their performance (Richman, vanDellen, & Wood, 2011). In relation to this, Tsui (2010) has identified, among other barriers, that individual acts of biased behavior, often committed unintentionally, may appear on their own as seemingly small and trivial, but collectively and over time will exert an effect of undermining females' self-confidence in their academic abilities, hindering learning, dampening academic and career aspirations and lowering general self-esteem. On the other hand, a study by Cereijo et al. (2002, cited in Tyler-wood et al. (2012) showed that such gender based discriminant factors for women have positive implications for men in such a way that boys display more positive attitudes towards science and math and this attitudes toward science and math is highly correlated to their science achievement which in turn leads them to better participate in STEM fields contributing for the widening of the STEM gender achievement gap.

These gender-based barriers are long rooted. There is also a big connection between students' gender biased precollege experiences and their future STEM degree attainment. Ma (2011) has shown that three precollege conditions - achievement, course taking, and attitudes/aspirations in high school can potentially influence women's intent to persist in college STEM majors and pursue STEM careers. Tyler-Wood (2012) said that though it is commonly believed that boys have higher academic achievement in STEM than girls, some literature suggests that the gender gap is less of an ability gap than a gap in perceptions of science careers, which in case of women is negatively impacted by different stereotypical discriminations.

Structural Barriers

In her discussion about the attrition and turnover of women faculty in STEM, Yonghong Jade Xu (2008) has said that a deficient work climate and negative individual experiences directly hinder the success of women faculty in STEM, and lead to their low job satisfaction and high attrition and/or turnover rate. She said that such barriers as discrimination at hire, ‘‘glass ceiling’’ in promotion, and inequity in salary and support can potentially affect women’s participation in STEM fields, especially in the academia (p. 608). Supporting this idea, while discussing about the underrepresentation of women in tenure track faculty positions, Nancy Cantor (2010) said that some of the reasons for the problem include lack of hospitable climate, lack of collaboration and social support, and presence of rigidity in such institutions. The study of Tsui (2010) has described such factors as “chilly climate” (p.142) in which women are treated differently by male and female faculty as well as by fellow students.

The other structural barriers contributing to women’s underrepresentation in STEM, according to Seymour (1995, cited in Leetaru, 2010), include such factors as competitiveness of classroom culture, gender role expectations, different learning styles, and K-12 experiences rejecting women’s interest in STEM fields. This rejection of women in K-12 STEM subjects in turn increases the gender achievement gaps in secondary education in favor of the men and this in turn impacts women’s later participation in STEM (Van Langen et al. 2006 cited in Tyler-Wood et.al. 2012). Supporting this, even though there are considerable differences among countries, the result of a study indicated that the smaller the gender achievement gap for mathematics and science literacy between males and females in secondary education, the greater the STEM participation of females in higher education (Cereijo et al. 2002, cited in Tyler-wood et al. 2012).

The masculinity of the engineering culture, according to Seymour (1995, cited in Assimaki, Koustourakis, & Papaspyropoulou, 2012), is another structural barrier, which seems to have a negative effect on women's choices and distances them from the fields of the sciences and the new technologies. Some argue that science is suffering from the predominance of certain styles of doing science. If every individual is equally represented, irrespective of gender and race/ethnicity, scientific communities would benefit from greater diversity in styles of doing science (Rolin, 2008).

Saying this about the barriers for women's underrepresentation in STEM fields, I will discuss about the other face of the problem. Though research studies are showing that the number of women participating in STEM fields is considerably increasing, women are still marginally represented in the academic careers and in the top industrial and managerial positions. Researchers have given two major reasons for this problem; one is that there are fewer women entering STEM fields, and the other is that women are more likely to leave STEM somewhere in their career path (Ma, 2011). My discussion of this points will be based on Xu's (2008) framing of the case as "deficit model" (p. 609), and "pipeline model" (p. 608).

Deficit Model

This model deals with the inadequacy of the supply of women in the STEM fields. Xu (2008) said that the ''limited opportunities faced by women scientists in a gender-biased academic environment is the focal point of this model" (p. 609). It is often so difficult for women to enter traditionally male dominated and demanding areas of work, and even if few do manage to enter, they appear to experience unequal treatment, both directly and indirectly, when compared with their male colleagues (Cantor, 2010; Assimaki et al. 2012).

In general, the structural barriers discussed above are the most contributing factors for women not to join the academia in the first place, because the institutional culture of academic institutions is favoring for men (Cantor, 2010).

Xu's (2008) study has shown that women faculty's attrition from academic STEM disciplines may not be a credible explanation for their underrepresentation in the top positions. Subsequently, it suggests that the major leakage in the supply pipeline is more likely to be the disproportionately small number of women hired into faculty positions (Xu, 2008). In her study about the gender differences in the paths leading to STEM baccalaureate, Ma (2011) used data of postsecondary students at three locations, high school, early college study, and late college study. And in her finding, almost 30 percent of male students intended to major in STEM fields during high school but only 10 percent of female students had similar plans. However, males experienced a significant loss at the second location of the pipeline (early college studies) when they claimed their initial college majors, and this loss continued toward degree attainment. Females, on the other hand, did not experience any loss from the first location to the second location (high school to early college); instead, a slightly higher proportion of females claimed their initial majors in STEM than they did in high school. Though females experienced some loss from the second location to the third, their loss was much less salient than that of males. This shows that the problem of women's underrepresentation in STEM fields is more of their less recruitment in those fields than it is a pipeline problem.

Pipeline Model

This model is about the sustainment of women in STEM fields once they choose to follow the STEM pathways. Xu (2008) explained the pipeline model as the volume of flow of women in STEM. The problem is that, all who start in STEM do not flow all the way up the ladder. Laefer (2009) has studied the gender disparity in engineering as a function of physics enrollment and its implication for civil engineering. She emphasized on American students in engineering majors and has found that the higher the degree level, the greater the disparity grows especially for American citizens and permanent residents, with most of the gain in female graduate enrollment in engineering comprised of foreign nationals (Laefer, 2009). The result of her study showed that there are fewer women in graduate engineering studies than in undergraduate studies. A study by Berryman (1983, cited in Ma, 2011) showed that there is a leaking pipeline where women leave the STEM fields in almost all stages of the career path.

As we go up on the ladder of professoriate, female faculty members in male-dominated STEM fields face challenges. The major problem related to this is once women get out of the STEM pipeline for different reasons, even if they wish to get back to the workforce, they face a particular set of problems and difficulties and these problems are more pronounced for those trying to get back into the STEM sectors (Herman & Kirkup, 2008). The question that needs to be asked here is, what is the reason behind the leaking pipeline? I will categorize the major reasons in to three as: lack of female role models and mentors, family responsibilities, and gender socialization.

Lack of Role Models and Mentors

Finding female mentors and role models in heavily male-dominated fields poses a serious challenge (Tsui, 2010). Female role models who demonstrate that women can be successful and who support other women's success potentially contribute to women's feelings of belongingness in traditionally men-dominated fields (Richman et al. 2011). Although it is believed that exposure to role models in STEM fields can lead toward enhanced self confidence in scientific ability and greater interest in STEM subjects and STEM careers (Weston, et al. 2008, cited in Charyton et al. 2011), male and female college students can't list any women scientists or women Nobel laureates in a self-generated list of creative persons. Women were most listed as entertainment celebrities or artists. On the other hand these same students were able to list men scientists and Nobel laureates (Charyton et al. 2011).

The role models could either be both parents or a father or a mother. Research has shown that 52% of Nobel Prize winners had one or both parents in similar careers, or an interest in the same field of science, as the Nobel laureate. In contrast, only 17% of the individuals in other professions had parents in similar occupations. Gender of the parent impacted the Nobel laureate’s career choice 83% of the time such that women are more likely to follow the footsteps of their mothers and men that of their fathers (Charyton et al. 2011). Therefore, the worse underrepresentation of women in the previous decades influenced likelihood of women of the next generation to pursue STEM fields. The need for female role models is very vital since women form their self-efficacy perceptions primarily from their secondhand experiences and the social and verbal persuasions they receive from others. “Seeing people similar to oneself perform successfully typically raises self-efficacy beliefs in observers, because they come to believe that they themselves also possess the capabilities to successfully perform comparable activities. Women were persuaded that, if others could do it, so could they” (Zeldin, Britner, & Pajares, 2008, p.18).

Furthermore, there is a research finding that in fields with few other women students and few women faculty members, women, on average, may be more likely than men to switch out of those majors once they encounter difficulties, and the GPA of undergraduate women in STEM is higher when there are more female faculty in the fields (Sonnert & Fox, 2012). This shows how affective role models are for the success and persistence of women in STEM.

Family Responsibility

In most nations, especially the developing ones, women are more likely to perform household labor and childcare. One of the problems in hiring female faculty in STEM fields is the limited faculty housing and childcare facilities (Tsui, 2010). When it comes to its impact on their career outcomes, married women are less likely than single women to be tenured, which is the reverse for married men (Charyton et al. 2011). Women who switched form STEM careers said that they were happy with their decision to be in another career that they found the work to be much more fulfilling than their previous careers and that their new work was a better balance with their family priorities (Snyder, 2012). In other words STEM careers are not friendly with women's family responsibilities, because work and family are both highly demanding institutions. There is a notable report of work-family interference, which goes in both directions - work interferes with family/household, and family/household interferes with work (Fox, 2010). Assimaki et al. (2012) also noted that one of the challenges that women faculty in STEM face is the demands of an academic career due to the parallel demands of the role of the woman as wife and mother.

Early Gender Socialization

The "cumulative disadvantage theory," which deals with the collective effect of barriers women face starting from their early ages, discussed in Ma (2011, p.1171) showed that early gender socialization leads women to be hesitant toward math and science, which in turn leads to their low expectation for STEM careers, which makes them further disadvantaged in choosing a college major in STEM and even less likely to obtain related degrees. This theory emphasizes that women suffer from higher attrition in STEM fields than men because of the aggregated challenges they face in their life experience (Ma, 2011).

Xu's (2008) study also showed that the underrepresentation of women in STEM is mainly caused by innate differences or gender-oriented socialization. In her study about the turnover and retention intention of women faculty in STEM, she said that even though women faculty are not satisfied with their salary, they suffer more from lower visibility, lower power, and lower support from the leadership, which is directly or indirectly related to gender socialization. More specifically, in engineering and technology, the views and positions of the two sexes differ, due to biases about their differing roles, making women's representation in the academia of that field more difficult (Assimaki et al. 2012). They emphasized that the existence of prejudices regarding the female gender, which result in the unequal treatment of women in STEM academic fields can potentially distance them from these fields.

The Double Binding

When it comes to being a woman of color, there comes to be two binding issues. One is being female, and the other being of color. That is why the problem of underrepresentation of Women in STEM is worse for women of color. A study by Espinosa (2011) has found that women of color in STEM often find themselves challenged to form meaningful social and academic relationships in courses where the majority of students are White and/or male, which is typical of STEM fields. They rather benefit more from participating in academic organizations in science and engineering that place emphasis on racial/ethnic diversity. Though there are a few of such organizations, they are not growing in their popularity and didn't have a strong national presence until recent times (Espinosa, 2011).

Unlike the common assumption that Asian men and women are doing fine in STEM fields, the double bind also exists for Asian women (Wu & Jing, 2011). The experience of women of color in early science related subjects and late STEM fields and careers, is different from that of their white and male counterparts. Persistence in STEM majors is much lower for women and minorities, and the effect will be worse for minority women

(Griffith, 2010). Most research studies in the area do not fully capture the experience of women of color in STEM. By looking at women and ethnic minorities separately, they neglect the intersection of race and gender. As a result when using research results to create STEM initiatives and programs, this underrepresentation leads to the invisibility of women of color (Tate & Linn, 2005).

Ong et al. (2011) has shown the challenges women of color face both in undergraduate and graduate levels. These include: “difficulties of transitions between academic stages (i.e. high school to college, community college to four-year institution/college to graduate school) and transitions from MSIs to PWIs; the critical role that climate plays in women’s satisfaction and retention in STEM, including issues of isolation, identity, invisibility, negotiating/navigating, micro aggressions, sense of belonging, and tokenism; and the positive and negative effects of words and actions by faculty, peers, and family members” (p. 196).

A study by Tate and Linn (2005), which described the experience of some women of color in engineering majors through “a lens of multiple identities” (p. 486), has found three emergent identities that these women have in their majors; academic, social, and intellectual identities. This idea of multiple identities is supported by discussions with students about their peer groups, their perception of engineering, their academic and social activities, and their self-reported identity. This study showed how interactions between these multiple identities; academic, intellectual, and social identities jointly influence perceptions of educational experiences and career aspirations. These identities provide insight into the complexities of their lives.

Narrowing the Gender Gap

Much is said about strategies of how to narrow the gender achievement gap in STEM fields. Improving the elementary female’s perception of science would seem to be an essential goal if one is to increase science achievement in female students and subsequently increase the number of females participating in science careers (Tyler-wood, 2012).

The need for different programs, which promote women's participation is unquestionable. Structurally based programs focusing on the awareness of and attention to institutional climates, links between the program and other units within the institution, and the educational experiences relevant to students in sciences and engineering could have a big positive impact in increasing women's participation in STEM fields (Fox, Sonnert, & Nikiforova, 2009). Szele´nyi and Inkelas (2011) studied the role of Leaving Learning programs in women's plans to attend graduate school in STEM fields. They defined such programs as "communities that involve undergraduate students who live together in a discrete portion of a residence hall (or the entire hall) and participate in academic and/or extra-curricular programming designed especially for them" (p. 351). Their study focused on Leaving Learning Programs tailored specifically to students interested in STEM fields." Their finding has shown that one year of involvement in these programs at the beginning of women's college education has a positive relationship with STEM graduate school plans in the fourth year of college.

A project studied by Tyler-Wood (2012) has showed that girls with improved achievement and attitudes towards science are actually more likely to have positive perceptions of science at the college level. Changing the characteristics of effective classroom curriculum, focusing on early interventions, targeting girls' perceptions of science careers, and long term mentoring are some of the strategies to narrow the gender achievement gap in STEM fields (Tyler-Woods, 2012). Another solution which is found to be successful is students' engagement in their academic environment via help seeking practices such as study groups, tutoring, and mentoring, which are important in the development of their academic identities (Tate & Linn, 2005). Such programs have long-term contributions on the participation of women as an under-represented group in higher education STEM fields (Tyler-Wood, 2012; Szele´nyi & Intelas, 2011).

When we talk about women in STEM, their participation in the various fields of science and engineering is usually uneven, where some fields contain relatively higher percentages of women and others relatively lower percentages. Some science related fields like the physical science and engineering suffer most from lower numbers of women. That is why it is recommended for policies or programs supporting female undergraduates in these fields "to take field differences into account and to figure efforts and initiatives to the situation in specific fields rather than simply targeting 'women in science' or 'women in science and engineering'" (Sonner, Fox, & Adkins, 2007, p. 1352)

In relation to this, a study by Debra Laefer (2009) has shown the effect of poor participation of high school girls in advanced math and physics courses on their intention to join college engineering majors. As an initial set of steps to creating a gender-neutral environment for females in physics and calculus in American educational institutions, she proposed six action items. These are; connecting the early math and science experiences to advanced high school curriculum, using methods such as sponsoring summer programs and establishing academic clubs to increase physics enrollment, training high school science and math teachers about gender equity, promoting enquiry learning, creating mentorship, and segregating university level physics and math enrollment based on students' previous achievement in those subjects.

One of the places where women are highly underrepresented in STEM fields is in faculty positions. The number of women applying for tenure-track positions is much lower than those who finished their PhDs, which is described as "pattern of erosion of critical mass" (Cantor, 2010 p.2). This problem needs the attention of different stakeholders in the area. Mainly, administrators should take a closer look at their hiring practices and make sure fresh women doctorates are given ample opportunities and resources to start and develop an academic career (Xu, 2008). The struggle needs both institutional and individual efforts. The solution should start from the women themselves. If women can manage to survive and succeed as insiders in men-dominated fields, and also keep pushing the perspectives of outsider, they can make the institution better for all concerned (Cantor, 2010). Women faculty may need to actively construct their own support networks as a numeric minority in men-dominated areas, it is equally important for them to seek opportunities in leadership and make their voices heard at the management level (Xu, 2008).

At institutional level, leaders at different levels should organize workshops and seminars to educate the community about the importance of gender equity and women's participation in STEM careers. Mentoring and professional and social networking are also among the successful strategies to narrow the gender gap in STEM faculty (Xu, 2008). It is important to increase the presence of female faculty to attract more female students in STEM fields (Tsui, 2010). To narrow the STEM participation and achievement gap between women of color and their white counterparts, institutions should also strive to create more women of color STEM PhDs and getting them into faculty positions to help foster cultural changes that would improve overall faculty support for and increase the enrollment and retention of minority women (Ong et.al. 2011). In a wider lens, educators and educational administrators at different level, from the white house to the school level, must demand commitment to diversity in full by keeping underrepresented populations at the center of related discussions (Espinosa, 2011).

In addition to continued support of programs that help universities address the need for transformative structural change, there is a need for institutional-level policy that supports pipeline programs that begin in high school and extend through the early-and midcareer stages (Ong et.al. 2011). These authors also emphasized that once enrolled in STEM programs at either the undergraduate or graduate level, women of color should be provided with the support to engage in rigorous research, benefit from student-faculty mentoring relationships, and access professional development and publishing opportunities- all of which only come from intentional institutional policy and practice designed to support the advancement of underserved populations in science and engineering.

Other strategies found to be effective include strengthening academic societies such as Society of Women Engineers (SWE), Women in Science and Engineering (WISE), or any other diversity oriented student organizations which help students to build a sense of belonging and extra support (Tsui, 2010). It is researched that academic peer relationships - as opposed to strictly social ones, may be especially important (Espinosa, 2011). Tsui (2010) emphasized that participation in co-curricular activities can lead to greater student engagement and thus commitment to the major. Espinosa (2011) also supports the importance of engagement in co-curricular experiences and the integrative influence of scientific performance - both of which may help women of color see beyond a STEM culture that is uptight with barriers.

Implications for Ethiopia

I was born, raised, and schooled in one of the developing nations in the world; Ethiopia, where there are more important and urgent issues than the twenty-first-century economic competition. I was a Chemistry Education major and a Math Education minor in my undergraduate study, with a few female friends. We were not among the best achievers in the class because of different reasons that I will discuss in later sections. Most of us switched from our science career and are currently pursuing different career paths. It is now seven years since I graduated with my first degree, and though things are slightly changed, the problem of women's underrepresentation and higher attrition in STEM fields still exists in Ethiopia.

Like many other countries, the government of Ethiopia believes that achievement of the long-term vision of transforming the nation into a middle-income country demands a transformation of the economy through, among other things, conscious application of science, technology and innovation as the major instruments to create wealth. This, in turn, requires unfolding commitment to increasing the overall level of education of the population and a focus on science and technology education in particular. The vision calls on the one hand for a further expansion of access to high-quality basic education and special efforts to improve the overall literacy level of the population. It demands on the other hand that human resources development be strengthened by training competent and innovative people with special attention to engineering, technology and natural sciences, through introducing high quality science and mathematics curricula at primary and secondary schools and the recently adopted policy of the 70:30 university intake ratio in favor of science & technology, 40 % of which in Engineering (MoE, 2010). However, although the policy emphasizes on increasing the participation of women in these privileged fields, women are still underrepresented in those fields, especially in engineering. They still represent only 19.2% of regular undergraduate engineering majors in Ethiopian public universities (MoE, 2011).

Despite the presence of different national policies, including the constitution, promoting equal opportunity for women in all spheres of life, there are many challenges that women in the nation are living with. Regarding the challenges of Ethiopian women pursuing STEM fields, they share all the barriers discussed earlier in this paper: even in a worse condition than what is said. The gender based stereotypical biases and the lack of role model and mentor are especially worse for Ethiopian women than the case of the developed countries, which most literature in the area discuss about.

Based on my own experience in science and my observation and reading about the current situation in my country, there is a lot out there to be researched. Unfortunately, almost all of the literature found in the area is about the problem in the most developed countries; with most in USA, and some in Europe. The dearth of available literature on this same problem in African Nations is a sign and invitation for researchers to give it an eye. This paper is only the beginning of my effort to take part in identifying solutions to create a women friendly climate in STEM fields in my country.

References

Assimaki, A., Koustourakis, G. & Papaspyropoulou, K. (2012). Female faculty members in the field of electrical and computer engineering: The case of Greek universities. Problems of education in the 21st century, 39, 15-28.

Brickhouse, N. (2001). Embodying science: A feminist perspective on learning. Journal of Research in Science Teaching, 38(3), 282-295.

Cantor, N. (2010, February). Women in the academy: Reflections on best practices for survival and success. Address at Washington University, St. Louis, MO.

Charyton, C., Elliott, J., Rahman, M., Woodard, J. & Dedios, S. (2011). Gender and science: Women Nobel Laureates in Science, 45(3), 203-214.

Espinosa, L. (2011). Pipelines and pathways: Women of color in undergraduate STEM majors and the college experiences that contribute to persistence. Harvard Educational Review, 81(2), 209-240.

Federal Ministry of Education (MoE). (2011). Education Statistics Annual Abstract 2003E.C./2010-11 G.C.

Federal Ministry of Education (MoE). (2010). Education Sector Development

Program IV (ESDP IV) 2010/2011-2014/2015.

Fox, M. (2010). Women and men faculty in academic science and engineering: Social- organizational indicators and implications. American Behavioral Scientist, 53(7), 997-1012. Doi: 10. 1177/0002764209356234.

Fox, M., Sonnert, G. & Nikiforova, I. (2009). Successful programs for undergraduate women in science and engineering: Adapting versus adopting the institutional environment. Journal of Research in Higher Education, 50, 333-353. Doi: 10.1007/s11162-009-9120-4.

Griffith, A. (2010). Persistence of women and minorities in STEM field majors: Is it the school that matters. Economics of Education Review, 29, 911-922.

Hagedorn, L., S. & DuBray, D. (2010). Math and science success and nonsuccess: Journeys within the community college. Journal of Women and Minorities in Science and Engineering, 16(1), 31-50. doi: 10.1615/JWomenMinorScienEng.v16.i1.30

Herman C. & Kirkup, G. (2008). Learners in transition: the use of ePortfolios for Women returners to science, engineering and technology. Innovations in Education and Teaching International, 45(1), 67-76.

Laefer, D. (2009). Gender disparity in engineering as a function of physics enrollment and its implications for civil engineering. Journal of Professional Issues in Engineering Education and Practice, 135(3), 95-101. doi: 10.1061/_ASCE_1052-3928

Leetaru, K. (2010). A new look at the institutional impact on women in postsecondary engineering education 1966-2007. Journal of Women and Minorities in Science and Engineering, 16(1), 177-197. doi: 10.1615/JWomenMinorScienEng.v16.i2.60

Ma, Y. (2011). Gender differences in the paths leading to a STEM baccalaureate. Social Science Quarterly, 92(5), 1169-1190. Doi:10.1111/j.1540-6237.2011.00813.x

National Science Board (NSB). 2010. Science and Engineering Indicators 2010. Arlington, VA: National Science Board.

Ong, M., Wright, C., Espinosa, & L. Orfield, G. (2011). Inside the double bind: A synthesis of empirical research on undergraduate and graduate women of color in science, technology, engineering, and mathematics. Harvard Educational Review, 81(2), 172-208.

Pinnick, C. (2008). Science education for women: Situated cognition, feminist Standpoint theory, and the status of women in science. Journal of Science and Education, 17, 1055-1063. doi: 10.1007/s11191-008-9153-7

Richman, L., vanDellen, M. & Wood, W. (2011). How women cope: Being a numerical minority in a male-dominated profession. Journal of Social Issues, 67(3), 492-509.

Rolin, K. (2008). Gender and physics: feminist philosophy and science education. Journal of Science and Education, 17, 1111-11125. Doi: 10.1007/s11191-006-9065-3

Snyder, C. (2011). Pride badly shattered: The transformational journey of career-changing women in secondary education. Journal of Transformative Education, 9, 242-260. doi: 10.1177/1541344612445927

Sonnert, G. & Fox, M. (2012). Women, men, and academic performance in science and engineering: The gender difference in undergraduate grade point averages. Journal of Higher Education, 83(1), 73-101.

Sonnert, G., Fox, M. & Adkins, K. (2007). Undergraduate women in science and engineering: Effects of faculty, fields, and institutions over time. Social Science Quarterly, 88(5), 1333-1356.

Szelenyi, K. & Inkelas, K. (2011). The role of living–learning programs in women's plans to attend graduate school in STEM fields. Journal of Research in Higher Education, 52, 349-369. Doi:10.1007/s11162-010-9197-9

Tate, E. & Linn, M. (2005). How identity shapes the experience of women of color engineering students. Journal of Science Education and Technology. 14(5/6), 483-493. doi: 10.1007/s10956-005-0223-1

Tsui, L. (2010). Overcoming barriers: Engineering program environment that support women. Journal of Women and Minorities in Science and Engineering, 137-160. doi: 10.1615/JWomenMinorScienEng.v16.i2.40

Tyler-Wood, T., Ellison, A., Lim, O. & Periathiruvadi, S. (2012). Bringing up girls in science (BUGS): The effectiveness of an afterschool environmental science program for increasing female students' interest in science careers. Journal of Science Education and Technology, 21, 46-55. doi: 10.1007/s10956-011-9279-2

Wu, L. & Jing, W. (2011). Real numbers: Asian women in STEM careers: An invisible minority in a double bind. Issues in Science and Technology.

Xu, Y. (2008). Gender disparity in STEM disciplines: A study of faculty attrition and turnover intentions. Journal of Research on Higher Education, 49, 607-624. doi:10.1007/s11162-008-9097-4

Zeldin, A., Britner, S. & Pajares, F. (2008). Comparative study of the self-efficacy beliefs of successful men and women in mathematics, science, and technology careers. Journal of Research in Science Teaching, 45(9), 1036-1058.

THE LEVEL OF SCIENTIFIC ATTITUDE/SUPERSTITION AMONG BACHELOR OF SCIENCE EDUCATION STUDENTS: IMPLICATIONS FOR SCIENCE EDUCATION IN UGANDA

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Abstract

The main purpose of this study was to investigate the incidence of superstition among Bachelor of Science Education students in Busitema University. The objectives of the study were to: determine the level of superstition among the BSc (Education) students in Busitema University; determine the level of scientific attitudes among the BSc (Education) students by using their level of superstition; compare the level of scientific attitude between finalists and fresh students (before their lectures in university); and examine the relationship between gender, religious affiliation, tribe and the level of superstition/scientific attitudes. Data were collected using a questionnaire, which was administered to 186 students. The data was analyzed using frequency counts and percentages. The findings were that the level of scientific attitude among students was too low. There was a slight difference between final year BSc (Education) students (after final exams) and fresher students (before lectures in university). No relationship was observed between gender, religion, tribe and the level of scientific attitude. The conclusion was that most pre-service science teachers believe in superstition. It is recommended that there is need to reform the science curriculum to address the methods and attitude of science during the science lesson, other than emphasizing scientific facts which students easily forget after their exams.

Keywords: Scientific attitude, Superstition, Science Education, Pre-service science teachers

1. Introduction

Background

It is well known that, the main difference between the first world countries and third world countries lies in their level of science and technology development. Scientific and technological capacity embodied in knowledge and well trained human resources can help transform economies, it can enhance productivity and make the social sector more effective. Science and technology capacity is formed mostly in the education system.

The Uganda government today emphasizes science and technology studies at all levels. All secondary school students in ordinary level study sciences and advanced level students have either to do computer studies or mathematics if, they do not offer a science combination, hence it is expected that the learners who go through the education system in Uganda have acquired sufficient levels of scientific attitudes/scientific literacy. Despite this science education policy, our society still holds many superstitions/beliefs like sacrificing children to acquire wealth and people claiming to make/stop rain. Since no country can be better than its education system, and no education system is better than its teachers, it was paramount to investigate whether the pre-service science teachers are scientifically literate since they are the backbone of the country's science education.

The main purpose of the study was to investigate the level of scientific attitude /superstition among Bachelor of Science education students in Busitema University. Busitema University was selected mainly because it trains only science teachers who pursue chemistry, biology, physics, and mathematics and computer studies.

The objectives of the study were:

- To determine the level of superstition among BSc-Education students in Busitema University.

- Determine the level of scientific attitudes among the BSE/Education students by using their level of superstition.
- Compare the level of scientific attitude between a finalist (3rd year) and a "fresher" (first year students, before their lecturer in University).
- Examine the relationship between gender, religion, tribe and the level of superstition/scientific attitudes.

Nature and Scope of Science Education

The amount of scientific knowledge accumulated over the last couple of decades bears witness to knowledge explosion and can be no longer ignored. The newspapers and other media give due coverage to new application of science. The teaching of science in the schools is of greater interest today than in the past especially at secondary level. However, despite the tremendous progress in science and technology and increasing interest in science, schools in Uganda have not succeeded in producing scientific awareness among individuals. Perhaps the fault lies squarely with science teachers. In order to impart and develop thorough interests among the students, a science teacher should not only have adequate understanding of science, but also be familiar with processes of science.

The importance of having on accurate understanding of both the nature and the relationship of science, technology and society cannot be undermined.

What is Scientific Literacy?

Scientific literacy means a firm understanding of the nature of science and inter-relationship between science, technology and society. Hence scientific literacy implies

- A good science background knowledge of facts, concepts and theories with the ability to apply them.
- A clear understanding of the nature of science
- A positive attitude to science and technology
- An appreciation of the value of science and technology and their effect on society
- The ability to make value judgment and decision in science based societal issues
- The ability to use scientific method to solve problems and to make decision in our day-to-to-day life.
- Sufficient process skills in sciences, which allow a person to function in a better manner as a citizen.
- A better understanding of the world around him/her as a result of science instruction.

A person possessing the above traits could be considered to be scientifically literate. Unfortunately, in our schools science teachers themselves lack several of the above attributes. They may possess the basic science background with knowledge of facts, concepts, but fail to impart the other aspects of scientific literacy to their students.

Role of the Science Teacher in Promoting Scientific Literacy

A science teacher is the single most important means of promoting scientific literacy. An effective teacher should possess the following characteristics

- Have mastery over her/his subjects
- Be up-to-date with the latest technological advances

- Have a good understanding of the nature of science
- Be willing to provide suitable situations encouraging students to develop scientific inquiry skills
- Provide them with learning experiences which help them develop a positive attitude toward science
- Help develop value judgments regarding science-based issues in our lives
- Develop in her/his students the ability to study the interaction of science, technology and society.

What is Science?

Science is viewed by a layman as a body of scientific information. To the scientist, however, it is a method by which the hypotheses are tested. On the other hand, a philosopher would view science as a way of questioning the truthfulness of knowledge. A comprehensive definition of science views science as a body of knowledge, a way of investigation (or a method), and a way of thinking in the pursuit of understanding nature (an attitude towards life).

Science as a Body of Knowledge

Science has been characterized as a body of knowledge obtained by scientists. This includes facts, concepts and theories that are subject to error and change. Various types of scientific knowledge exist in the form of (a) facts, (b) concepts, principles, laws, hypotheses and theories."

A scientifically literate person should be able to discern between that which is supported by evidence and that which is merely speculative; the person should also be conscious of the ever-changing nature of science.

Science as a Method of Inquiry

An effort to define scientific method was a major pre-occupation of philosophers in the early nineteenth century. According to Karl Pearson, the scientific method involves the following six steps

- Identification of the problem
- Gathering observation relevant to the problem at hand
- Statement of a hypothesis based on observations gathered
- Testable predictions of other related observable phenomena are developed from the hypothesis
- The hypothesis is tested through experimentation and observation
- As a result of empirical observation, the hypothesis is supported, rejected or modified

The science teacher should emphasize to their students that scientists do approach the solution of any specific problem in an organized manner. While the steps defined by Pearson are helpful guidelines in solving a problem, true scientists solve problems with inspiration, imagination and insight.

Science as an Attitude towards Life

Science can also be regarded as an attitude to life. The acquisition of a scientific attitude is one of the most important outcomes of science.

A person with a scientific attitude will have the following characteristics

- Open mindedness
- Objectivity
- Freedom from belief in superstations
- Belief in cause-effect relationship
- Accuracy and truthfulness in reporting observation
- Methodical way of solving problem on hand
- Up-to-datedness
- Respect for other peoples opinion though he/she may not agree with them
- Ability to distinguish between scientific evidence and scientific proof
- Ability to discern between facts and fiction

A science teacher can by her/his example, help develop these characteristics in his/her students.

What are Superstitious Beliefs?

Superstition beliefs are irrational beliefs and notions held by human beings, which are based on fear, magical thinking, ignorance and blind faith. [1] Opined that these beliefs and nations lacked evidence or proof and do not have any basis in logic, facts, and common sense or in reality. Some of these beliefs include beliefs in gods, ghost, juju, charms, witches and wizards, black medicine, miracle and magic.

These superstitious beliefs have a negative influence on lives especially on education [2] said superstition exerted negative influence in children's (and even teachers') learning from science. These beliefs are often held tenaciously and tend to impede an individuals conceptualization of scientific knowledge by creating an existing prior knowledge, which is in contrast to the science knowledge to be learned. A vigorously implemented and balanced science curriculum will significantly reduce individuals dependence on superstitious beliefs since more and better science create scientifically liberate individuals. The more scientifically exposed on individual is, the more readily she/he would discard these beliefs (Olurundale, 1998).

[3], in a study of the relationship between scientific literacy and African superstition observed that traditionally it was believed that science and superstition are not compatible. Superstitious beliefs are used to teach certain moral values. For example in some Yoruba communities (Nigeria), eating yam with the same knife used for peeling the yam can destroy tooth setting. What this is trying to teach is law of hygiene, telling young ones to be polite. In real sense, eating with such knife has nothing to do with teeth setting.

With the development of science and technology most of these superstitious beliefs become more of speculation that has no proof and therefore not acceptable no matter how reasonable they may be, contrary to the opinion of [3] that superstitious beliefs by Africans show evidence of scientific reasoning.

Superstition is not limited to African alone, but as observed by [4], it is a worldwide phenomenon that cuts across sex, creed and dime. Because of anxiety problems, [5] posted that women are more superstitious than men. All in all, the higher the level of scientific literacy (attitude) of the individual, the less the level of superstitions.

This implies that the pre-service science teachers with higher level of superstition have the lowest level of scientific attitudes accordingly.

Superstition is a pejorative term for beliefs in supernatural causality; that one event leads to the cause of another without any physical process linking the two events such as astrology, religion, omens, witchcraft, etc, that contradict natural science [6].

Literature Review

Survey of science teachers in Zimbabwe [7] and in Nigeria [8] showed that they associated science with the production of useful technology and the improvement of human welfare; they failed to recognize curiosity and human creativity as the fundamental driving force in the advancement of science. Teachers in the Zimbabwe sample viewed science in an authoritarian manner as an unchanging body of knowledge amassed via application of a determinate scientific method; they had a text book view of science as a body of knowledge and immutable laws. In another study, primary school, junior secondary, and high school students valued science from only a materialistic standpoint in so far as it led to the production of useful technology [14].

The international association for the evaluation of educational achievement (IEA) assessments pointed to the poor performance in science of students in developing countries when compared to their counter parts in the developed countries; the 1984 assessment of Junior secondary students showed that the bottom 20% of students in developing countries including, Nigeria, the Philippines, Zimbabwe, and others were ‘scientifically illiterate.’

They consistently scored at the bottom of 23 nations surveyed on the literacy measures applied [9].

Evidence also exists to suggest that African students do not necessarily utilize what they learn in science education in real life [10, 11]. [10] Observes that students go through the ordeal of memorizing what is necessary to pass tests and examination after which they return to the security of their traditional beliefs. [12] Found that, African students learned science in ways which contradicted approaches suggested in science curricula simply because what is presented to them as science is so alien to their ordinary circumstances and life. Consequently, science teaching has only resulted in his/her (Africans) learning facts, procedures and techniques, but he/she has not yet become imbued with the spirit of science, with a scientific way of looking at nature, and with a scientific manner of approaching new problems [12]. Jahoda, as cited in [13], found evidence of persistence of traditional superstitious beliefs among Ghanaian undergraduates; the beliefs existing in a state of cognitive co-existence with western science education, but emerging more under stress. [7] Interviewed teachers who were enrolled for a degree programme in science in Zimbabwe. A Biology teacher remarked, “I don’t see how science can interfere with my beliefs, I still have my beliefs -------so I still have my beliefs they are there, science is there too.” Using the same sample of teachers, [14] found that, the science teachers were themselves not strong traditionalists but maintained a fairly traditional posture with regards to aspects of traditional authority, religion, view of nature and social change. They showed a much stronger shift from tradition with regards to sex rules, causality and problem solving. An American professor found that, Nigerian science students were distressed by the tentative nature of the scientific enterprise; there was a tendency to embrace, even tongue-in-cheek, information having a superstitious base, but at least a definite answer in preference to wrestling with several scientific alternatives [15].

A comparative study of teachers in Botswana, Indonesia, Japan, Nigeria and Philippines found that irrespective of their (non-western) cultural backgrounds, the teachers held views distinct from the science they teach, and they exhibited a form of collateral thinking where by an individual accepts or uses both mechanistic and anthropomorphic explanations depending on the context in question and without exhibiting any sign of cognitive dissonance [15]. [12] Made a claim that an African must find a connecting link between the principles of natural science and the basic assumption of his world view or he/she is lost. [17] Working in Botswana observed discontinuity between the common view of reality and the scientific education given in developing countries has not succeeded in instilling the scientific spirit in the educated; the indigenous common sense knowledge is so deeply rooted that it appears difficult to change.

These findings together do not suggest that Africans or people in other developing countries cannot understand or appreciate science and technology. Rather the suggestion is that the spontaneous application of the scientific spirit learnt through western forms of education is lacking (Yokubu, 1994, 344). The points arising from the review so far, raise a possibility that science and technology literacy, the umbrella goal of science education, is not being achieved in non-western developing countries, particularly those in Africa. The explanations of the limited success of science education seem to lie in the difference between indigenous thoughts and beliefs, and worldviews promoted in science. [12] Raised the need for the recognition that there are certain cultural ideas in the African situation, which may well impinge directly on the ease with which an African child can appreciate science.

Methodology

A case study/survey research design was used involving a quantitative research strategy. The instrument of data collection was a questionnaire containing twenty five (25) superstitious statements with options of agree /disagree. It was administered to 186 students (25 female and 161 male) of the four levels [‘freshers’, first, second, and third year students (after final second semester exams)], in August 2012 and May 2012 respectively. It was expected that all the students will disagree with all the superstitious statements due to their level of scientific literacy.

Data was analyzed using descriptive method such as percentages, graphs, and frequencies by Ms-excel program. Each of the superstitions question agreed/disagreed was scored 4 points, hence the 25 superstitions statement had a total of 25 x 4 = 100 points = 100%. The students who agreed with all superstitious statements, scored 100% (agree), which implied high level of superstition and lowest level of scientific attitudes. Box 1 shows a sample of the five superstitious statements presented to students.

Please, you are requested to participate in the following survey by the Department of Education, Busitema University.

SECTION A

Gender: Male ☐ Female ☐

Teaching subject

SECTION B:

Please indicate whether you Agree or Disagree with the following assertions below; by ticking in the respective boxes accordingly.

1. Lightening/thunder can be sent by a person to kill/destroy property of another person.

Agree ☐ Disagree ☐

2. Ghosts in our community are used to treat/cure diseases like HIV/AIDS, Mental illness, etc.

Agree ☐ Disagree ☐

3. A person can direct a rainbow to suck blood in another person and die.

Agree ☐ Disagree ☐

4. Many people die because they have been bewitched by witchdoctors in our society

Agree ☐ Disagree ☐

5. Some students excel in exams because they use spiritual powers from witch doctors

Agree ☐ Disagree ☐

Results

Level of Superstition among "fresher" BSc. Education Students

Table 1a: Level of Superstition among 'fresher' BSc. Education Students

SCORE RANGE	AGREE	DISAGREE	% AGREE	% DISAGREE
100	0	3	0	7
90-99	0	6	0	13
80-89	0	10	0	22
70-79	1	8	2	18
60-69	0	11	0	24
50-59	2	4	4	9
40-49	7	2	16	4
30-39	8	0	18	0
20-29	11	1	24	2
10 TO 19	7	0	16	0
1- TO 9	6	0	13	0
0	3	0	7	0
TOTAL	45	45	100	100

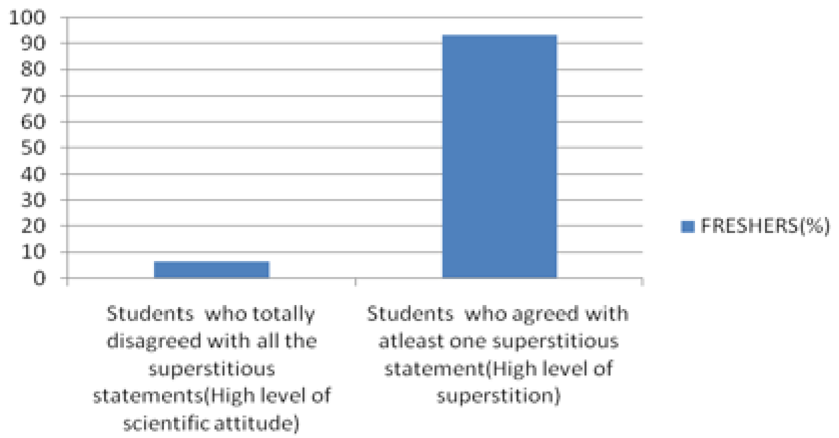

Figure 1 a: Bar graph showing the level of superstition among BSc – Education fresher students in Busitema University (2012/2013 academic year)

Level of Superstition among First Year Bsc-Education Students

Table 2a: showing the score/Percentage of first year BSc –Education students who agreed/disagreed with superstitious statements

SCORE RANGE	AGREE	DISAGREE	% AGREE	% DISAGREE
100	0	6	0	13
90-99	0	5	0	11
80-89	1	6	2	13
70-79	0	6	0	13
60-69	3	4	7	9
50-59	6	9	13	20
40-49	10	8	22	17
30-39	3	1	7	2
20-29	8	0	17	0
10 TO 19	4	1	9	2
1- TO 9	5	0	11	0
0	6	0	13	0
TOTAL	46	46	100	100

Figure 2 a: Bar graph showing the level of superstition among BSc – Education First year students in Busitema University (2011/2012 academic year)

Level of Superstition among Second Year BSc-Education Students

Table 3a: Showing the score /Percentage of second year BSc –Education students who agreed/disagreed with superstitious statements.

SCORE RANGE	AGREE	DISAGREE	% AGREE	% DISAGREE
100	0	7	0	14
90-99	0	7	0	14

80-89	1	9	2	18
70-79	1	3	2	6
60-69	2	10	4	20
50-59	5	6	10	12
40-49	9	6	18	12
30-39	7	1	14	2
20-29	7	2	14	4
10 TO 19	5	0	10	0
1- TO 9	7	0	14	0
0	7	0	14	0
TOTAL	51	51	100	100

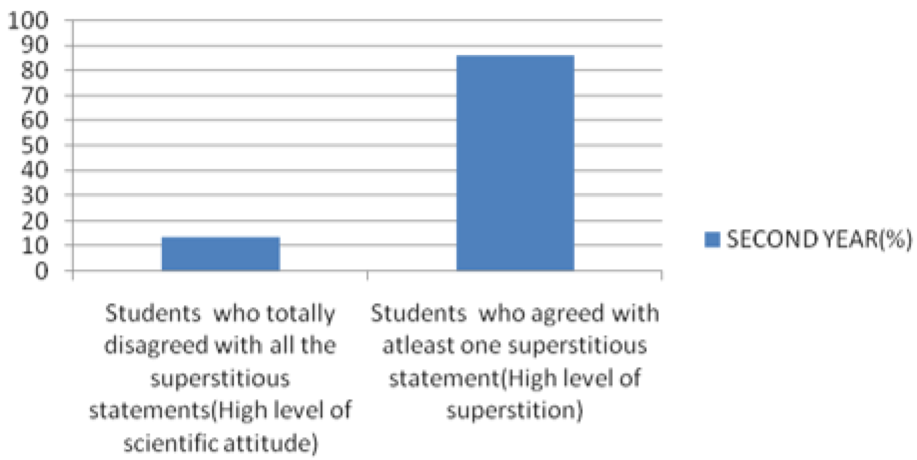

Figure 3 a: Bar graph showing the level of superstition among BSc – Education Second year students in Busitema University (2011/2012 academic year)

Level of Superstition among Third Year BSc-Education Students

Table 4a: Showing the score /Percentage of third year BSc –Education students who agreed/disagreed with superstitious statements.

SCORE RANGE	AGREE	DISAGREE	% AGREE	% DISAGREE
100	0	13	0	30
90-99	0	5	0	11
80-89	0	11	0	25
70-79	0	3	0	7
60-69	1	4	2	9
50-59	3	4	7	9
40-49	6	4	14	9
30-39	2	0	5	0
20-29	11	0	25	0
10 TO 19	3	0	7	0
1- TO 9	5	0	11	0
0	13	0	30	0
TOTAL	44	44	100	100

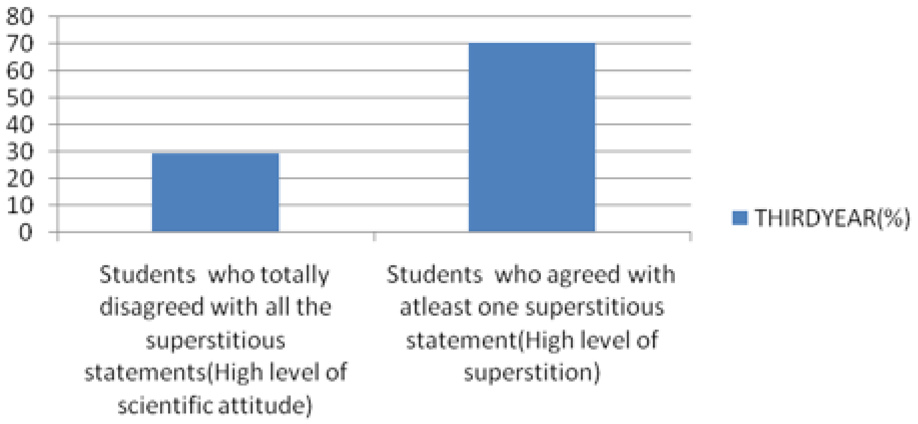

Figure 4a: Bar graph showing the level of superstition among BSc – Education Third year students in Busitema University (2011/2012 academic year)

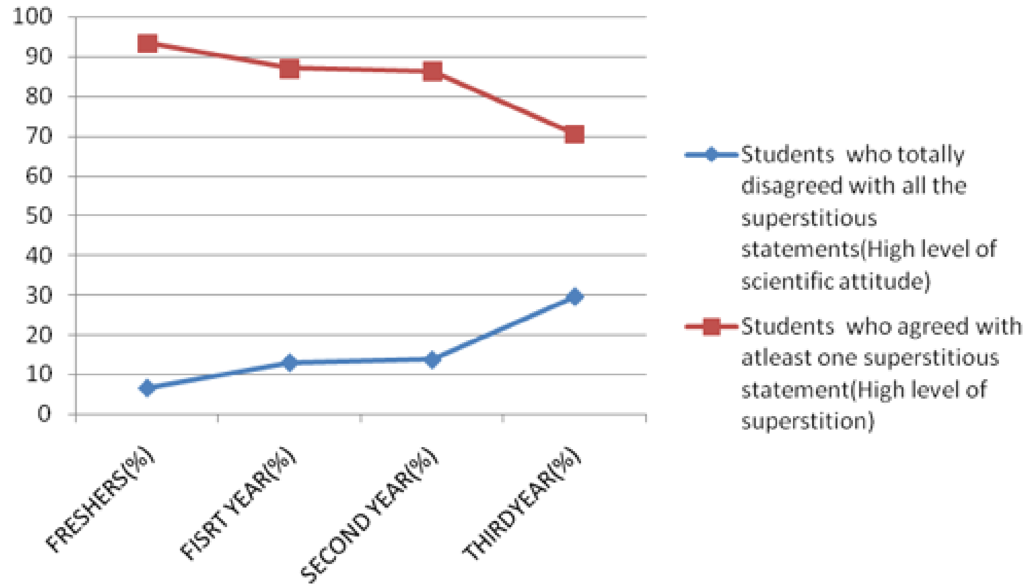

Figure 6b: Line graph comparing the level of superstition and scientific attitudes among the "fresher", first, second and third year students BSc-Education students in Busitema University (2012)

Summary of Findings

The level of superstition among Bachelor of Science education students in Busitema University was very high ('freshers' = 93.33%, first year =86.96%, second year = 86.27% and third year =70.45%)

The level of scientific attitude among Bachelor of Science education students was very low ('freshers' = 6.67%, first year = 13.04%, second year = 13.73% and third year = 29.55%)

There was a slight difference between the level of scientific attitudes of freshers' and third year final students (i.e. 29.55% - 6.67% = 22.88%).

No relationship was observed between gender/religion/tribe and the level of scientific attitude among Bachelor of Science education students.

Discussion, Conclusion and Recommendations

Discussion

The findings of the study revealed that, the level of superstition among Bachelor of Science education students in Busitema University was very high. The above findings agree with [10] who observed that students go through the ordeal of memorizing what is necessary to pass tests and examination after which they return to the security of their traditional believes. Also Jahoda, as cited in [13] found evidence of persistence of traditional superstitious beliefs among Ghanaian under graduates ‘the beliefs existing in a state of cognitive co-existence with western science education, but emerging more under stress.’

The findings of the study also revealed that the level of scientific attitudes among Bachelor of Science education students was very low. The findings agree with findings by Oginniyi, et al. (1995) in their comparative study of teachers in Botswana, Indonesia, Japan, Nigeria and Philippines, where they found that irrespective of their (non-western) cultural background, the teachers held views distinct from the science they teach. Also [2] said that superstition exerted negative influence in children’s (and even teachers’) learning from science. These believes are often held tenaciously and tend to impede an individual’s conceptualization of scientific knowledge by creating an existing prior knowledge which is in contrast to the scientific knowledge learned.

The findings also agree with [7] and [8] who found out in the survey of science teachers in Zimbabwe and Nigeria respectively that,’ they associated science with production of useful technology and improvement of human welfare, they failed to recognize curiosity and human creativity as fundamental driving force in the advancement of science. However, the findings disagree with [3], opinion that, ‘superstitious beliefs by Africans show evidence of scientific reasoning’.

The study also revealed that, there is no relationship observed between gender, religion, tribe and the level of scientific attitude/superstition among Bachelor of Science education students in Busitema University. These findings agree with [4] who observed that superstition is not limited to Africa alone; it is worldwide phenomenon that cuts across sex, creed and dime. However, it disagrees with [5] who posted that women are more superstitious than men. However, considering the fact that the girls who pursue sciences at advanced level are normally ‘super women’, hence gender was unlikely to influence their level of superstition/scientific attitude.

Conclusion

The conclusion from the study was that; Pre-service science teachers believe in superstition hence their level of scientific attitude is very low. This has a negative effect to successful implementation of science education in Uganda.

Recommendations

There is need to reform the science curricula at all levels (primary, secondary and university) to address the method and attitude of science during the science lesson, other than emphasizing the scientific facts which students easily forget after their exams. Also, more research need to be conducted to determine the level of scientific attitude among the in-service science teachers in primary, secondary and colleges so that, in-service trainings are organized to improve their scientific literacy.

References

Albert, S. (2010). The psychology of superstition. Is magical thinking hurting or helping you? com/371213/ the psychology of superstition. Doc. D. www.winipedia.org/wiki/superstition.

Abimbola, i.o (1997). African world-view and school science. Journal of science Teachers’ Association of Nigeria. 16, (1), 15-27.

Cobern, W.W. (1989). ‘Acomparative analysis of noss profiles on Nigerian and American pre-service secondary science teachers’. Journal of Research in Science Teaching, xxvi, 533-541.

Igwe, I. (2009). Africa anti superstition campaign manifesto for Africa. Retrieved from: www.policalcortex.com/history/2009/5/25/82617/london

Morris, R. W., (1983). Science and technology education and development (Pans, UNESCO)

Odhiambo, T.R (1968). 'Understanding of science. The impact of the African view of nature; in P.G.S Gilbert and M.N Lovegrove (eds). Science education in Africa (London, Heinemann), 39-46.

Ogunniyi, M. B., Jegede, O. J., Ogawa, M., Yandila, C.D., and Oladele, F.K. (1995). nature of world view presuppositions among science teachers in botswana, indonesia, japan, nigeria, and the philippines, journal of research in science teaching, xxii, 817-832.

Ojo, J. (2010). Man and superstition. Retrieved from: www.jetteojo.biogspot.com/2010/02/man-an-superstition.html.

Olorundare, S. (1998). Superstitious beliefs as constraints in the learning of science. Nigerian Journal of Guidance and Counseling. 6, (1 and 2), 133-150

Postlethwaite, N.T. (1991). Achievement in science education in 1984 in 23 counties, in T. Husen and J.P. Reeves (eds), Issues in science education. Science competence in a social and ecological context (oxford, Pergaman press), 35-64

Prophet R.B (1990, Rhetoric and reality in science curriculum development in botswana. International Journal of Science Education, xii, 13-23.

Shumba, O. (1995). 'Science teachers' assessment of the interaction of indigenous African. Culture with Science Education in Zimbabwe. Zimbabwe Journal of Educational Research, vii, 259-300.

Shumba, O. (1999, in press). Relationship between secondary science teachers' orientation to traditional culture and beliefs concerning science instructional ideology. Journal of Research in Science Teaching.

Shrigley, R.L. (1983). ‘The attitude, concept, and science teaching; Science education, lxvii,
(iv), 425-442.

Swift, D. (1992). Indigenous knowledge in the service of science and technology in developing countries. Studies in Science Education, xx, 1-28.

Yakubu, J. M. (1994). Integration of indigenous thought and practice with science, and technology. A case study of Ghana. International journal of science education, xvi, 343-360.

PREPAREDNESS OF MATHEMATICS TEACHERS FOR TEACHING MATHEMATICS USING ICT IN SECONDARY SCHOOLS OF TIGANIA EAST DISTRICT, KENYA

Irene Mukiri Mwingiwira

Introduction

Background to the Study

Abstract

This study aimed at investigating the current level of mathematics' teacher preparedness in embracing ICT for teaching. Teacher preparedness was measured in three main aspects; teacher's training levels, teacher attitudes towards ICT and the use of available ICT resources. The study was carried out in Tigania East District, which has 30 secondary schools. The design selected for this study is a descriptive survey. The study used Mathematics Teachers Questionnaires, Interview Schedule and an Observation Guide to collect data. The researcher used simple random sampling techniques to select 30% of the teachers to constitute the sample size. The Cronbach reliability coefficient alpha of 0.79 was realized meaning there was internal consistency of the data collected. Data was analyzed by use of descriptive statistics such as the frequencies, and percentages. This was done using the SPSS program as a tool to aid the analysis. The study revealed a variety of ICT resources in the secondary schools in Tigania East District. Further, 66.9% of schools in the district had support structures such as electricity and generators. The study further showed that teachers did not use the ICT resources available as they lacked knowledge on appropriate usage. The lack of pre-service and in-service training was sighted as a major limitation. The study concluded that mathematics teachers in Tigania East District were unprepared to embrace ICT resources in their teaching because they lacked relevant training and enthusiasm, and were found not to use the available ICT resources. The study recommends a retraining of mathematics teachers through INSETs on how technology should be applied to improve the teaching of Mathematics. The study also recommends that the ministry of education improves on the staffing of mathematics teachers who are trained to use ICT as most schools were seen to have a shortage of these teachers. The findings of this study will be useful to mathematics teachers, school administrators and the quality assurance standard officers in the ministry of education.

Mathematics is one of the core subjects in the secondary school curriculum. Students in Kenyan secondary schools are required to do a minimum of seven subjects at KCSE level. Out of these seven, mathematics is one of the three compulsory subjects, besides English and Kiswahili. Cockcroft report (1982) notes that “mathematics is only one of the many subjects which are included in the school curriculum, yet there is greater pressure for children to succeed in mathematics…. This suggests that mathematics is in some way thought to be of special importance”. This causes the great pressure that teachers experience in teaching mathematics. Further pressure comes in during selection of courses. Most colleges in Kenya require a certain minimum grade in mathematics before a student is enrolled into any course.

Orton and Frobisher (1996:1) notes that

> “The importance of mathematics is emphasized when future employment of a child is being considered. The subject is used as a filter or hurdle possibly more often than any other subjects. Normally, a mathematics examination pass at an appropriate level is demanded before entry to a particular profession or occupation can even be considered – whether any mathematics is required in the performance of the job or not.”

This use of mathematics as a filter at different levels makes the teaching and learning of the subject demanding as the teachers and learners are not relaxed to enjoy the subject. Pressure to succeed and to pass examinations makes it hard for learners to be at ease with the subject matter, to develop a state of mind, which is receptive to the idea that mathematics can be enjoyable and need not generate anxiety and panic. Pressure also makes it difficult for teachers of mathematics at any level to aim at teaching for the enjoyment of learning and achieving effective teaching of mathematics rather than for future examination success.

Introduction of Information and Communication Technologies (ICT) into the teaching process has been recommended with the aim of improving the teaching and learning of mathematics. According to Pelgrum and Plomp (2002) “investments in Information and Communication Technology (ICT) have increased in recent years, with the perception that increased student use of computers and other electronic forms of media may have a positive impact on students’ achievement”(p.15). The use of electronic media in the process of teaching mathematics is hoped to improve the learning environment depending on how well the teachers are prepared to use these resources. The use of ICTs on its own may not improve the teaching of mathematics if the teacher is not properly prepared to use these resources in the appropriate ways.

In the *Principles and Standards of School Mathematics* the National Council of Teachers of Mathematics (NCTM) identified the "Technology Principle" as one of six principles of high quality mathematics education (NCTM, 2000). This principle states: "Technology is essential in teaching and learning mathematics; it influences the mathematics that is taught and enhances students' learning" (p.24). This implies that technology influences the teaching methodology applied by the mathematics teachers. The situation in the teaching of mathematics using ICT in Kenya should be established, to find out if this principle is applied in the day to day teaching or not. There is widespread agreement that mathematics teachers, not technological tools, are the key change agents to bringing about reform in mathematics teaching with technology (Kaput, 1992; NCTM 1991, 2000). Teachers therefore should be in control of the available ICT resources and be able to manipulate them to enhance their teaching. Although the National Council of Teachers of Mathematics identifies technology as essential in enhancing the teaching of mathematics, these resources by themselves would not do it. Teachers are the change agents. Preparing teachers to use technology appropriately is therefore a necessary task for teacher educators. Waits & Demana (2000) argue that adoption of technology by teachers requires professional development that focuses on both conceptual and pedagogical issues, ongoing support in terms of "intensive start-up assistance and regular follow-up activities" and a desire to change from within the profession (p. 53). In addition, their studies of teachers' implementation of educational technology document that at least three to five years are needed for teachers to become competent and confident in teaching with technology. Graduate teachers in Kenya are trained for four years, while diploma teachers go through a three-year training, which fits within the time recommended in the above study. The duration mathematics teachers are trained not withstanding, there is a task to establish if these teachers are prepared to use technology in their teaching. This is because times are changing and technology is advancing with each passing day. For mathematics teachers to be effective in their teaching, they need to keep pace with the ever-changing technology.

Kenyan secondary schools have embraced the use of ICT in the teaching of mathematics. This is observed as almost all secondary schools are currently using calculators besides other resources during mathematics lessons. In the year 2002, the Kenyan government approved a policy on calculator use for all secondary school mathematics students. This policy has since been implemented with the aim of making the subject less complicated and to help students in mathematics so as to concentrate on conceptualizing ideas. Schools have further invested in computers and other technologies such as the radio, television and video. Further the rural electrification program has made it possible for most schools to use these ICT resources. Having put the necessary policies into place and provided the necessary infrastructure, the preparedness of teachers who are to embrace the policies and the use of these resources should be addressed to ensure the successful teaching of mathematics. For teachers to be effective, they need to understand the fundamental principles that underlie school mathematics so that they can teach it to the diverse groups of students as a coherent, reasoned activity

The challenge however, lies with the teachers in the implementation of ICT in teaching and learning of mathematics. Teachers are faced with major decisions on how to present the information, which ICT resource to use, which content to teach using, which ICT resource and also how to plan for the standard 40 minutes lesson time. According to Bingimlas (2008) the major barriers when teaching using ICT are lack of confidence, lack of competence and lack of access to resources. This discourages teachers from even attempting to use ICT in mathematics lessons. Teachers believe in being well prepared before going to teach. If a teacher wants to use ICT in teaching mathematics but feels incompetent in the use of ICT, he/she will shy off from using it. This therefore calls for preparation of teachers to enable them embrace the available ICTs for teaching mathematics. The educators not only need the ICT resources but also need to know what to do with it and at what point and content to use ICT. According to ICT and Education–Policy, Strategy, and Further Progress of 2001, the human environment must be prepared and the support of stakeholders must be enlisted. Teachers and education system administrators can be the strongest agents of change, or they can very easily resist it. Investments that seek to implement infrastructure, computers, and specialized software without taking the necessary time to lay the human groundwork are doomed to a long and costly learning curve.

There was technical support available, but obviously that was not enough. A recent study based on the Kenyan system of education by Ogwel, on the integration of ICT in mathematics education gives the challenges of integrating ICT as; lack of curriculum coherence, poor articulation within the education system, inadequate teacher preparation and professional development. Is this likely to be the case in many learning institutions in Tigania East District?

Statement of the Problem

A study by Kanja (2001:70) on mathematics education in Kenya states that performance on mathematics concepts is poor, the quality of teaching is poor and that most students said that classroom environment is harsh and unfriendly. In the face of this situation Kanja recommended that mathematics teachers need to understand and implement good teaching skills and that information communication technology be incorporated into the teaching. Various studies including (Papert, 1987; Voogt & Pelgrum, 2005; Watson, 2004) have recommended ICT as a solution to improve the teaching of Mathematics. In accordance to this, many programs such as, the NEPAD (New Partnership for African Development), computer for schools Kenya (CFSK) and the ICT trust fund have been started to fund information technology in secondary schools of Tigania East district with an emphasis on computerization. The first KCSE after the formation of the new district was done in 2009, during which the overall KCSE mean grade for the district was 4.72 while the mean for the mathematics subject was 2.64. During the following year, 2010, the overall district mean was 5.26 while the mean for mathematics was 2.998. From this trend, mathematics in the district is one of the subjects that were below the average mean for the district. Due to this, the researcher found it necessary to establish what was being done to improve the teaching of mathematics in the district. Stakeholders in secondary schools are working hard to ensure their schools are up to date with technological advancement. The rural electrification program has been put in place to ensure secondary schools in rural areas have access to electricity in order to ensure that use of ICT resources is possible. Despite this government support, the teaching of mathematics has remained poor. Since ICT resources have been availed to secondary schools, it means the real solution is yet to be established. It was the intention of this study to find out if teachers are prepared to embrace these ICT resources and how these resources are being used in teaching of mathematics. The purpose of this study was to establish the preparedness of mathematics teachers to embrace ICT in the teaching of mathematics in terms of training, perceptions and the use of ICT resources

Objectives

The objectives of this study were:

a) To establish the teachers' use of ICT resources available for teaching mathematics in secondary schools within Tigania East District;

b) To establish teachers' ICT training, in readiness for teaching mathematics;

c) To establish the mathematics teachers' perceptions towards the use of ICT in readiness for mathematics instruction;

d) To assess the support structures available for the use of ICT instructional resources in the selected secondary schools.

Research Questions

This research set out to answer the following research questions;

a) To what extent do mathematics teachers use available ICT resources in teaching mathematics?

b) What ICT training do teachers of mathematics in Tigania East District possess in readiness for the teaching of the subject?

c) What perceptions do mathematics teachers have towards the use of ICT in mathematics instructions?

d) What ICT support structures do schools in Tigania East District have that help in teaching mathematics?

Methodology

Research Design

The design adopted for this study was descriptive survey. By adopting this design, the subjects were observed making no attempt to change their behavior or conditions. This design was selected since no intervention was done to modify the subject's conditions. The data was expected to be quantitative in nature and therefore was analyzed by use of descriptive statistics.

Location of the Study

The study was carried out in Tigania East District of Meru County. The district is approximately 700 square kilometers in size with a total of 29 public secondary schools and 1 private secondary school. The district's headquarter is located approximately 25km from Meru towards Maua. This district was chosen because it is a newly formed district from the larger Meru District, in which there is a wave of ICT development in most secondary schools. Tigania East being a new district, not much research has been done to establish reasons for its poor performance in national examinations such as computers, calculators, radios, televisions and video machines among others.

Target Population

Nkpa (1997) defines target population as the population to which the researcher hopes to generalize the findings. It refers to the entire group of persons or elements that have at least one characteristic in common. The target population for this study comprised of the 100 mathematics teachers from Tigania East District. Since schools keep on recruiting new teachers while others retire or go on transfer to other schools and districts, the study focused on the Mathematics teachers as at January 2011, when the data was being collected. The respondents were drawn from a sample of the 30 secondary schools in the District.

Sampling Procedure and Sample Size

Sampling Procedure

The sampling of the subjects for this study was done at three levels. The researcher first sampled Tigania East District through purposive sampling; secondly, secondary schools in the district were sampled through simple random sampling and then teachers who provided data for the study were sampled through purposive sampling. Out of the 30 secondary schools in the district, the researcher selected 9 of them for the purpose of the study. Further, all Mathematics teachers in each school were selected purposively. The intention of the researcher was to get a fair representation of the actual scenario in the target secondary schools. To obtain this fair representation, participants were selected using simple random sampling procedure to obtain the required sample. According to Kothari 2004, the implications of simple random sampling are that it gives each element in the population an equal probability of getting into the sample and further gives each possible sample combination an equal probability of being chosen.

Research Instruments

The researcher used teachers of mathematics questionnaires for the 27 teachers and interview schedule for 9 of the selected mathematics teachers to establish relevant information on teacher's attitudes, teacher qualifications among other factors. These 9 mathematics teachers were each a representative of his/her school. A questionnaire for the school principals was used to complement the information given by the teachers. Further, an observation schedule was used to examine the kind of ICT equipment available in various schools in Tigania East District and how they are used. The researcher therefore obtained quantitative data since the study was non experimental in nature.

Data Collection

The researcher collected the data by first making a visit to the sampled schools in order to familiarize self with the respondents and to create a rapport. The researcher secondly booked appointments and prepared a program of activities so as to visit each of the selected schools as planned. All the sampled 79 teachers were given questionnaires by the researcher herself while she interviewed a teacher per sampled school in order to supplement the findings from the questionnaires.

Data Analysis

The study generated both qualitative data and qualitative data.

Objective one, two, four and five, which sought to establish the available ICT resources in Tigania East district produced quantitative data which was analyzed using descriptive statistics such as frequencies and percentages. The obtained data was presented by using charts and graphs as shown in chapter 4. Objective three which sought to establish teacher perceptions using likert scale questionnaires. The data was analyzed using percentages, frequencies and mean with the help of the SPSS computer package as a tool for analyses. These helped in making relevant deductions and conclusions about the state of teacher readiness in embracing ICT for teaching mathematics in Tigania East District.

Summary, Conclusions and Recommendations

Introduction

This study documents the use of ICT for teaching mathematics in Tigania East District in relation to availability and teacher preparedness. The study also looked at how the available ICT resources are used and barriers that hinder teachers from using these available ICT resources. The chapter gives a summary of the findings, conclusions, recommendations and suggestions for further studies.

Summary of the Findings

Availability of ICT Resources

This study observed the following: First, all secondary schools in Tigania East district have some sort of ICT resource, calculators being the basic ICT resource in each secondary school. Since the introduction of calculators in secondary school mathematics curriculum, school administrations have embarked on a supportive mission on provision of calculators to their teachers. Students on the other hand have had their parents buy for them calculators. Generally therefore all secondary school mathematics teachers have access to this ICT resource and can use it for teaching of the subject.

Secondly, more than 50% of secondary schools in the district have electricity. Other secondary schools, which do not have electricity have a plan or are in the process of acquiring it through the rural electrification program. The presence of electricity makes it easy for schools to use ICT resources such as computers, printers, television, radio and projectors among others. This is because lack of power is a major limiting factor as these resources cannot operate without it.

In addition, 59.3% of secondary schools have computers and printers, which are either bought by the schools or provided by donors. Out of the schools with computers, only 0.05% have a centralized room where teachers can take students and present a lesson with students sharing computers such that each can access a screen. On average the few schools that had many computers had a sharing ratio of 1:3. In other schools, computers are few and mostly reserved for office purposes.

Finally, other ICT resources such as television, video and radio are available in almost all secondary schools that have electricity. In all the schools that were found to have this resource, the quantities were 1 or 2 per school since they were meant for entertainment and not as a teaching or learning resource.

Utilization of Resources

In the case of calculators, although mathematics teachers said it can be used in a variety of topics such as statistics, trigonometry, binomial expansion among others, in real practical sense they do not use them for teaching. Having observed several lessons in various schools, it was established that the calculators were only reserved for computations except for the topic of “errors and use of calculators” which is taught at form 3 level. During this topic, the mathematics teacher demonstrates the functions of various keys on the calculator as learners practice. Once this topic has been taught, the teacher rarely carries a calculator to class.

Secondly, mathematics teachers said that a computer is a vital resource in teaching of mathematics in topics such as 3-dimensional geometry, statistics, and geometrical constructions where they proposed the use of computer simulations to help in better understanding concepts. However, on further questioning, teachers admitted that they do not use computers in their teaching mainly because it is not a priority. They felt it would require more time and the preparation for the lesson would also be hectic.

Thirdly, mathematics teachers seem to be aware that Internet is a source of vital information and lesson content but they do not often refer to it. They claimed that the content from the textbook is not even sufficiently covered within the available time.

Fourthly, the availability of television, video and radio does not seem to appeal to the mathematics teachers in terms of utilization in mathematics lessons. The mathematics teachers agree that the television and video can be used in the presentation of recorded lessons in areas that seem to challenge students such as geometrical constructions. However, the teachers do not use either of these resources in their teaching of mathematics.

Professional and Academic Qualification of the Respondents

With regard to professional qualifications, the researcher found out that 66.3% of the mathematics teachers in the district had been trained to teach mathematics either at degree level or diploma level. This category of mathematics teachers is well equipped to handle any mathematics concepts and also can present their lesson in an organized way.

Another 37% was that of untrained mathematics teachers; many secondary schools in Tigania East district seem to be understaffed in terms of trained mathematics teachers so they employ any available teacher. These include those with degrees in other areas and form four leavers. A big percentage of those teachers handling the subject are KCSE certificate holders. Such a teacher is not qualified in terms of methodology of teaching and even in terms of content. It was observed that these teachers only read the textbook content and transfer it without the use of any resources. These teachers further do not spend time experimenting with resources rather they present their lessons by lecture and demonstration methods.

Mathematics Teachers' Qualifications in Relation to ICT

The study observed that the mathematics teachers lacked proper training in the use of ICT. It was observed that in the course of teacher training for both diploma and degree holders for mathematics teachers, the teachers were not exposed to training in the use of ICT as a teaching resource in the subject. Teachers with degrees and diplomas found to have some sort of ICT training had attended computer colleges on their own for personal reasons other than the use for teaching. These teachers have certificates in computer packages and a few have diplomas in information technology.

Among the mathematics teachers who lacked professional training, 47% had some ICT qualifications such as certificate in computer packages and others had diploma in information technology. However, having ICT qualification but lacking professional training does not help in lesson delivery due to lack of methodology.

Teacher Perceptions in use of ICT

The study observed that mathematics teachers had a general positive attitude that the use of ICT resources helps to improve the general lesson. They seemed to be in the agreement that the use of ICT during mathematics lessons improves the learning environment, learners' interest and level of understanding.

The teachers however had different views in terms of lesson coverage and time spent. A large percentage felt that the presence of ICT resources required more time to deliver a concept and that it slowed down the teachers pace in the lesson coverage.

However since the response was 50% in favor of ICT in terms of syllabus coverage and proper utilization of time. The researcher concluded that the mathematics teachers in Tigania East district have a positive perception towards the use of ICT in mathematics lessons.

Availability of Induction Courses

The study observed that besides the lack of a good ICT training program in diploma and degree courses in the Kenyan colleges and universities, there is a further shortage of in-service programs in the same area.

The study revealed that there is shortage in ICT training courses even after teachers have left colleges. No form of training for the teachers on how to use the teaching resource preceded the introduction of calculators in the secondary school curriculum.

Teachers who attended the SMASSE program successfully and went through the four-cycle program said that there was nothing to learn on the application of ICT in their teaching. In addition, the few workshops mathematics teachers attend are mostly based on the performance of students in national exams and rarely are they based on teaching methodology.

Mathematics Teachers Preparedness to Embrace ICT

Preparedness of teachers to embrace ICT in teaching Mathematics in Tigania East District is implied from the above findings. The study established that schools in the district had a variety of resources but teachers were mostly seen to avoid these resources in their teaching. On considering the teacher's perceptions and attitudes towards ICT, it was seen that teachers portrayed a positive attitude and they seemed to view ICT as a solution to their teaching problems. Teachers felt incompetent to use these resources and hence shied away from using them. They said they did not receive any training when calculators were introduced so they viewed the calculator as a tool for computation rather than for teaching. Television and radio on the other hand were used purely for entertainment purposes. Mathematics teachers desired regular training to keep up with the changing times.

Conclusion

Teacher preparedness was looked at in three aspects namely; utilization of available resources, teacher training and teacher attitudes towards ICT. The research established that there is a serious lack of both professional and ICT related training among mathematics teachers of secondary schools in Tigania East District. In utilization of resources, teachers were seen not to use the available resources exhaustively. Teacher attitudes towards ICT were generally positive which implies that the teachers perceive technology as an add-on that would improve the teaching of mathematics. Although teachers perceive ICT as a tool that would improve their teaching of mathematics, they did not make use of the resources in their schools. This directs the researcher to the conclusion that teachers are willing to embrace ICT in the teaching of mathematics but the lack of knowhow is the hindrance. This implies that teachers are not prepared to embrace ICT resources for teaching mathematics in secondary schools of Tigania East District.

Recommendations

This study revealed issues that led to the following recommendations.

1. That there should be a proper plan to in-service mathematics teachers regularly to move with the current times. There should be in-service courses to improve the teaching methodologies from time to time.

2. Mathematics teachers should be oriented towards ICT use in teaching methods during the semesters when the units of the subject methods are taught. The department of communication technology should incorporate the ICT resource in the courses dealing with mathematics teaching methods. While learning this, the student teachers should learn how to incorporate calculators, computers, Power Point projection, radios and even video and television to improve the learning and teaching of the subject.

3. Secondary schools administration should prioritize ICT, which has been seen to improve the learning environment. Since most schools have electricity and generators, the schools should provide enough ICT resources for the teachers to use during lesson presentation.

4. The ministry of education should develop policies on timetabling to give enough time for mathematics teachers to effectively cover the syllabus. Respondents in this study seemed to avoid use of ICT resources because they felt, that this was time consuming. To solve this, more time should be allocated to cover the syllabus.

5. Having noted a teacher shortage to the extent of having KCSE certificate holders as mathematics teachers, it is recommended that the government needs to take urgent measures to help in the provision of qualified teachers.

6. Over the years, mathematics as a subject has been viewed as difficult. The teaching of the subject has remained static while technology has been dynamic. It is therefore

recommended that all mathematics teachers are completely retrained to fit in the rather changing technological time.

7. For schools with computer laboratories, it is recommended that the room is made accessible to all teachers so that those willing to prepare lessons have ample time to do it using the available resources.

References

Allen, J., Batchelor, P. & Higgins, C. (2003). ICT Connet: Books 5 and 6 oxford. Heinemann: Harcourt Education.

Cockroft, W. H. (1982). Mathematics Counts. Report of the committee of inquiry into the teaching of mathematics in schools. London: Her Majesty's stationery office.

Demana, F. and Leitzel, J. (1988). "Establishing Fundamental Concepts Through Numerical Problem Solving." In A. Coxford and A. Shulte (eds.). The Ideas of Algebra, K–12. Reston (VA): NCTM

Demana, F. and Waits, B. (1990). "Enhancing Mathematics Teaching and Learning Through Technology." In T. Cooney (ed.) Teaching and Learning Mathematics in the 1990s. Reston (VA): NCTM.

Kanja, C. Iwesaki H. Baba T. & Ueda A. (2001). Reform of Mathematics Education in Kenyan Secondary Schools. Journal of International Development and Cooperation, Vol.7, No.1, 2001, pp. 67–75

Kothari C.R. (2004). Quantitative technique (3rd ed.). New Delhi, Vikas Publishing house PVT LTD.

Nkpa, N. (1997). Educational Research for modern scholars. Enugu; Nigeria, fourth dimension publishing co. LTD

Ohara, M. (2004). ICT in the early years. London, Antony Rowe Limited.

Ogwel, A. (2008, November). Integrating ICT in mathematics education; curricula challenges in the Kenyan system of education. A paper presented in the 1st regional conference on e-learning, Kenyatta University.

Orina W. M. (2000). Availability, acquisition and utilization of instructional resources for Teaching Geography in selected secondary schools in Kisii District. Kenyatta University Orton, A. and Frobisher, L. (1996). Insights into teaching mathematics. Continuum, London.

Palmiter, J. (1986). "The Impact of a Computer Algebra System on College Calculus." Dissertation Abstracts International, 47: 1640A.

Papert, S. (1987). Computer criticism vs. technocentric thinking. Educational Research.New York: basicbooks.

Pelgrum, W. and Plomp, T. (2002). The Use of Computers Worldwide (Oxford)

Pollard et al (2005): The reflective teacher: Effective and evidence-informed professional practice. London, continuum publishers

Voogt, J. and Pelgrum (2005). ICT and curriculum change. Human Technology; an Interdisciplinary journal on Humans in ICT Enviroments, Vol2, pp 157- 175

Watson, A. Morgan, C. and TIkly, C (2004). Mathematics. New York: Routledge

INFLUENCE OF SOCIO – CULTURAL FACTORS ON INCLUSIVE EDUCATION AMONG STUDENTS AND TEACHERS IN NAIROBI INTEGRATED EDUCATIONAL PROGRAMME, KENYA

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Abstract

This paper reports on a study that examined the influence of socio-cultural factors on inclusive education among students and teachers in Nairobi integrated educational programmes in Kenya. The participants were full-time students and teachers of Kilimani and Our Lady of Mercy integrated primary schools in Nairobi County. A total of 63 participants participated in the study. Twelve students were visually impaired forty (40) sighted learners, seven class teachers and four officials from the Ministry of Education. Questionnaires were developed and used as measuring instruments to record the responses of the research respondents. Data were analyzed using descriptive statistics. The findings of the study indicated that teachers are of the view that inclusive education is a good idea, are positive about the inclusion of learners with visual impairment but were for the option that parents of learners with visual impairment need to be more involved in the schooling of their children. Learners with visual impairment and the sighted learners presented mixed feelings concerning inclusion. Learners with sight suggested that they are comfortable with learners with visual impairment when doing group work and at play but learners with visual impairment preferred carrying out their activities alone. The Ministry of Education officials were for the idea that inclusive education is a good idea. The results of this investigation are significant in the sense that the understanding of the attitudes of students and teachers is critical for the successful implementation of inclusive education.

Key words: Influence of socio-cultural factors on inclusive education. Integrated educational programmes

Introduction

The concept of disability has undergone significant changes the world over. According to Payne and Thomas (1978), the treatment of the disabled has been through five historical eras; the first was the era of extermination. During this era, the Greeks and the Romans killed newly born infants who were found to have physical deformities and severe forms of mental retardation. During the second era, the disabled were ridiculed. The physically handicapped and the mentally retarded were made court clowns and were used to entertain the privileged class until a social conscience took over. Instead of ridiculing them, the church decided to put the disabled in asylums and accorded them humane and charitable care. The final periods were the eras of education and vocational adequacy. These periods, which stretch to the present, perceive the disabled as capable of benefiting from education, vocational training, self-reliance and other societal norms.

A family's cultural heritage shapes its reaction to/and interpretation of disabilities. Disability being a socially and culturally constructed phenomenon (Linan-Thompson & Jean, 1997), families from culturally diverse backgrounds may have differing perspectives on the meaning of exceptionality. These alternative views can easily affect the evaluation process, educational planning, life goals and attempts of establishing collaborative relationships (Turnbull & Turnbull, 2001). Each culture defines what it considers to be deviant as well as normal. Research reveals that families, which are culturally diverse seem to suggest that a disability is defined by the child's future. Just as the notion of disability is determined by society, the aetiology or cause of a disability is also a reflection of a family's cultural reference. Cultures perceive the cause of disability differently. Generally speaking, in the United States, they believe that the cause of a disability can be identified and treated scientifically. Families from different cultures may express a belief in fate, spiritual reasons, violation of social taboos, or intergenerational reappraisals as possible causes for the child's disability (Hansen, Lynch, & Wayman, 1990). At the risk of stereotyping, some Hispanic American families may attribute a youngster's disability to "god's will." In Asian

American families, a disability, especially if the child is a male, the aetiology of the disability may be seen as punishment or retribution for past sins.

The traditional African approach to mainstreaming children with special needs is influenced by African beliefs, cultures and attitudes. Some studies observed that, among the factors contributing to the general apathy and neglect of children with disabilities in emergent African countries are beliefs that regard disability as a curse from the gods. Disability in Africa is regarded as a continuous tragedy. Many people regard disability as a strain in their social status. Families with children who are disabled tend to hide them. This attitude of shame breeds overprotection since people with disabilities cannot be let out to fend for themselves. Over protection can arise from the shame of others seeing a person with a disability in the family. In some instances, the individual who is disabled is not allowed out in the presence of visitors. The tragic nature of this existence is also believed to engender sadness most of the time. Many associate disability with bad omen and therefore, would not like to visit special schools, or even let their children learn alongside students with disabilities in the same class setting (Ndurumo, 1993).

The treatment of the persons with disabilities in Africa and other developing countries is not well documented. However in Ghana, the most critical barriers to free universal education for students with disabilities are negative attitude and prejudice. Some Ghanaians still attribute the causes of disabilities to curses from gods (Agbenyega, Deppler & Harvey 2005). For example, the people of Northern Ghana believe that a newly born child who is disabled is not a human being. It is a fairy, a spirit, a snake and they will find a way of doing away with that child. Others will not kill but hide the child for they would not like anybody to know because they view it as God’s punishment for some disobedience. This is consistent with what (Avoke, 2002) notes that negative attitude and persistent low regard for students with disabilities possess serious barrier to social and educational inclusion in Ghana.

In Zimbabwe, a majority of students with disabilities are from low socio-economic status (Mpofu, 1999) and their parents or guardians are marginally involved in their schooling. The higher prevalence of disabilities in children from low socio-economic backgrounds in Zimbabwe is due to lack of parental literacy and inadequate access to preventive medicine or healthcare. Low socio-economic status families might typically lack knowledge about appreciation of community resources that would make the student more successful in school. For example, Mpofu (2004) reports a case about a father of a child with spastic cerebral palsy who received a wheelchair with the help of an international relief agency. The father used the chair as his personal chair, preventing the child from using it for personal mobility needs and transportation to school.

In Kenya, persons with disabilities not only represent a crucial sector of the marginalized population but also face special problems as a result of their disabilities. They have no access to education, health, employment and rehabilitation. Majority of the persons with disabilities experience hardships as a result of built-in social, cultural and economic prejudices, stigmatization and more often ostracism, abuse and violence. The effect has been that laws intended as instruments of social-engineering and avenues of awareness and intervention in alleviating the plight of the persons with disabilities have not been explicit in addressing cultural and political opportunities that are available in the country. For many children, the presence of impairment leads to a rejection or isolation from experience that is part of normal development. This situation may be exacerbated by faulty family and community attitudes and behaviours during the critical years when children’s “worth nothing” is often the prognosis in early childhood.

Cultural practices the world over have been unkind to persons with disabilities, they were viewed as objects of bad omens and were either killed, abandoned or offered as sacrifices to the gods (Ndurumo, 1993). Most of these harsh treatments have since been discarded. However; a more salient challenge has remained resistant to this, i.e. attitude. People view the disability of the individual before seeing the person. They make judgements about the person in relation to the disability both visible and imagined and continue to assign them duties, responsibilities and expectations pegged on these. Cultural practices and attitudes cannot be changed without offering alternatives. The most viable alternative is to return these learners to the regular schools to support them from there and help them succeed (Randiki, 2002).

Change is never easy, as it involves a process that can change one, sometimes up to several years, rather than a single occurrence or event. It involves more than just programmes, materials, technology or equipment, but primarily about individuals in an established system. It is highly personal, affects people, is viewed differently by each participant and requires personal growth. Yet change is inevitable when innovative practices demonstrate greater effectiveness than past services. In spite of the initiation of new policies and curricula, this process of change has raised numerous questions about the role and responsibilities of school personnel in providing appropriate education for all learners enrolled in the ordinary schools. As agents of change in the education situation, it is not surprising to find that teachers have many concerns about the implementation of these new initiatives (Forlin, 1997). The reason for this is that change is difficult to bring about in schools and classrooms, as it requires simultaneous reforms in professional development, learner support services, and classroom management along with a change in teachers and learners' attitudes, beliefs, values and knowledge. It is specifically the last mentioned aspect that may facilitate or constrain the implementation of inclusive policies as the success of such a challenging programme depends on the co-operation and commitment of those most directly involved (Avramidis, Bayliss & Burden, 2000).

Statement of the problem

The study was concerned with the socio-cultural factors on inclusive education among students and teachers. The underlying assumption here is that socio-cultural factors may well act to facilitate or constrain the implementation of inclusive education. Most studies in this field have been conducted on attitudes of teachers and students. This study focused on how social-cultural background of the participants has influenced their attitudes towards inclusion. Most teacher training programmes in Kenya do not prepare pre- service teachers for the teaching and learning environment that is inclusive. After training, teachers go to class with their pre-perceived ideas about disabilities, which they acquire from traditional backgrounds. This makes it critical for the need to conduct research in this field.

Objectives

i) Identify the socio-cultural factors that influence the attitudes of students and teachers towards inclusion.

ii) Examine the role played by Ministry of Education in addressing the issues of attitudes among students towards inclusion.

iii) Identify the challenges experienced by Ministry of Education in addressing the issue of attitudes in schools.

Justification

The findings of the socio-cultural factors that influence the attitudes of learners and teachers may help the Ministry of Education to put up plans to sensitize the learners, teachers, parents and the community on the need to embrace inclusive education. It will also help the Ministry of Education to have a clear direction on how to approach the attitudes of the learners and teachers as they plan for implementation of inclusive education.

Methodology

A field survey approach was employed to investigate the problem. A survey design was appropriate for the study since it allows direct interaction with the research participants and also determines the status quo and is concerned with gathering of facts rather than manipulation of variables. The participants were students and teachers in two integrated programmes in Nairobi County. The study sampled seven teachers, twelve learners with visual impairment, forty (40) learners with sight and four Ministry of Education officials. Three questionnaires were prepared to collect data. One for teachers, second for learners with visual impairment and the third for learners with sight, interview guide was prepared for Ministry of Education officials.

Results

Teacher's views on the socio-cultural factors influencing inclusion

Table 1: Social-cultural factors as per teachers' views.

Statements	SA (%)	A (%)	D (%)	SD (%)
I treat all the learners in my class equally	3(42.9)	2(28.6)	1(14.3)	1(14.3)
Inclusive education is a good idea	6(85.7)	1(14.3)	0(0)	0(0)
Learners without visual impairment do not pick inappropriate behavior from peers with visual impairment.	1(14.3)	1(14.3)	3(42.9)	2(28.6)
Learners without visual impairment have positive attitudes towards friendship with their visually impaired classmates.	3(42.9)	3(42.9)	0(0)	1(14.3)
There is no stereotyping in my class.	2(28.6)	2(28.6)	0(0)	3(42.9)
I enjoy teaching learners with visual impairment in my class.	4(57.2)	1(14.3)	1(14.3)	1(14.3)
Some parents are not happy that their sighted children are learning in the same class with visually impaired children.	1(14.3)	1(14.3)	4(57.1)	1(14.3)
Most parents are not concerned with the integrated programme in the school.	2(28.6)	1(14.3)	3(42.9)	1(14.3)
In my opinion, visually impaired learners would benefit more from residential schools for the blind.	1(14.3)	2(28.6)	1(14.3)	3(42.9)
Learners with visual impairment throw tantrums in class when they are not picked to answer questions.	0(0)	2(28.6)	3(42.9)	2(28.6)
Most of the visually impaired learners in class show some withdrawal symptoms.	2(28.6)	4(57.1)	1(14.3)	0(0)

This study sought to establish the socio-cultural factors influencing inclusive education. Some of the statements were given to respondents who in turn were supposed to indicate whether they strongly Agreed, Agreed, Disagreed or Strongly Disagreed. The findings in table 1 above indicate that all the teachers sampled were of the view that inclusive education is a good idea, and 6 (85.7%) agreed that learners without visual impairment have positive attitudes towards friendship with their classmates who are visually impaired. Another 6 (85.7%) agreed to the statement that most of the learners with visual impairment show some withdrawal symptoms in class. It was noted by California Research Institute (1992) that general education students developed more positive friendships with their classmates with disabilities. Research by Walsh (1994), Vaughn & Klingrer (1998) indicates present mixed picture. Five (71.5%) of them indicated that they treat all learners equally, indicating that the teachers are positive about schooling of the learners with visual impairment, 3 (42.9%) were for the opinion that most parents are not concerned with this arrangement. The findings are in agreement with Mpofu (1999) who observed that parents or guardians were marginally involved in the schooling of their children with disabilities. This shows that as per the teachers' views, most parents are concerned about inclusive education.

Students views on Socio-cultural factors

The study also sought to determine the socio-cultural views of pupils with sight. Table 2 below represents the summary of the outcome.

Table 2: Socio-cultural factors as per views from pupils with sight

Statements	SA (%)	A (%)	D (%)	SD (%)
I have friends who are visually impaired.	35(87.5)	3(7.5)	0(0)	2(5.0)
I play with learners with visual impairment	29(72.5)	8(20.0)	1(2.5)	2(5.0)
Learners with visual impairment disturb us in class.	2(5.0)	4(10.0)	3(7.5)	31(77.5)
I hate learners with visual impairment.	0(0)	0(0)	2(5.0)	38(95.0)
My parents allow me to play with children with disabilities at home.	32(80.0)	4(10.0)	1(2.5)	3(7.5)
I like engaging in various group activities with learners with visual impairment.	31(77.5)	7(17.5)	0(0)	3(7.5)
I enjoy learning with learners with visual impairment in my class.	34(85.0)	5(12.5)	0(0)	1(2.5)
Learners with visual impairment disturb teachers in class.	2(5.0)	5(12.5)	4(10.0)	29(72.5)
Learners with visual impairment should have their own school.	1(2.5)	4(10.0)	2(5.0)	33(82.5)
Learners with visual impairment throw tantrums over small issues in class and even during play.	1(2.5)	1(2.5)	15(37.5)	23(57.5)

According to the responses in table 2, all pupils without visual impairment did not agree with the statement that they hate learners with visual impairment. Majority, 39 (97.5%) agreed that they enjoy learning with learners with visual impairment in class, 38 (95%) of the pupils agreed that they had friends who were had visual impairment, another 37 (92.5%) indicated that they play with them. Others 36 (90%) agreed that their parents allow them to play with children with disabilities at home while a further 34 (85%) indicated that they liked carrying out group activities with learners with visual impairment. A further 33 (82.5%) of the pupils disagreed to the statement that learners with visual impairment disturb teachers in class. The above indicate that pupils without visual impairment have positive attitude towards inclusive education. These findings are in agreement with York et al., (1992) who indicated that students believed that inclusion was a good idea.

Table 3: Socio-cultural factors as per views from pupils with Visual Impairment

Statements	SA (%)	A (%)	D (%)	SD (%)
Pupils in my class are friendly.	12(100.0)	0(0)	0(0)	0(0)
I hate students in my class.	6(50.0)	0(0)	3(33.3)	2(16.7)
Students in my class are supportive.	6(50.0)	6(50.0)	0(0)	0(0)
I prefer working alone in class.	11(91.7)	1(8.3)	0(0)	0(0)
Students in my class do not like supporting VI learners.	6(50.0)	3(25.0)	2(16.7)	1(8.3)
My parents allow me to play with my friends who are sighted.	12(100)	0(0)	0(0)	0(0)
My neighbors do not allow their children to play with me.	3(25.0)	2(16.7)	0(0)	7(58.3)
I hate my neighbours at home.	2(16.7)	0(0)	0(0)	10(83.3)
My parents do not allow me to eat in the presence of visitors at home.	2(16.7)	0(0)	0(0)	10(83.3)
My parents are happy with my school.	12(100.0)	0(0)	0(0)	0(0)
My parents help me with my homework.	10(83.3)	0(0)	0(0)	2(16.7)
My parents ensure that I come to school early.	12(100.0)	0(0)	0(0)	0(0)

Pupils with visual impairment were also given statements related to the socio-cultural factors. This information is summarized in table 3 above. All pupils with visual impairment agreed to the following statements; that their peers were friendly, their parents are happy about their school and that their parents allow them to play with their peers who are sighted. Also, all pupils with visual impairment agreed that they prefer working alone in class while a further 9 (75%) indicated that pupils in class do not like supporting learners with visual impairment. This shows that although learners with visual impairment agreed that pupils in class are friendly, they did not support them in class, which makes them prefer working alone. These findings are in agreement with Walsh (1994); Vaughn and Klingrer (1998) who indicated that the personal accounts of students with disabilities with an aspect to their experiences in general educational settings present a mixed picture. Some reported that life in the mainstream was characterized by fear, frustration, ridicule and isolation while others saw placement in general education as the defining moments in their lives in terms of friendship, intellectual challenges, self-esteem and success in careers.

Role of the Ministry of Education in Addressing the Attitudes Portrayed by Learners in Integrated Programmes towards Inclusive Education

The four officers from the Ministry of Education interviewed were of the opinion that the learners in integrated educational programmes in Kenya seem to be appreciating the programme. However, the officers noted lack of adapted curriculum; lack of training in special needs education by all educational personnel and lack of full involvement by all stakeholders on matters concerning changes in education sector were cited as possible challenges facing the implementation of inclusive education in Kenya. The officers also suggested refresher courses in SNE, provision of instructional learning materials, and involvement of all stakeholders in decision-making as possible suggestions for successful implementation of inclusive education in Kenya.

Challenges Experienced by the Ministry of Education in Addressing the Issue of Attitudes in Schools

The following are the challenges the Ministry officials face:

i) The system of examination, which currently emphasizes the use of the mean score type of grading in school. This practice is not in favor of inclusive education as many headteachers decline to admit learners with special needs in their schools feeling that their presence will negatively affect the school mean score in national examination grading.

ii) Lack of enough trained teachers in special needs education that would provide support to learners with special needs in the regular schools. Most teachers in regular schools have not been trained to work with learners with diverse needs. Trained teachers are always more positive in the implementation of inclusive education than non-trained teachers.

iii) The curriculum used in ordinary regular schools is rigid and overloaded and does not take care of the individual needs of learners with special needs.

iv) The teacher-learner ratio has gone up following the provision of free primary education since 2003. Inclusive education would make extra demands on teachers who are already finding it difficult to cope with their teaching loads considering the fact that schools are understaffed.

v) Lack of barrier free facilities; schools are inaccessible to learners with special needs in terms of desks, toilets, doors, curriculum and paths.

Summary

It was noted that all teachers sampled were of the view that inclusive education is a good idea. Their concern was that most parents of children with disability were not concerned with the children at school. The studies revealed that learners without visual impairment had positive attitudes towards friendship with visually impaired learners. Training of teachers is an essential factor towards inclusion of learners with special needs. Most of the teachers were of the opinion that the training they got did not adequately prepare them to meet the educational needs of learners with disabilities. This implied that teacher training in special needs education poses a possible challenge to them; this could consequently influence their attitude towards inclusive education in that they could feel inadequate to handle learners with visual impairment. The officers interviewed from the

Ministry of Education were of the opinion that learners in integrated educational programmes seemed to enjoy the arrangement. Further, the officers noted lack of adapted curriculum; lack of training in special needs education by all education personnel and lack of full involvement by all stakeholders in matters concerning changes in education sector were cited as possible challenges facing the implementation of inclusive education in Kenya.

Conclusion

The study came up with the following conclusions:-

- Sighted learners are friendly to learners with visual impairment but not supporting them in classwork; they prefer working alone.
- Learners with visual impairment prefer female teachers to male teachers.
- Training teachers is essential for successful implementation of inclusive education
- Creating awareness and sensitizing the community concerning inclusive education.
- There is need to make the school environment and syllabus more adaptable to learners with visual impairment.
- There is need to sensitize school community on the importance of inclusive education.
- There is need for serious involvement of all stakeholders in decision- making for successful implementation of inclusion in Kenya.

Recommendations

- Sensitization should be done in schools and the community to eliminate negative attitudes towards inclusion.

- The government should ensure that more teachers are trained in Special Needs Education (SNE) especially the headteachers.

- The Ministry of Education through Kenya Institute of Curriculum Development should assist the schools to acquire appropriate resources and other teaching and learning materials for learners with visual impairment through funding.

- Involvement of all stakeholders in decision-making for successful implementation of inclusive education in Kenya.

References

Agbenyega, J.S. & Deppler, J. Harvey, D. (2005). Attitudes towards inclusive education in Africa scale (ATIA): An instrument to measure teachers' attitudes towards inclusive education for students with disabilities. Journal of Research and Development in Education, 5 (1-5).

Avoke, M. (2002). Models of disability in the labelling and attitudinal discourse in Ghana. Disability and Society, 17(7), 769-777.

Hanson, M., Lynch, E; & Wayman, K. (1990). Honoring the cultural diversity of Families when gathering data. Topics in Early Childhood Special Education, 10 (1) 112 – 131.

Linan-Thompson, S. & Jean, R. (1997). Completing the parent participation puzzle: Accepting diversity. Teaching Exceptional Children 30 (2), 46 – 50.

Mpofu, E. (1999). Social acceptance of early adolescence with physical disabilities. Unpublished doctoral dissertation University of Wisconsin-Madison, Madison, WI.

Ndurumo, M. M. (1993). Exceptional children; Developmental consequences and Intervention. Nairobi: Longman Kenya Ltd.

Payne, J.S. & Thomas, C. (1978). The mentally retarded. Columbus, OH: Menrill.

Randiki F.O. (2002). Module on historical development of special needs education, Kenya Institute of Special Education.

Turnball, A; & Turnball, H. (2001). Families, professionals and exceptionality: A special partnership (4th Ed.) Upper Saddle River, NJ: Prentice-Hall.

Vaughn, S. & Klingner, J. (1998). Students' perceptions of inclusion and resource room settings. The Journal of Special Education. 32(2), 78-88.

Walsh, R. (1994). Making the journey to communication with assistive technology. Exceptional parents, 24(11), 34-41.

York, J., Vanercook, T., Macdonald, C. Helse-Neff, C. & Caughey. E., (1992). Feedback about integrating middle school students with severe disabilities in general education classes. Exceptional Children, 58(3), 244-258).

JOB SATISFACTION TRENDS AMONG STAFF IN MIDDLE LEVEL COLLEGES: THE CASE OF KENYA TECHNICAL TEACHERS' COLLEGE

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Abstract

This is a follow up of the tracking study conducted at Kenya Technical Teachers' College at the beginning of the 2011/2012 financial year. The data for this survey was collected at the end of the financial year 2011/2012 and the report compiled in July 2012. This survey was tailored to establish the changes that may have taken place in job satisfaction as perceived by the staff by the end of the financial year. The main objectives of the survey were to establish the job satisfaction index in the current financial year, compare the job satisfaction index with the previous years and establish the areas that needed to be improved and those that needed to be maintained.

The design of the study was a complete replication of the tracking survey hence a replication of the baseline study. Basically, this was a descriptive survey involving drawing of comparisons with results of four financial years. The target population was mainly teaching staff numbering 116 and support staff numbering 232. A stratified proportionate random sampling technique was used for selection of respondents. The departments were used as a basis for stratification. The instrument used was a self -administered questionnaire. The questionnaire contained closed ended items and most of them were rating items of the Lickert type. The results indicated that at the end of the financial year, the staff rated their job satisfaction at 56.76%. The change from the previous year was found to be +1.67%. The teaching staff perceived a higher job satisfaction level than the non-teaching staff as compared to the previous year. The work environment is perceived favorably by both the teaching and non-teaching staff. The elements highly rated in the favorable direction were in the realm of recognition for work well done for both and specifically the role of the trade union for the non-teaching staff. The elements least rated have a bearing on salaries and allowances. The results generated a safe conclusion that the college staffs have a favorable attitude towards their jobs but more strategies are needed for

improvement. Specific recommendations and an implementation matrix is drawn with a view to improve job satisfaction levels among staff at Kenya Technical Teachers College

Introduction

This article is based on studies conducted in the years 2009, 2010, 2011 and 2012. The first one was a base line survey while the subsequent were follow-ups. The purpose in focus was the measurement of job satisfaction among the teaching and non-teaching staff at the Kenya Technical Teachers College.

The Kenya Technical Teachers College (KTTC) opened in 1978. The Education Act Cap 211 (revised 1980) and Legal notice No.242 of 1978 mandates KTTC to train technical teachers for all technical training institutions in Kenya. The College trains students at higher diploma, Diploma and Certificate levels. It has a current workforce of 116 teaching and 232 non-teaching staff with a student population of 2000.

1.1 The concept of Job Satisfaction

Job satisfaction describes how contented an individual is with his or her job. The happier the people are within their job, the more satisfied they are said to be. The methods of enhancing job satisfaction include job rotation, job enlargement and job enrichment. Other influences on satisfaction include the management style and culture, employee involvement, empowerment and autonomous work groups. Job satisfaction is a very important attribute which is frequently measured by organizations. The most common way of measurement is the use of rating scales where employees report their reactions to their jobs. Questions relate to rate of pay, work responsibilities, variety of tasks, promotional opportunities, the work itself and co-workers. Weiss (2002), has argued that job satisfaction is an attitude but points out that researchers should clearly distinguish the objects of cognitive evaluation which are affect (emotion), beliefs and behaviors. This definition suggests that we form attitudes towards our jobs by taking into account our feelings, our beliefs, and our behaviors.

The concept of job satisfaction cannot be explained in isolation of motivation. Maslow (1954) suggested a hierarchy of needs, which progress upwards. Once individuals have satisfied one need in the hierarchy, it ceases to motivate their behavior and they are motivated by the need at the next level up the hierarchy. Other scholars who have documented issues on job satisfaction include Alderfer (1972), Mumford (1976), Hertzberg (1959), Adams (1965), Vroom's (1964), Guirdham (1995) and Locke (1968).

Hackman and Oldham (1975) suggested that jobs differ in the extent to which they involve five core dimensions: 1) Skill variety, 2) Task identity, 3) Task significance, 4). Autonomy and 5) Task feedback. They suggest that if jobs are designed in a way that increases the presence of these core characteristics, three critical psychological states can occur in employees: 1) Experienced meaningfulness of work, 2) Experienced responsibility for work outcomes and 3) Knowledge of results of work activities.

According to Hackman and Oldham, when these critical psychological states are experienced, work motivation and job satisfaction will be high. In a nutshell, important factors conducive to job satisfaction include mentally challenging work, equitable rewards, supportive working conditions, and supportive colleagues. Commitment to and involvement with the organization and the actual job are also factors.

There are many methods for measuring job satisfaction. By far, the most common method for collecting data regarding job satisfaction is the Likert scale. Other less common methods of gauging job satisfaction include: Yes/No questions, True/False questions, point systems, checklists, and forced choice answers. The **Job Descriptive Index (JDI),** created by Smith, Kendall, & Hulin (1969), is a specific questionnaire of job satisfaction that has been widely used. It measures one's satisfaction in five facets: pay, promotions and promotion opportunities, coworkers, supervision, and the work itself. The scale is simple, participants answer either yes, no, or can't decide (indicated by '?') in response to whether given statements accurately describe one's job. The **Job in General Index** is an overall measurement of job satisfaction. It is an improvement to the Job Descriptive Index because the JDI focuses too much on individual facets and not enough on work satisfaction in general.

For purposes of this study, the following components of job satisfaction formed critical variables for investigation:

a) Salary / wages and benefits

b) Compensation / allowances

c) Welfare services

d) Recognition

e) Performance evaluation

f) Labor relations

g) Work environment in terms of:

i) Ergonomics (physical environment)

ii) Resources for performing work

iii) Work content

iv) Autonomy on work performance

v) Communication

1.3 Objectives of the study

The following objectives were set to guide the study

1. To establish the job satisfaction index for the KTTC staff in the financial year 2011/2012
2. To compare the current job satisfaction index with for the previous three financial years
3. To establish perceived areas of that need improvement

1.4 Rationale for the survey

The Kenya Technical Teachers College has a 5year strategic plan that it intends to successfully implement. The college management also signed performance contracts with the Ministry of Higher Education Science and Technology for the financial years 2008/209, 2009/2010, 2010/2011 and 2011/2012. The college management looks forward to signing the performance contract for the financial year 2012/2013. The implementation process of the said documents is carried out by human resources identified with KTTC. Achievement of the strategic objectives requires a committed workforce. The workforce can only be committed if they have a favorable perception about their jobs. The baseline survey on the job satisfaction conducted at the beginning of the financial 2009/2010 informed the college management on the areas of weakness that required improvement and those areas that needed to be maintained. The tracking survey revealed that indeed there was improvement. For maintenance and continual improvement the tracking survey recommended strategies that were to be implemented. It becomes prudent that the strategies put in place are re-evaluated to determine the extent of satisfaction achieved by the employees in the fourth year following the implementation of the performance contract. The college therefore, requires an accurate measure of the current job satisfaction perception so that strategies can be put in place for continuous improvement and hence tapping the maximum from the human resources for further development of the college. In addition, the government has recognized the value of organizations understanding where they are so that they can chart out their destiny. This is evidenced by the requirement in the performance contract that this study shall be conducted

2.0 Methodology

This was mainly a descriptive survey. The design used during the baseline and tracking surveys is replicated. The fact that this is a follow up of three surveys in a way it is intended to establish trend formation. In that respect the cumulative cross sectional surveys qualify attainment of a longitudinal survey. The variables considered critical to job satisfaction among the teaching and non-teaching staff formed a basis for determination of their status and subsequent description. The same factors will anchor future studies to determine any changes that will have occurred after introduction of interventions by the end successful financial years

2.2 Target population

The target population was mainly the staff in KTTC. Staff in this case refers to the teaching and non-teaching workforce. The staff returns record to the Teachers Service commission indicates that the teaching staffs were 116. The records from the registrars' office indicate that there is a total of 232 Board of Governors staff.

The total number of both the teaching and non-teaching staff of 348 is considered fairly large. For reasons of cutting down on costs it was considered necessary to sample. A stratified proportionate random sampling technique was used. A sample size of 50% for each of the respective categories was considered ideal. The stratification criteria used was on the basis of departments for both teaching and non teaching staff.

2.2 Instruments

The instruments used during the previous survey were administered without any alteration. However, there was an addition of one open ended item. This item was intended to capture opinions to enrich the qualitative aspects of the study. The fact that the teaching staff and the non-teaching staff do not perform exactly similar duties, different instruments was initially developed for the two groups. Each instrument was tailored in language and content to fit the respective category. The fact that the instruments had been used before, it did not necessitate their piloting. They contained closed ended items especially those generating the background data and the Likert type of rating scale items for obtaining the opinion of the staff on a 5-point scale. The instrument for teaching staff has 5 items for generation of respondent background data and 79 other rating scale items. The instrument for the Board of governors' staff has 5 items for generation of respondent background data and 67 other rating scale items. Both instruments are tailored to obtain data on work environment as well as job satisfaction.

The positive statements in the 5 point rating scale are scored in increasing points from strongly disagree at 1 point to strongly agree at 5 points. The negative statements are scored in the reverse order. Strongly disagreeing with a statement is equivalent to rating the component or sub component of job satisfaction as very poor or strongly agreeing being equivalent to a rating of very good. Intermediates hold true in either case.

2.2 Data Analysis Procedure

Job satisfaction is expressed as an index. This index is in a form of a percentage (x%). The software SPSS version 17.0 was used for data analysis. Descriptive statistics were largely used and mainly the means were generated. The mean responses were converted to percentages to obtain the overall satisfaction index and the individual component indices. Averages of the means are done for the teaching and non-teaching staff to obtain the overall composite index of job satisfaction for all staff. It is important to note that items with no responses were treated as missing values; apparently they are not included in computation of means. This minimizes the vulnerability of extreme low score effect on the resultant means. The respective indices obtained were then compared with those of the previous surveys and explanations offered. There are arguments on the weight that each component should contribute to the composite job index. For purposes of this study and considering other expert views, the weights were assigned as shown in table 3.1.

3.0 Results

The purpose of this survey was to obtain an index of job satisfaction as perceived by the KTTC staff in the financial year 2011/2012. This index is a measure expressed as a percentage (x%). The job satisfaction index for the year 2011/2012 computed is then compared with known values of three previous financial years. Subsequently, evidence for the measure is provided on the various variables of job satisfaction.

The response rate from the questionnaires issued was 71.8%, which is considered reasonable for reliable findings.

3.1. The Job Satisfaction Index at KTTC in July 2012

The index presented in this section represents the perception the teaching and non-teaching staff had on their jobs at the end of the 2011/2012 financial year. There were 7 components, which were used to compute the overall rating of the KTTC staff job satisfaction index (see table 3.1).

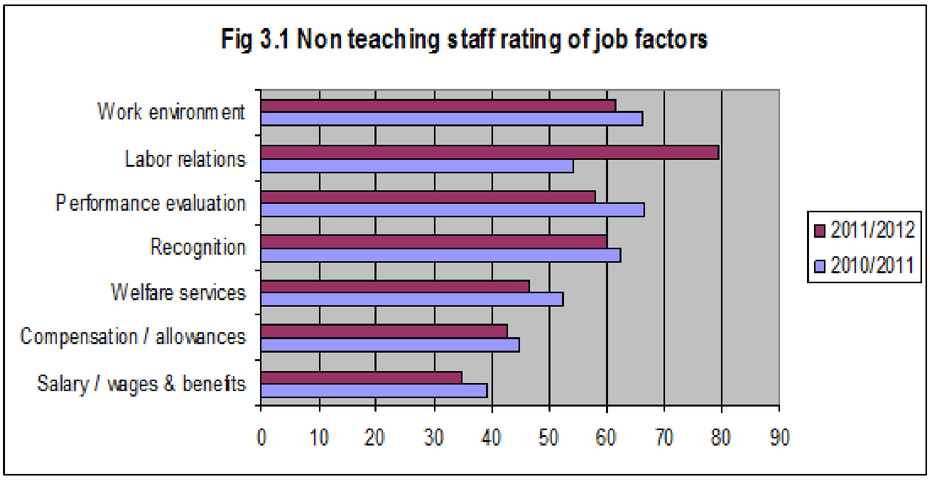
The work environment component has a significant number of variables and hence a weight proportionate to its contribution was assigned in the computation of the index (see table 2.1 and table 3.1). The corporate job satisfaction index is worked out as an average of the summation of the weighted averages of the job satisfaction levels for the teaching and non-teaching staff across the identified variables.

The average rating by the teaching staff is 60.71%. The average rating by the non-teaching staff is 52.8%. These two figures when averaged give the KTTC staff job satisfaction index of 56.76%.

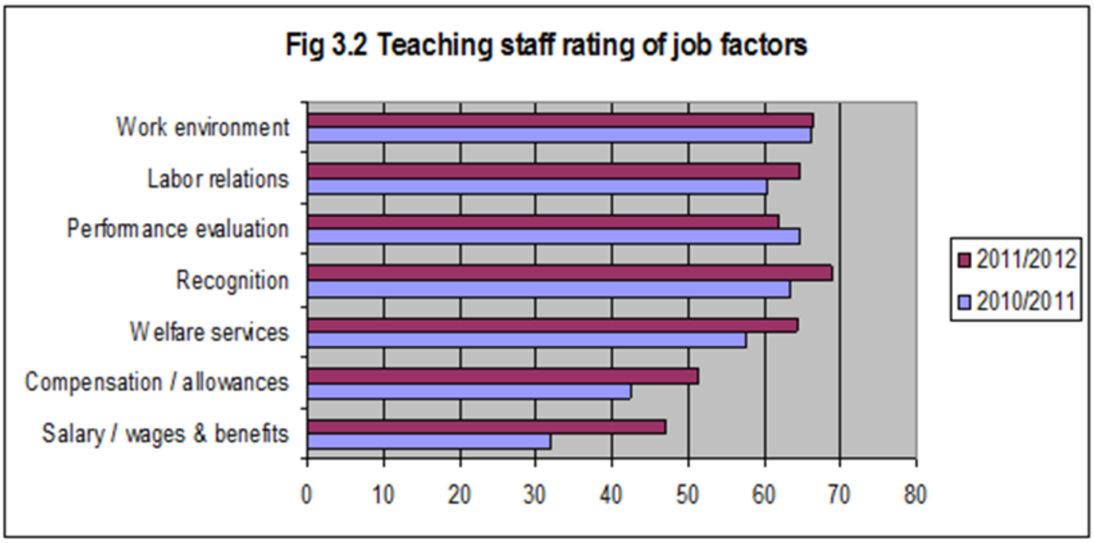
Table 3.1 Job satisfaction weighted rating for teaching and non-teaching staff

Job satisfaction Component	Weight %	BOG Score %	BOG Weighted score %	Teachers score %	Teachers weighted score %
i) Salary / wages & benefits	25	34.8	8.7	47	11.75
ii) Compensation / allowances	10	42.8	4.28	51.47	5.15
iii) Welfare services	5	46.53	2.33	64.27	3.21
iv) Recognition	5	60	3	68.8	3.44
v) Performance evaluation	5	58	2.9	61.9	4.00
vi) Labor relations	5	79.4	3.97	64.8	3.24
vii) Work environment	45	61.39	27.63	66.48	29.92
Total	100		52.8		60.71
Corporate Average	56.76				

When comparing the rating of the job factors among the non-teaching staff, the data reveals areas that have improved and those that have declined. This is presented in figure 3.1. It is evident that the role of the trade union is perceived more positively in 2011/ 2012 than the previous year.



There is a marked contrast in the pattern of rating of the job factors by the teaching staff (see fig. 3.2). The teaching staffs perceive nearly all the job factors to have improved from the previous year. The highest rated factor is recognition for the work well done by the supervisors. The performance evaluation factor with respect to how it is done and the utilization of the results has dropped.



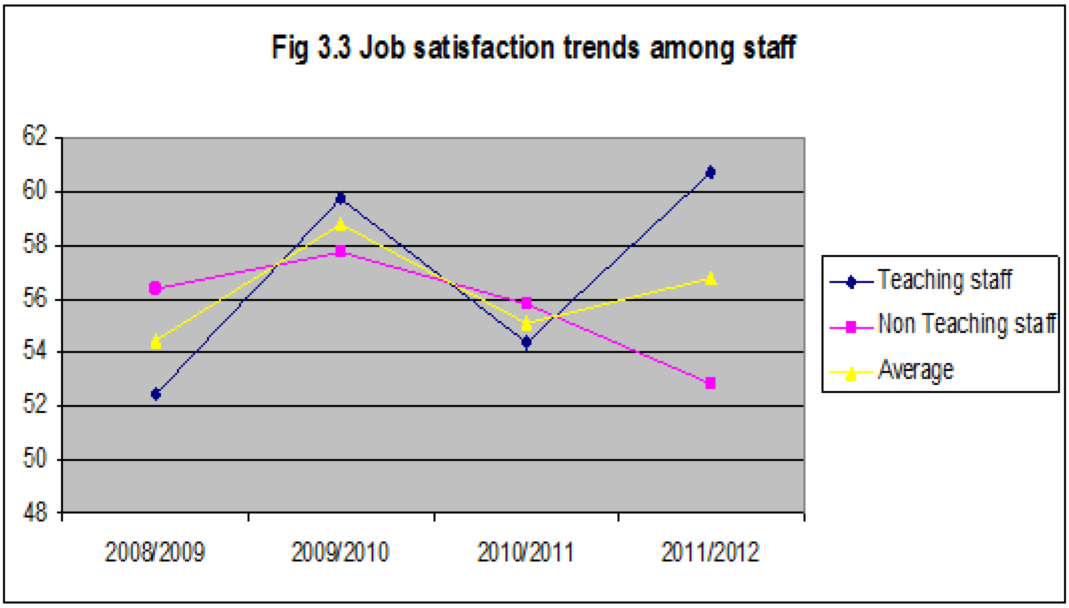
3.1.1 Trend of Job satisfaction 2008 – 2012

The job satisfaction indices for the past four financial years are presented in table 3.2.

Table 3.2 Trend of job satisfaction among staff at KTTC

Staff Category	Financial year			
	2008/2009	2009/2010	2010/2011	2011/2012
Teaching staff	52.46	59.77	54.35	60.71
Non Teaching staff	56.38	57.72	55.83	52.8
Average	54.42	58.75	55.09	56.76

As shown in table 3.2, there is an improvement in job satisfaction from the previous year. The trends among teachers are not predictable owing to the fluctuations exhibited through the financial years. The trend for the non-teaching staff is consistently declining.



3.2 Job Satisfaction Factors

Analyses of specific elements influencing the job satisfaction index are presented in this subsection. The specific elements on rewarding human resources, labour relations, and recognition are ranked in terms of the average of responses and presented in one subheading. The elements on work environment are analysed separately.

3.2.1 Rewards and Labour Relations

These factors account for explaining 55% of the job index. The factors as perceived by the teaching staff are presented in table 3.3

Table 3.3 Teachers rating of job satisfaction elements

Job satisfaction element	N	Mean	%	Std. Dev
Appreciation of KTTC housing facility	34	3.53	70.6	1.080
Recognition for work well done by supervisors	36	3.44	68.8	.877
Methods of performance evaluation	37	3.32	66.4	.915
Staff relaxation facilities	27	3.26	65.2	1.095
Rating of teachers trade union	37	3.24	64.8	.983
Use of performance evaluation results	39	2.87	57.4	1.056
Maintenance of assigned college house	33	2.85	57.0	1.149
Satisfaction with TP allowance	35	2.74	54.8	1.039
Fairness of CEP* payments	40	2.63	52.6	1.102
Satisfaction with TSC salary	40	2.35	47.0	1.312
Satisfaction with TSC allowances	40	2.35	47.0	1.312

* CEP refers to Continuing Education / Parallel programmes

The elements below the average index of 55.09 (the average index of the previous year) need to be addressed if the job satisfaction index has to be raised. As given in the table from the point of the teaching staff, these are mainly:

a) Satisfaction with TP allowance

b) Fairness of CEP payments

c) Satisfaction with TSC salary

d) Satisfaction with TSC allowances

The above factors are under the control of the college management. However, salaries and allowances are a matter of concern to the teaching staff but beyond the control of the KTTC management. The data on the responses of the non-teaching staff is presented in table 3.7

Table 3.7 Non-teaching staff rating of job satisfaction elements

Job satisfaction element	N	Mean	%	Std. Dev
The workers union	68	3.97	79.4	1.159
Use of performance evaluation results	71	3.18	63.6	1.302
Level of recognition for work well done by supervisors	77	3.00	60.0	1.338
Methods of performance evaluation	74	2.62	52.4	1.290
Quality of staff relaxation facilities	76	2.37	47.4	1.069
Maintenance of college assigned house	65	2.31	46.2	1.198
Appreciation of KTTC housing facility	70	2.30	46.0	1.244
Fairness of CEP payments	74	2.28	45.6	1.298
Satisfaction with college allowances	70	2.00	40.0	1.251
Satisfaction with the salary	74	1.74	34.8	1.048

The factors that have been rated below 50% on the part of the non-teaching staff are:

a) Satisfaction with the salary

b) Satisfaction with college allowances

c) Fairness of CEP payments

d) Maintenance of college assigned house

e) Quality of staff relaxation facilities

3.2.2 Work environment

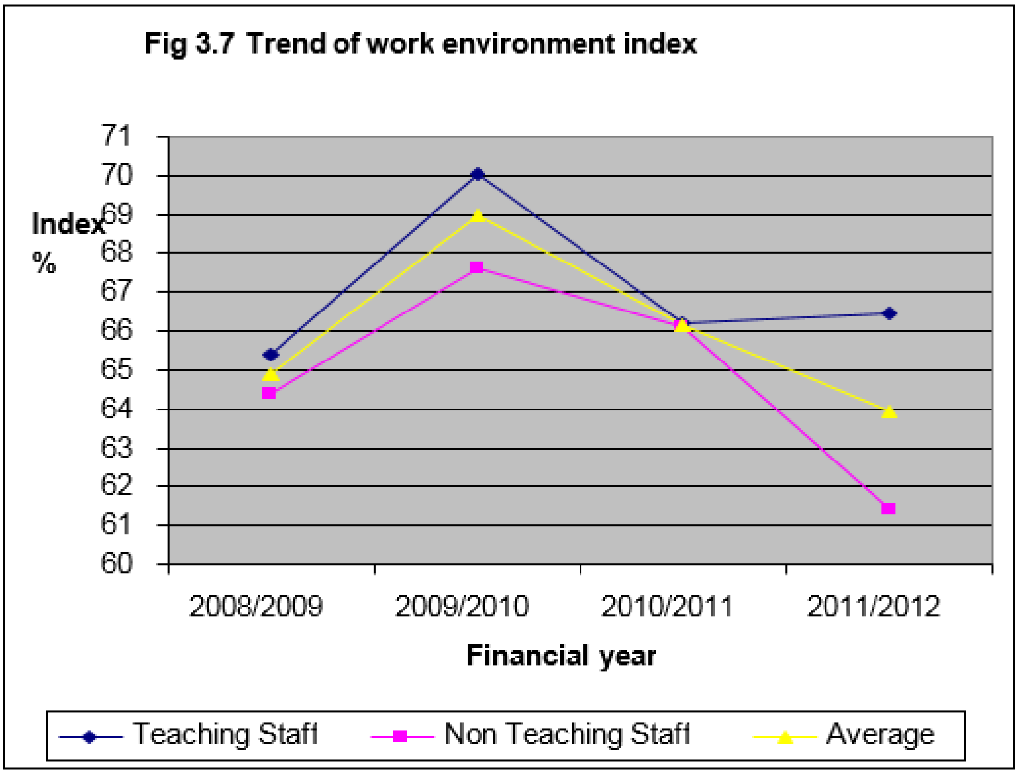
The index presented in this section represents the perception the teaching and Non-Teaching Staff had on the work environment at the end of the 2011/2012 financial year. There are 9 components, which have been used to compute the overall rating of the KTTC work environment. The components of concern are mainly: Ergonomics (physical environment), resources for performing work, work content, autonomy, communication, supervision & leadership, team work, protection (health, safety and security) and development of the human resources.

The average rating by the Teaching Staff is **66.48%.** The average rating by the Non-Teaching Staff is **61.39%.** These two figures when averaged give the KTTC work environment index of **63.94%.**

The work environment indices for the past three financial years are presented in table 3.8. The trend formation is illustrated in figure 3.7

Table 3.8 Trend of rating work environment among Staff at KTTC

Category of staff	% Rating in each financial year			
	2008/2009	2009/2010	2010/2011	2011/2012
Teaching Staff	65.40	70.04	66.20	66.48
Non Teaching Staff	64.40	67.60	66.10	61.39
Average	64.90	69.00	66.15	63.94



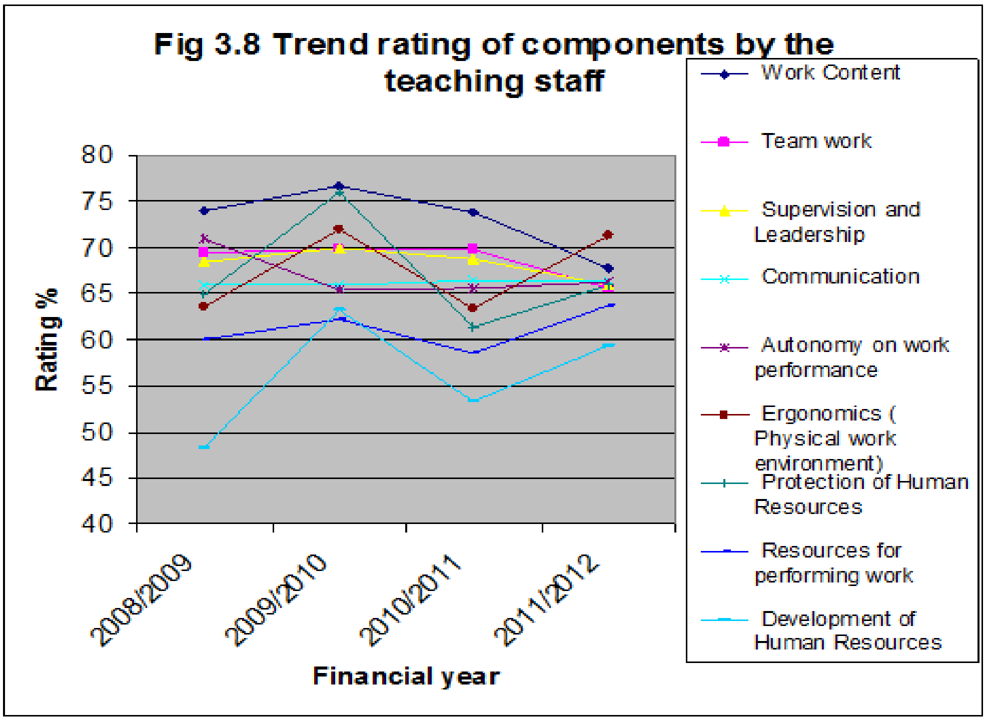
The data indicates an over all drop in the work environment index. Where as teaching staff perceive the work environment to be slightly improving, Non Teaching Staff perceive a higher deterioration in the work conditions. The rest of the sections in this chapter explore the specific components that have gained or decreased and a probe to specific elements is attempted.

The individual work environment components are presented and discussed in this section. Some of the components were rated by use of multiple items in the developed instrument. For more articulation, some of the work environment components are further broken down into sub components. The rating of the components as perceived by both the teaching and non-teaching staff is presented in table 3.9 and 3.10 respectively. A comparison is given for the baseline and tracking surveys.

Table 3.9 Rating of work environment components by the Teaching Staff

SNo.	Component of the work environment	Rating (%)			
		2008/ 2009	2009/ 2010	2010/ 2011	2011/ 2012
1	Ergonomics (Physical work environment)	63.6	72.0	63.4	71.23
2	Work Content	73.9	76.6	73.8	67.66
3	Communication	65.9	65.9	66.4	66.34
4	Autonomy on work performance	71.0	65.4	65.5	66.3
5	Protection of Human Resources	64.8	75.9	61.4	65.95
6	Supervision and Leadership	68.4	69.9	68.7	65.82
7	Team work	69.4	69.8	69.8	65.6
8	Resources for performing work	60.05	62.2	58.5	63.67
9	Development of Human Resources	48.3	63.2	53.2	59.4

The trends that have formed in the three successive years are presented as perceived by the Teaching Staff in figure 3.8

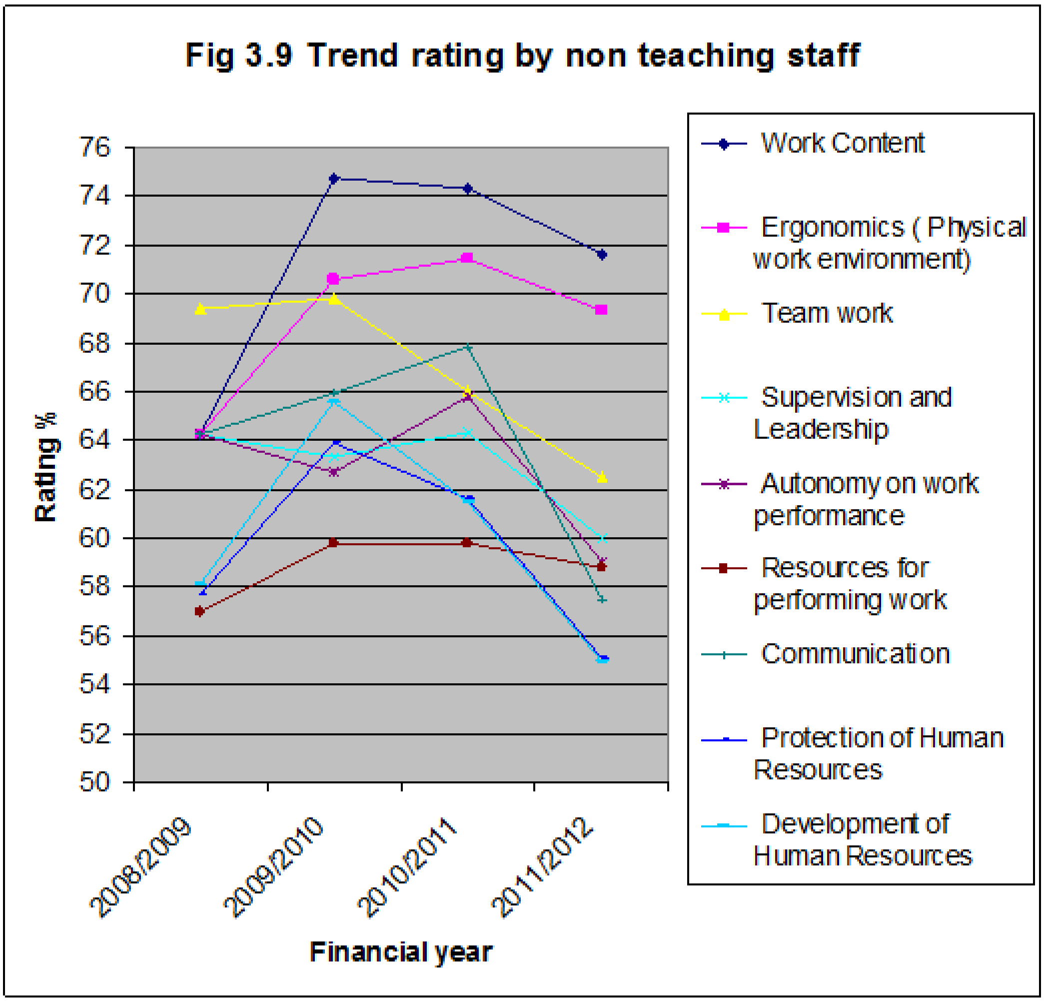


It is evident that some components have been rated a value below the base line (2008 /2009). This is the case for work content, autonomy on work performance, supervision and leadership. There is a remarkable improvement in 5 out of the 9 components as compared to the previous financial year. The areas of improvement are mainly the physical work environment, Protection of Human Resources, Resources for performing work and development of human resources. The areas of greatest challenge as compared to the previous financial year are mainly: Supervision & leadership, the work content and teamwork.

For the case of the non-teaching staff, the data on the trend of rating on the work environment components is presented in table 3.10 and fig. 3.9

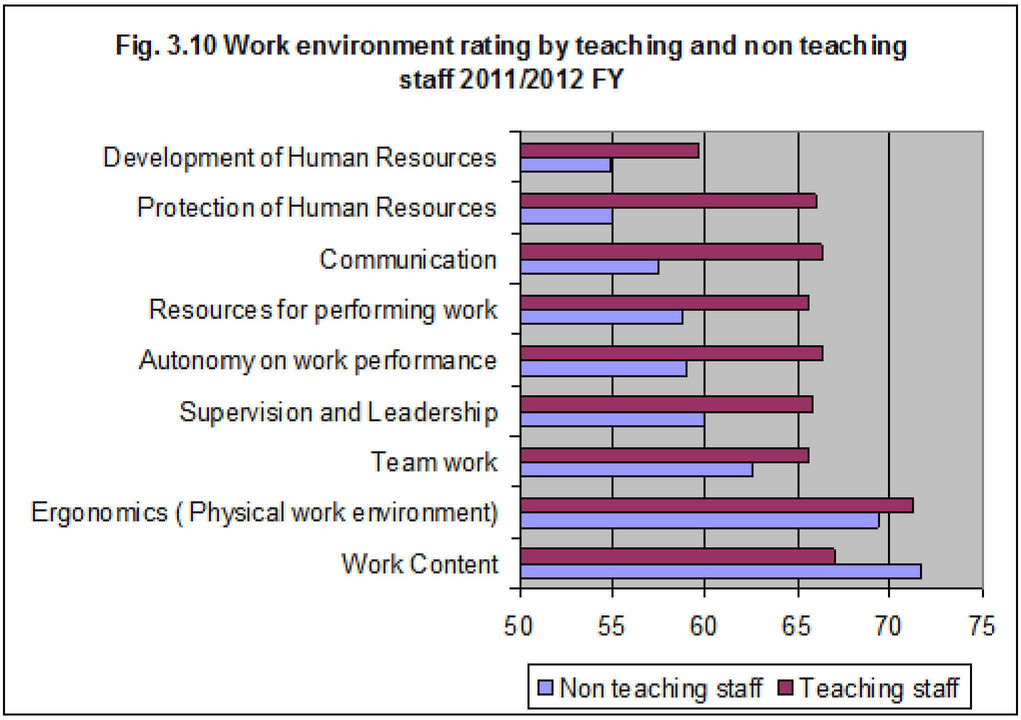
Table 3.10 Rating of work environment components by non-teaching Staff

SNO.	Component of work environment	Rating %			
		2008/ 2009	2009/ 2010	2010/ 2011	2011/ 2012
1	Work Content	64.2	74.7	74.3	71.6
2	Ergonomics (Physical work environment)	64.2	70.6	71.4	69.33
3	Team work	69.4	69.8	66.0	62.5
4	Supervision and Leadership	64.2	63.3	64.3	60.0
5	Autonomy on work performance	64.2	62.7	65.8	59.0
6	Resources for performing work	57.0	59.8	59.8	58.80
7	Communication	64.2	65.9	67.8	57.5
8	Protection of Human Resources	57.7	63.9	61.6	55.04
9	Development of Human Resources	58.1	65.6	61.5	54.96



The data presented in fig 3.9 indicates a downward perception in the work environment by the non-teaching staff. All the components of the work environment are rated lower than they were in the previous year. There are only 3 components that have been rated higher as compared to the baseline financial year. These are mainly: the physical work environment, work content Resources for performing work.

A comparison of the work environment components for the teaching and non-teaching staff for the financial year 2011/2012 is shown in figure 3.10. It is observed that development of the human resources is the biggest challenge for both the teaching staff and the non-teaching staff. The physical work environment component ranks highest for both teaching and non-teaching staff. It is safe to conclude that the teaching staffs have a relatively more favorable perception of the work environment.



The analysis so far presented is general in nature capturing the rating of the work environment by teaching and non-teaching staff. It is understood that the college is organized on the basis of departments. The question arises: are the departments rating the various work environment components in the same way? The details called for in this respect are beyond the scope of this paper.

4.0 Conclusion and Recommendations

The findings arrived at in the previous section have been used as a basis for drawing the conclusion for this study. The findings are also a springboard for the recommendations and the suggestions for a programme of action for sustaining and improving job satisfaction at KTTC.

Conclusion

The over all job satisfaction indexes at KTTC in the financial year 2011 / 2012 is at the level of good emerging practices. There is evidence of elements which are excellent and hence the college strengths. There are also areas, which require improvement and hence representing the college weaknesses. This study has revealed the whole spectra of extremes upon which the management can use in improving and sustaining a favorable job satisfaction for the staffs. It has to be noted that the job satisfaction index is a composite. Improving a single or a few elements may not necessarily lead to an over all improvement of the index. This is a lesson learnt from the previous years in relation to the financial year under study.

Recommendations

The recommendations made hereunder are to assist the management in improving job satisfaction. It is important to note that measurement of job satisfaction index is dependent on perceptions that employees have developed over a given period of time. Therefore, involving the employees in understanding what job satisfaction factors the College has chosen to maintain or improve is important in achieving any bench marks that may be set. From the findings it is safe to recommend the following:

a) The college management should benchmark on the extent of improvement or maintenance of job satisfaction desirable for the financial year 2012/2013

b) The human resource function in the college should be re-examined with a view to strengthen it so that human resource issues are continuously appraised as a springboard of creating favorable perceptions among staff

c) A strategy should be developed at corporate level and cascaded to departments so that the areas of weaknesses are addressed

d) Awareness of areas of strengths and good practices be enhanced with a view of maintaining their high status.

References

Åhlberg, M. (1995). "TQM for university level needs attention to neglected processes of quality Learning and quality research", Proceedings of the Seventh International on Assessing Quality in Higher Education, July 1995. Indianapolis, Indiana: Planning and Institutional Improvement, Indiana University-Purdue University Indianapolis.

Brennan J., De Vries P., Williams R. (1997) (Eds.). Standards and Quality in Higher Education. Higher Education Policy Series 37. London: Jessica Kingsley Publishers.

Freed, J.E., Klugman M.R. (1997). Quality Principles and Practices in Higher Education: Different Questions for Different Times. Oryx Press for the American.

Hoffman, A.M, Julius D.J. (Eds.) (1995). Total Quality Management: Implications for Higher Education. Maryville, Missouri: Prescott.

Mwancha, B. (2009). A Baseline Survey of the Work Environment at the Kenya Technical Teachers College. Unpublished Report: Kenya Technical Teachers College – Nairobi.

Mwancha, B. (2010). A Tracking Survey of the Work Environment at the Kenya Technical Teachers College. Unpublished Report: Kenya Technical Teachers College - Nairobi

Ruben, B.D. (Ed.) (1995). Quality in Higher Education. New Brunswick, New Jersey: Transaction Publishers

Sallis, E. (1993). Total Quality Management in Education. Kogan Page Educational Management Series. London: Kogan Page.

INFLUENCE OF SCHOOL FACTORS ON THE ATTITUDE OF STUDENTS AND TEACHERS IN NAIROBI INTEGRATED EDUCATIONAL PROGRAMMES TOWARDS INCLUSIVE EDUCATION

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Abstract

The purpose of this study was to investigate the influence of school factors on the attitude of students and teachers towards inclusive education in Nairobi integrated programmes in Kenya. The participants were full-time students and teachers of Kilimani and Our Lady of Mercy integrated primary schools in Nairobi County. A total of 59 participants participated in the study. Twelve students with visual impairment, 40 sighted learners and seven class teachers. Questionnaires were developed and used as measuring instruments to record their responses. Data were analysed using descriptive statistics. The findings of the study indicated that inclusive schools are considered the best option for educating learners with special needs in education. However, appropriate teaching and learning resources are necessary for effective learning of learners with VI. Also, the topography of the school compound needed to be made inclusive for easy movement of learners with VI. Together with this, more training skills for teachers and learner-friendly curriculum are needed. The results of this study are significant in the sense that the understanding of school factors, which may negatively influence the implementation of successful inclusion, is necessary so that education stakeholders will improve on them and thus allow successful implementation of inclusive education.

Key words: Influence, factors, attitude, students, teachers and inclusive education

Introduction

Research findings from across the globe indicate that, schools and teachers are struggling to respond to the wide array of students. Change is never easy as it involves a process that takes time sometimes up to several years, rather than a single occurrence or event (villa & thousand 1995). It involves more than just programmes, materials, technology or equipment but is primarily about individuals in an established system. It is highly viewed differently by each participant and requires personal growth. Yet change is inevitable when innovative practices demonstrate effectiveness than past services (Ryndax & Alper 1996).

Inclusion implies accommodating the learning environment and curriculum to meet the needs of all students and ensuring that all learners belong to a community. Inclusion or lack of it is also about equity of access to quality education and can be related to aspects of social disadvantage, oppression and discrimination (United Nations Economic and Social Commission for Asia and the Pacific UNESCAP 2002). Unfortunately, many educators have reservations about inclusion or supporting the wide spread placement of students with special needs in general classrooms (Bradshaw, 2003). One of the main factors influencing the successful implementation of any inclusive policy is the positive attitude of teachers (Shades & Stewart, 2000). Teachers' acceptance of the policy of inclusion is likely to affect their commitment to implementing it.

The inclusive education approach draws on the social model in understanding educational difficulties. Children who have impairments may also experience difficulties in education system; they may find some parts of the curriculum difficult to understand, for instance, or no be able to access oral or written instruction, or indeed not able to access school buildings. However, the inclusive education approach suggests that these difficulties cannot be explained simply in terms of children's impairments. Instead, it is the feature of the education system itself- badly designed curricula, poorly –trained teachers, inappropriate, medium of instruction, inaccessible building or whatever- that are creating 'barriers to learning for these children. Under these circumstances, establishing or extending a separate special school sector does nothing to address the barriers that exist in ordinary schools, separates more children from their peers and families and in any case, may be financially non-viable. A more appropriate response is, therefore to understand what the barriers to learning are and to develop ordinary schools, which work towards removing these barriers and are capable of meeting these children's learning needs (UNESCO, 2003).

Walsh, (1994), Vaughn and Klingner (1998) found that the personal accounts of students with disabilities with aspect to their experiences in general educational settings also present a mixed picture. Some students report that life in the mainstream was characterized by fear, frustration, ridicule and isolation while others saw placement in general education as the defining moments in their lives in terms of friendship, intellectual challenges, self-esteem and success in their careers. According to Al-Zyoudi (2006), teaches' attitudes play a considerable role towards the success of inclusive education in Jordan. Female teachers are more positive than male ones. In this case, the attitude of the teachers will considerably affect the attitude of learners towards school and learning.

Educational-environmental related variables in the influence of inclusion are very important to its success. Educational-environmental related variables include materials and physical resources and support for inclusion available for teachers. Availability of support services has consistently been found to be associated with more positive attitudes of inclusion (Janney, 1995; Leroy & Simpson, 1996). Other factors reported to negatively affect inclusion included overcrowded classrooms, lack of pre-prepared time for planning and meeting and inadequate specialist support (Avaramisis, Beybliss & Burden, 2000: Bradshaw, 2003) staff more distant from the classroom (administrators and advisors) expressed more positive attitudes than those closer to the classroom context (teachers). Special education teachers were the most positive, school heads next followed by classroom teachers (Forlin, 1995). Educational-environmental factors are the most frequently mentioned variables that affect inclusion perhaps because they are most obvious and possibly due to a feeling of control by someone.

Schroth, Moorman and Fullwood (1997) suggested that teachers' concerns about moving towards inclusion could be minimized using a number of strategies. They suggested that teachers should be empowered to initiate changes in their lessons and teaching plans and they should have opportunities to visit settings where inclusion is practised. Factors external to the school that affect the working conditions of teachers such as financial rewards, status in the society and professional expectations have also been found to influence the teacher motivation and dedication (Marchesi 1998).

Maunganidge and Kasayira (2002) observed that 52 per cent of regular education teachers had positive attitudes towards the education of students with disabilities in inclusive education settings. In their studies, students with physical and visual disabilities were considered more acceptable for inclusive schools than those with intellectual and hearing impairment. Furthermore, teachers in schools with inclusion with resource room support had more positive attitudes towards integration of students with disabilities than those at schools with unplanned inclusion. Their positive attitudes might be the result of the regular education teachers getting support from the resource room teacher, who provides instruction for helping special needs students in the inclusive classroom. In addition, teachers with special needs qualifications and experience and school administrators also had positive attitudes towards education in inclusive settings (Hungwe, 2005).

Statement of the Problem

There has been a marked increase of awareness on inclusive education matters. Most African countries have developed and adopted policies that strongly support education of children with disabilities. Despite their increase in awareness, many schools are ill prepared to meet the needs of these learners. Schools need to make the topography friendly for easy movement of the learners with visual impairment, the necessary learning and teaching materials must be availed in school and teachers need to be trained in Special

Needs Education. The curriculum must not be overloaded so that these learners can cope with class activities and homework and the school administrators must be trained and sensitized so that they can admit all students without discrimination. Therefore, this study has looked at the school factors that may influence the attitudes of learners and teachers towards inclusion.

Objectives

The objectives of the study were to:

i) Establish the teacher-related factors that influence learners' attitudes towards inclusive education.

ii) Examine the school-related factors that influence learners' attitudes towards inclusive education.

iii) Establish school administrators' related factors that influence inclusive education.

Justification

The findings of this study are hoped to help the Ministry of Education to have a clear direction on the implementation of inclusive education. They have to ensure that schools are well prepared to receive all learners without discrimination. Ensure that teachers are trained in Special Needs Education and that learning and teaching facilities are in place. The topography is conclusive and generally the school environment to be friendly to all learners.

Methodology

A field survey approach was employed to investigate the problem. A survey design was appropriate with the study since it allows direct interaction with the research participants and also determines the status quo concerning gathering of facts rather than manipulation of variables. The participants were Kenyan teachers and students in two integrated programmes in Nairobi County. The researcher sampled 7 class teachers, 12 learners with visual impairments and 40 sighted learners. Kilimani and Our Lady of Mercy integrated primary schools were sampled for the study. Purposive sampling was used for class teachers and learners with VI and random sampling for the sighted learners. Three questionnaires were prepared to collect data. One for teachers, second for learners with visual impairment and the third for sighted learners. Instruments were piloted and adjustments done on any items which presented ambiguity. A correlational coefficient of 0.65 was achieved.

Results

Teacher-Related Factors Influencing Attitudes of Learners towards Inclusive Education

This study also sought to establish the teacher-related factors influencing inclusive education. Some of the statements were given to respondents who in turn were supposed to indicate whether they strongly Agreed, Agreed, Disagreed or Strongly Disagreed. The results are presented in table 1 below.

Table 1: Teachers' responses on their attitude towards inclusive education

Statements	SA (%)	A (%)	D (%)	SD (%)
I have little confidence and ability to plan and implement instructional needs of students with visual impairment.	1(14.3)	0(0)	3(42.9)	3(42.9)
The training I got did not adequately prepare me to meet the educational needs of learners with disabilities	4(57.2)	1(14.3)	1(14.3)	2(28.6)

The above table summarises the teachers' responses on their attitude towards inclusive education. Majority 6 (85.8%) of the teachers disagreed with the statement, which implied that they have little confidence and ability to plan and implement instructional needs of students with visual impairments. Others 5 (71.5%) of the teachers still agreed that the training they got did not adequately prepare them to meet the educational needs of learners with disabilities. The findings confirm what Schumm and Vaugh (1995) who stated that teachers believe that their pre-service training did not adequately prepare them to meet the educational needs of students with disabilities. This implies that teacher training in special needs education is a possible challenge to them. This could consequently influence their attitude towards inclusive education. Teacher training as concerns special needs education can be a possible factor influencing inclusive education. Responses for pupils with sight are tabulated in table 2 below.

Table 2: Pupils with Sight Responses on Teachers' Attitudes towards Inclusive Education

Statements	SA (%)	A (%)	D (%)	SD (%)
Teachers in my class are friendly to learners with visual impairment.	31(77.5)	1(2.5)	2(5.0)	6(15.0)
Teachers in my class assist learners with visual impairment.	24(60.0)	2(5.0)	8(20.0)	6(15.0)
Teachers in my class do not like learners with visual impairment.	7(17.5)	0(0)	0(0)	33(82.5)

Pupils with sight were given statements related to the teacher-factors. This information is summarized in the table above. Majority 33(82.5 %) disagreed with the statement that teachers hate learners with visual impairment. However, 32 (80%) of the learners with sight were of the opinion that teachers in their class are friendly to learners with visual impairment, another 26 (65%) agreed that teachers in class assist learners with visual impairment. Only 7 (17.5%) of the pupils agreed that teachers in class do not like learners with visual impairment. This clearly indicates that teachers have established a good rapport with pupils with visual impairment. And teachers' negative attitudes towards pupils, according to the pupils with sight cannot be a possible teacher-related factor that influences pupils' attitudes towards inclusive education.

School-Related Factors Influencing Inclusive Education

This study also sought to determine the school-related factors influencing inclusive education. Some of the statements were given to respondents who in turn were supposed to indicate whether they Strongly Agreed, Agreed, Disagreed or Strongly Disagreed as shown in table 3. Below.

Table 3. School-related Factors as per Teachers' Views

Statements	SA (%)	A (%)	D (%)	SD (%)
Learners with visual impairment are actively involved in class activities.	5(71.4)	1(14.3)	1(14.3)	0(0)
Learners with visual impairment do not have enough brailed textbooks and paper for use.	3(42.9)	2(28.6)	0(0)	2(28.6)
Learners with visual impairment do not have enough Braille machines and stylus for writing.	3(42.9)	2(28.6)	0(0)	2(28.6)
The self-concept, self-skills and problem- solving skills of all students in the integrated programmes have improved.	2(28.6)	4(57.1)	0(0)	1(14.3)
The toilets in the school are not conducive for use by learners with visual impairment.	2(28.6)	1(14.3)	2(28.6)	2(28.6)
The topography of the school compound is not conducive enough for learners with visual impairment to move with ease.	1(14.3)	2(28.6)	1(14.3)	3(42.9)
Inclusion of learners with visual impairment in regular classes affects the academic performance of the sighted peers.	1(14.3)	2(28.6)	1(14.3)	4(57.1)
Learners with special needs in education should be separated from the mainstream classes.	0(0)	1(14.3)	1(14.3)	5(71.4)
In my opinion, the school administration is not supportive of inclusive education.	1(14.3)	1(14.3)	1(14.3)	4(57.1)
The curriculum in regular schools is rigid and overloaded and does not take care of the individual needs of learners with special needs in education.	3(42.9)	1(14.3)	2(28.6)	1(14.3)
In my opinion, inclusion has positive changes on performance of the learners in general classrooms.	2(28.6)	1(14.3)	2(28.6)	2(28.6)
Most of the visually impaired learners do not finish their homework in time.	4(57.1)	2(28.6)	1(14.3)	0(0)
General education teachers' possess skills and the experience needed to work with learners with visual impairment in an inclusive setting.	0(0)	1(14.3)	3(42.9)	3(42.9)

According to the findings above, 6 (85.8%) of the teachers agreed that learners with visual impairment are actively involved in class activities, another 6 (85.8% did agree that self-concept, self-skills and problem-solving skills of all students in the integrated programmes had improved. A further 6 (85.8%) of the teachers disagreed to the statement that general education teachers possess skills and experience needed to work with learners with visual impairment in an inclusive setting. 5 (71.5%) of the teachers agreed that learners with visual impairment do not have enough braille machines for writing, another 5 (71.5%) of them disagreed that the school administration was not supportive of inclusive education. A further 4 (57.2%) of the teachers agreed that the curriculum in ordinary regular schools is rigid and overloaded and does not care for the individual needs of learners with special educational needs, however, the same number disagreed that inclusion of learners with VI in regular classes affects the academic performance of their sighted peers.

The findings showed that 3 (42.9%) of the teachers felt that inclusion has positive challenges on performance of the learners in the general classroom. A further 3 (42.9%) of the teachers agreed that the toilets in the school were not conducive for the use by learners with visual impairment while another 3 (42.9%) agreed that the topography of the school compound is not conducive for learners with visual impairment to move with ease with only 1(14.3%) being of the opinion that learners with special needs in education should be separated from the mainstream classes. The above findings concur with Kochung' (2003) who stated that the curriculum used in Kenyan ordinary schools is rigid and overloaded and does not care about the individual needs of learners with special needs education. From the results, there was a strong indication that teachers believed that they did not have enough training in special needs education and therefore, cannot handle learners with special needs in education effectively. This consequently emphasizes the need for teachers with training in special needs education. Table 4 Presents views of pupils without VI.

Table 4: School-related Factors as per Views from Pupils with Sight

Statements	SA (%)	A (%)	D (%)	SD (%)
Learners with visual impairment find it difficult to find their way around the school.	14(35.0)	4(10.0)	3(7.5)	19(47.5)
Our head teacher likes learners with visual impairment.	30(75.0)	5(12.5)	3(7.5)	2(5.0)
I have benefited from individualized instruction meant for visually impairment learners in my class.	20(50.0)	13(32.5)	0(0)	7(17.5)
I have an opportunity to learn about human diversity.	24(60.0)	12(30.0)	3(7.5)	1(2.5)
Learners with visual impairment have brailed textbooks to use while doing their homework.	29(72.5)	6(15.0)	0(0)	5(12.5)
The homework we are given by the teachers is too much for learners with visual impairment.	14(35.0)	4(10.0)	1(2.5)	21(52.5)
Learners with visual impairment find it difficult to use the toilets in our schools.	17(42.5)	2(5.0)	0(0)	21(52.5)

Results in the table above show that 36 (90%) of the pupils agreed that integrated programmes give them an opportunity to learn about human diversity. A further 35 (87.5%) of the pupils agreed their head teacher likes learners with VI. Another 35 (87.5%) were of the opinion that learners with visual impairment have Braille textbooks to use while doing their homework, while 33 (82.5%) of the pupils agreed that they have benefited from individualized instruction meant for learners with visual impairment in class. These findings concur with Hehir (1995) who noted that the programme that gives special education teachers and teacher aids the opportunity to work in a general education classrooms with both students with and without disabilities resulted in an “incidental benefit” to students who are not disabled.

The results further indicate that 22 (55%) of the pupils disagreed that learners with VI find it difficult to find their way around the school, another 22 (55%) disagreed that the homework given by the teachers was too much for learners with visual impairment. A further 19 (47.5%) agreed that learners with visual impairment find it difficult to use the toilets in the schools.

Table 5: School-related Factors as per Views from Pupils with VI

Statements	SA (%)	A (%)	D (%)	SD (%)
I am often absent from school.	0(0)	0(0)	0(0)	12(100)
I hate my teachers.	3(25.0)	2(16.7)	1(8.3)	6(50.0)
I like all my female teachers.	7(58.3)	4(33.3)	1(8.3)	0(0)
I like the head teacher of my school.	12(100.0)	0(0)	0(0)	0(0)
I like my male teachers.	6(50.0)	0(0)	0(0)	6(50.0)
The homework given by teachers is a lot.	2(16.7)	1(8.3)	5(41.7)	4(33.3)
My teachers are always patient with VI learners in class.	3(25.0)	1(8.3)	6(50.0)	2(16.7)
My teachers ensure that we understand new concepts just like our sighted counterparts.	1(8.3)	2(16.7)	5(41.7)	4(33.3)
I use Braille machine to write my work.	1(8.3)	2(16.7)	7(58.3)	2(16.7)
We have enough brailed textbooks in our school.	2(16.7)	6(50.0)	1(8.3)	3(25.0)
We are provided with enough writing materials in our school.	2(16.7)	7(58.3)	2(16.7)	1(8.3)
I don't like toilets in my school.	6(50.0)	0(0)	0(0)	6(50.0)
I can walk in my classroom comfortably.	4(33.3)	2(16.7)	0(0)	6(50.0)
I can walk around my school compound comfortably.	6(50.0)	0(0)	0(0)	6(50.0)
Our school library has a section, which caters for learners with VI needs.	10(83.3)	2(16.7)	0(0)	0(0)
I participate in games activities in my school.	(12(100.0)	0(0)	0(0)	0(0)

Table 5 above shows that all the pupils agreed to the statements that they like the head teacher of the school and they participate in games activities. However, all the learners disagreed with the statement that they are often absent from school. Eleven (91.6%) of them indicated that they liked all the female teachers with only 6 (50%) indicating they like male teachers. This is in agreement with AL-Zyoudi (2006) who observed that female teachers in Jordan are more positive towards inclusion than male teachers. Another 9 (75%)

of the pupils disagreed that teachers ensured that they understood new concepts just like sighted counterparts and a further 8 (66.7%) disagreed that teachers are always patient with learners with visual impairment in class. However, 8 (66.6%) of the pupils agreed that they had enough Braille textbooks in the school with a further 9 (75%) of the pupils agreeing that they were usually provided with enough writing materials in the school.

Concerning the school and its facilities, 6 (50%) of the pupils agreed that they did not like toilets in their school with all the learners agreeing that the school library has a section which caters for pupils with visual impairment. A further 6 (50%) agreed that they could walk in the classroom as well as the school compound comfortably; 5 (41.7%) agreed that they hate their teachers with 7 (58.3%) disagreeing with this statement.

Learners with visual impairment indicated that they like female teachers to male teachers, implying that pupils with visual impairment preferred female teachers and this could be a factor influencing the attitudes of the pupils towards inclusive education. Again, the views from pupils with Visual Impairment tend to reveal that teachers do not pay more attention to learners with Visual Impairment to ensure that they understand concepts like their sighted counterparts. The gender of the teacher and the teaching techniques could be said to be possible factors influencing the attitudes of students towards inclusive education.

Summary

Appropriate resources and other teaching and learning materials were necessary for effective learning for learners with visual impairment. The self-concept, self-skills and problem-solving skills of all students in the integrated programmes improved. From the findings, it was noted that the topography of the school compound was not conducive for learners with visual impairment. Inclusive schools are considered the best options for educating learners with special needs in education. Teachers agreed that the curriculum in ordinary regular schools was rigid and overloaded and did not take care of the individual needs of learners with special needs in education. According to the findings, teachers indicated that they were not skilled enough to handle learners with special needs in education; this emphasizes the need for teacher training in special needs education, more sensitization and awareness. Learners with visual impairment indicated that they preferred female teachers to male teachers. The head teachers indicated that the learners with visual impairment appeared to be happy with integrated programmes. According to head teachers the challenges facing integrated educational programmes include lack of enough Braille machines, Braille papers and adequate trained teachers in special needs education

Conclusion

The following conclusions were drawn from the findings of the study:

i) Learners with visual impairment agreed that pupils in class are friendly but were not supporting them fully in class, which made them prefer working alone.

ii) Learners with visual impairment preferred female teachers to male teachers.

iii) Teachers suggested there is need to employ teachers with training in special needs education as well as the government creating awareness and sensitizing the community about inclusive education.

iv) Learners with visual impairment suggested that there is need to make the school environment and syllabus more adaptable to learners with visual impairment as well as providing more materials such as Braille.

v) Pupils without visual impairment suggested the need to include Braille lessons in the school timetable so as to keep the skills of the pupils with visual impairment updated as well as the need for sensitizing both teachers and learners on the importance of inclusive education.

vi) There is general need for provision of instructional learning materials, adapted curriculum and refresher courses for the teachers.

vii) The school administrators viewed inclusion as a good idea.

viii) There is need for serious involvement of all stakeholders in decision-making for successful implementation of inclusive education in Kenya.

Recommendations

- Teachers should encourage learners with sight to be supportive of learners with visual impairment in class work.
- All students should have positive attitudes and be friendly to learners with visual impairment regardless of sex.
- More teachers to be trained in special needs education.
- Provision of learning/teaching materials to be provided.
- Stakeholders should fully be involved in the implementation of inclusive education in Kenya.

References

Al- Zyoudi, M. (2006). Teachers' attitudes towards inclusive education in Jordanian schools. International Journal of Education. 2(2), 55-62.

Avramidis, E. Bayliss, P. & Burden, R. (200). A survey into mainstream teachers' attitude towards the inclusion of children with special education needs in the ordinary school in one local educational authority. Educational psychology, 20(2), 193-213.

Bradshaw, L.G. (2003). Brunei SENA teachers speak out. Studies in Education, 8(1)

1-10.

Forlin, C (1995). Educators’ beliefs about inclusive practices in Western Australia. British Journal of special Education, 22(2). 179-185.

Hungwe, T. (2005). Attitudes of teachers towards children with moderate mental retardation in ordinary primary schools in Zimbabwe.

Jenney, R.F., Snell, M.E., Bears, M.K. & Raynes, M. (1995). Integrating children with moderate and severe disabilities into general education classes. Exceptional Children 61(5), 425-439.

Marchesi, A. (1998). International perspectives on special education reform. European Journal of Special Needs Education, 13, 116-122.

Maunganidzed, L. & Kasayira, J. M. (2002). Educational integration of children with disabilities in schools in the midlands region of Zimbabwe. The Zimbabwe Bulletin of Teacher Education, II (I), 72-82.

Ryndax, D.L. & Alper, S. (1996). Curriculum content of students with moderate and severe disabilities in inclusive settings. Boston: Allyn & Bacon.

Schhorth, G, Moorman, M and Fullwood, H. (1997). Effects of training teachers; stages of concern regarding inclusion. In D. Montgomeny (Ed), promoting progress in times of change: Rural communities leading the way-conference proceeding of the American Council on Rural special education (pp67-74). Manhattan, KS: Kansas state university, American Council on Rural special education.

Shade, R.A. & Stewart, R, (2001). General education and special education pre-service teachers, attitudes towards inclusion. Preventing school failure, 46(1), 37-41.

UNESCAP (2002). Summary paper: current trends impacting the situation of people with disabilities.

UNESCO (2003). Open file in inclusive Education, support materials for managers and administrators.

Vaughn, S. & Klinger, J. (1998). Students' perceptions of inclusion and resource room settings. The Journal of Special Education 32(2), 79-88.

Villa, R.A & Thousand J.S (1995). Creating an inclusive school. Alexandria: Association of supervision and curriculum development.

Walsh, R. (1994). Making the journey to communication with assistive technology, Exceptional Parents, 24(II). 37-41.

KENYA'S ONE LAPTOP PER ONE PUPIL INITIATIVE: A DREAM OR REALITY? REFLECTIONS OF AN EDUCATIONAL TECHNOLOGIST

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Abstract

This paper is based on research findings on the use of computers by teachers in Western Kenya (Kavagi, 2001) and review of literature to reflect on the Kenya Government's initiative of providing all standard one pupils with laptops starting 2014. The paper reports that the concept of a laptop per school pupil is not new. It has been around since the 1990's with proponents aiming to enable universal access to and use of laptops by all pupils (Kavagi, 2011). The concept is premised on the ability to produce laptops at very low prices (100 US Dollars). In 2013, the Government of Kenya decided to introduce laptops for all pupils joining class one in 2014; and thereafter for every pupil joining class one every year. The laptops are to be used in schools for learning purpose. Thus, the political leadership hopes to gradually build a 'digital age.' To respond to this initiative, within the constraints created by the government directive, the Kenya Curriculum Development Institute embarked on developing e-content that would be used with the laptops. Procurement was simultaneously started to acquire laptops in time for the start of the school year. Prior to this, computers were mainly used in school as a subject of study in secondary schools and as additional subject at the primary school level especially in private schools. The paper argues that with the Government pronouncement the drive for computer use in education seems to suddenly shift from the vocational drive to the social drive. However, the paper argues, such a shift may be apparent without corresponding drive at the school level. The lack of sound policy and ill preparation are cited as a major set backs to the initiative. Central to this set back is teachers' lack of computer knowledge and skills to facilitate learning (Kavagi, 2011). Also, the lack of infrastructure is a hindrance that needs addressing. The paper further argues that curriculum in e-format needs careful professional development, testing, and quality control. A neutral quality assurance body should vet software prepared for delivering the official curriculum.

Key words: Computers, teacher, educational technology, curriculum, learning, learning resources, educational software, E-learning

Introduction

The advent of computers in education is a reality that is here to stay. Many studies have shown that the reception accorded to computers in education and in schools is unlike that afforded other media resources (Kavagi, 2001; 2011). This is true in developing countries, countries with economies in transition, and developed countries. Computers are not only attractive to teachers and learners, but to society as a whole. Political leaders, professionals and school administrators recognise the importance of the use of computers in schools (Kavagi, 2001).

It's therefore not surprising that during the 2013 General Elections in Kenya the Jubilee Coalition campaigned on the platform of a digital age promising to provide one laptop for every child joining class 1 in primary school in 2014[1]. Interestingly, the laptop promise completely overshadowed the overall educational thrust/vision of the Jubilee Coalition.

The Jubilee Coalition's vision, as presented in its political manifesto, was to raise the quality of education, increase access to education at all levels, increase transition from one level to the next, and improve educational standards. To achieve this, the Coalition's strategy was to remove financial and non-financial barriers, and increase funding to education. Provision of laptops was therefore one of the tools to facilitate the achievement of the educational vision of the Coalition. But the laptop promise is what caught the public's attention up to date. This focus on the laptop promise may be an indicator of the kind of interest that society has in computer.

[1] The Manifesto states that the Jubilee Government will "Work with international partners to provide solar powered laptop computers equipped with relevant content for every school age child in Kenya" p26

The laptop promise has further generated a reaction due to unprecedented as it has high financial implications involved in providing over 1.35 million laptops to pupils in schools. The reaction could also reflect the problems facing provision of education for all especially basic education following the free primary education that was rolled out in 2003. The current challenges facing basic education especially those related to high enrolment following the introduction of free and compulsory primary education in Kenya 2003 is a problem that is on stakeholders' mind. It is estimated that in 2012 enrolment in standard one stood at over 1.4 million pupils.

2.0 Challenges Facing Introduction of Computers in Schools

The challenges facing introduction and use of computers in schools are many. They range from the common challenges that affect education in general to specific ones limited to issues directly related to technology and technology use. Appreciating these challenges is important to understating the background against which the discourse on introduction and use of computers in schools is based. Among the challenges to education include wide spread poverty. It has been observed that many communities in Sub-Saharan Africa, Kenya included, live in stark poverty. To make the situation even worse, some remote counties face famine due to persistent drought that causes many pupils to miss school or attend school on empty stomachs. Consequently families are forced to engage school-age children in some form of family income subsistence activities (Buchmann, (2000), Admassie, 2002; Edmonds & Pavcnik, 2005) in the form of "unpaid agricultural and domestic labour, often at the expense of their education," Admassie (2003).

The problem of the girl child has been highlighted in many development efforts especially those related to absence from school due to lack of sanitary towels for which the civil society2 in Kenya and other actors were instrumental in lobbying the government to provide free sanitary towels to schools in 20113. However the free sanitary towels initiative did not receive as much public attention and interest as did the laptop initiative in 2013; in spite of the high impact that provision of sanitary towels would have on the access to education and retention of girls in schools. One wonders why? There seems to be a mismatch here that clearly contradicts Maslow's law of hierarchical needs (i.e. that human beings will tend to first satisfy basic needs such as shelter food and clothing before satisfying the next higher level of needs). This contraction can be heard in the questions continuously popping up in the public gallery such as whether we should be providing school feeding programme or laptops.

Infrastructural challenges are at the core of access to, and quality of education in Kenya today. Unfortunately, the exponential increase in enrolment following the roll out of free primary education in Kenya in 2003 has not been matched with provision of adequate infrastructure. The construction of new classrooms and/or schools to absorb the high number of pupils still lags. In fact many schools - in both rural and the urban poor areas lack basic infrastructure such as classrooms and furniture. The density of schools is also very low especially in remote rural areas such as Kajiado, Turkana, Tana River, and Moyale where pupils are forced to walk long distances (several kilometres) to school. Ackers et al (2000) reported:

> 38% of primary heads claiming that their schools are in need of major repairs, 42.8% of schools in one province have open air classrooms, 16% of schools nationally do not have an office for the head, 34% have no storeroom (a major concern for the SPRED

[2] For instance the Kenya Girl Child Programme run by a network of civil society organisations (http://www.girlchildnetwork.org/) providing educational support to affected schools and communities was instrumental in lobbying the government to introduce sanitary towels as a means of ensuring education for all.

[3] The news caught the attention of both local and international media e.g. *The Guardian* reported thus, "For the first time ever, the finance minister has allocated almost $4m from the current national budget to provide free sanitary pads to schoolgirls." (http://www.guardian.co.uk/global-development/2011/jul/29/kenya-schoolgirls-sanitary-pads-funding. Accessed 10 June 2013 at 17:15hrs)

textbook programme) and 23% have no gardens, despite the fact that agriculture depends on access to a school garden. Furthermore 66% do not have a typewriter and 74% lack a duplicating machine (p. 370).

The question of infrastructural barriers in Kenya is not a recent phenomenon. Kafu (1974) noted that the lack of classrooms and basic learning materials pose real and fundamental constraints to learning. However this challenge does not seem to stop schools from introducing computers. While noting the finding that secondary school teachers in western Kenya ranked textbooks as priority need followed by computers and furniture respectively, Kavagi (2010) suggested that since schools are under immense pressure from the society to introduce the most talked about technology, they are forced to embrace computers as they grapple with lack of basic needs.

According to findings from the study in Western Kenya, Kavagi (2001) reported that donation was the most significant mode of acquiring computers by schools. This finding concurred with findings by Makau (1990) a decade earlier. This view is further supported in the findings of the study by Ackers, Migolib, & Nzomo, (2001) who reported that although Kenya spends a higher level of its national budget on education (6.8% of GDP) than other developing countries, 95.5% of the budget goes to recurrent expenditure (mainly salaries) leaving only about 4.5% for development expenditure. They note that, "The central financial problem in primary education is that 96% of expenditure was on salaries or emoluments in 1997 and this percentage rose, rather than fell, over the next two years, due to the settlement of a teachers' strike" (Ackers et al. 2001: 363).

The lack of basic educational equipment and resources led Makau (1990) to recommend that introduction of computers in schools should be shelved until such a time that basic facilities such as classrooms, books and laboratory equipment were in place in most schools. True as it may sound, Kavagi (2001, 2011) premised that such a recommendation may have been overtaken by events because of the obligation that schools have towards parents, students and society at large and the immense pressure exerted by these stakeholders by demanding the “most talked about” technology. Also, the society’s perception of and expectation from education is not in mere schooling. Rather they evaluate to see the benefits of the returns accruing therefrom (Buchmann, 2000).

The development path for Kenya and other developing countries will not be linear and gradual along the one taken by developed nations. It must be in leaps and bounds. It will not wait for infrastructure to become available or for other pressing needs to be addressed. One such leap is the government’s resolve to provide laptops to each child joining standard 1 in 2014. It’s a leap because the use of computers in schools has not grown gradually as would have been expected over the years since the 1990’s when computers were being introduced and used in Kenyan schools on experimental/pilot basis. Instead, schools are being exposed to cutting edge technology without going through the intermediate developmental stages.

Besides infrastructure, schools lack or do not have adequate/appropriate basic resources such as furniture, learning materials and textbooks and stationery. Although the provision of funds to purchase text books for pupils in primary schools has gone a long way in trying to address this issue. However a 1:1 ratio between pupils and text books has not been achieved and the increase has not translated into better scores, but rather tended to increase the scores of the brighter academically stronger pupils (Glewwe, Kremer, Moulin, (2009).

Equity is an important consideration in the use of computers. Computers may be worsening equity both in access to, and quality of, education and unduly widening the educational divide between: the developed and the developing countries; the rich and the poor communities and families; the urban and the rural children; and the young and older pupils/students. This ends up further disadvantaging the poor children on one hand, while on the other hand increasing the gap between urban and rural schools.

Governance goes to the heart of the success of every development programme. Without proper sound governance structures in place the projects tend to be swallowed by corrupt deals and persons. Corruption is something to watch for especially where projects have high costs such as Kenya's laptop initiative estimated to cost 52 billion shillings over three years.

Software issues are a challenge where the computer industry is young or not developed at all. Commercially available software used in word processing, spreadsheets, and presentations are not in themselves educational. It is important to convert paper-based curriculum content into digital media in the form of e-learning materials. The process of digitisation is not as simple as scanning. The content has to be reformatted and programmed in an e-learning environment that will be intuitive, personalised and interesting to learners. In other words you shouldn't read a paper version of a book on the screen of a laptop/desktop computer, for doing so is missing out on the very power and versatility of the computer. The initial cost of developing content is therefore high and time consuming.

Secondly the content once developed must be piloted by publishers and revised before being presented for vetting by a quality assurance section or a similar regulatory body established by law. The regulatory body should certify as "fit for purpose" educational software meant for use in delivering the official curriculum before it can be released to the market. This process requires that the statutory body is itself well equipped with cutting edge educational software evaluation tools and is manned by professional curriculum developers/assessors well versed in e-content.

The cost of computer technology is a challenge to most schools. From the case of the One Laptop per Child Initiative (described below) it can be said that cost considerations can halt a well-intended project. The OLPC did not achieve its intended results even after an aggressive and well managed championing. This was due to the high cost of hardware (it proved difficult to achieve the USD 100 price tag); insufficient funding to meet the roll out, distribution and other logistics; and lack of buy-in by beneficiary countries. Cost considerations should not be underestimated. They go beyond the initial purchase price of the hardware and extend to the software used, maintenance and replacement costs, and the support costs of technicians and teachers alike (Kavagi, 2010). Rapid changes in information technology can also be a challenge that adds up to the cost of computers. In a survey of schools in Western Kenya, Kavagi (2001) reported that most schools acquired their computers through donations due to the high capital outlay required. As evidenced by research, this limitation is however a blessing-in-disguise as communal computers (involving sharing between groups of pupils) may actually improve cooperative learning (Kruger, 1993).

Kavagi (2001) found that faced with lack of funds, schools had developed innovative ways of acquiring computers through a quasi-private-public partnership where a business person entered into an agreement with a school that provided space while the business supplied computers. Students were then charged a fee for using computers, which was shared between the school and the business person. Other schools used their computers to generate income by training members of the surrounding communities.

3.0 Factors Influencing the Introduction of Computers in Schools

The development of ICT in education requires an enabling environment in the form of sound educational policy and attendant institutional structures. For over a decade, schools that were adaptors of technology were several paces ahead in introducing and using computers in their curriculum/operations in the absence of Government (Ministry of Education) guidelines and a national educational ICT policy (Kavagi, 2001). Although the absence of a national policy did not deter schools from forging ahead the consequence was the ad hoc and uncoordinated effort at all levels: primary, secondary, and tertiary. The Ministry of Education was rather reactionary providing piece meal solutions such as developing a national curriculum for computer studies as a subject at secondary school level. In the years that followed however, the education sector undertook extensive stakeholder consultations culminating in an educational ICT policy through the Kenya ICT Trust Fund4 that was established in 2004 as a public private partnership for development of ICT at all levels of education.

The excitement and interest created by computers among learners of all ages is one key factor in the uptake of computers in schools. Furthermore many empirical studies show that computers improve learning (see for instance Bii, 2001). This is also true for learners of tender age in preschool (Scrase, 1997), young learners with special needs (Schery and O'connor, 1997) as well as other learners with special needs (Okolo, Reith, & Bahr, 1989).

Computers have an important advocate in the school principal. As administrators of schools, principals are particularly attracted to computers as they help in the management of schools such as preparing professional-looking documents, book keeping, stores and inventory control, and general record keeping including generating report cards with ranked scores. In a study of 21 systems of education in the CompEd study of 1989 Pelgrum and Plomp (1993) reported that principals of schools had a positive attitude to computers particularly in matters to do with the use of computers for school administration.

In Kenya societal demand exerts immense pressure on schools to introduce computers. Kavagi (2001) reported that leaders and employers were catalytic in calling for the introduction and use of computers in schools, with some warning that schools that failed

[4] Established in 2004 under the Ministry of Education as the host institution, the mandate of the Kenya ICT Trust Fund "is to facilitate Public-Private Partnerships (PPP) in mobilizing and providing Information and Communication Technology (ICT) Resources to Kenyan public schools through various like-minded implementing agencies under the umbrella of the Network Initiative of Computers in Education (NICE)" (http://www.kenyaictfund.or.ke/about.html accessed 19 June 2013 at 07:20hrs)

to embrace computers risked being behind the information age. As noted by Buchmann (2000) the value of education is assessed by the benefits accruing therefrom. It follows that since society views the future worker as dependent on information technology, it is important to produce graduates that fit such a profile.

Societal demand may be expressed in different lobbying/advocacy initiatives such as the ‘One laptop per child”5 global initiative by the civil society which advocates for universal provision of laptops to all children in schools. The laptops should be: cheap (about USD 100) but robust to withstand severe and rough handling conditions; they should rely on solar power rather than mainly electricity; and digital content to enable the use of the laptops in day-to-day learning in, and out of, classrooms. Available data shows that by June 2013, the initiative had provided over 2.4 million laptops to children and teachers in 42 developing countries, out of which Kenya had about 500 laptops.

Not to be forgotten are parents. In Kenya, parents are known to closely monitor the performance of schools particularly in national examinations. Kavagi (2001) noted that in some instances parents have ended up locking out principals of their schools for poor performance. When it comes to computers, parents are keen to see their children learn computers in the hope that the knowledge and skills gained will help them compete better in the labour market.

The nature of computer technology especially its capability to be used across all subjects in the curriculum lends its use in schools than any other technology. Furthermore the intuitive relation between a user and the computer creates a type of dependency that makes the user feel a personal attachment to a computer in a way that makes him/her tend to trust the computer.

[5] The One Laptop per Child (OLPC)’s web site (http://one.laptop.org/about/mission) states, “We aim to provide each child with a rugged, low-cost, low-power, connected laptop. To this end, we have designed hardware, content and software for collaborative, joyful, and self-empowered learning. With access to this type of tool, children are engaged in their own education, and learn, share, and create together. They become connected to each other, to the world and to a brighter future”.

Hawkridge, Jaworski and McMahon (1990) identified four rationales for the introduction of computers in the systems of education in third world countries: social rationale where computers are used across all subjects and to prepare pupils to use information technology as part of life; vocational rationale involves teaching computers as a subject on the curriculum with the aim of preparing learners for higher training and careers in information communication technology; pedagogical rationale that hopes to improve teacher effectiveness and productivity through improved learning methods; and the catalytic rationale in which technology is used to trigger of a specified educational change such as introducing/promoting adoption of a learner centred curriculum.

Understanding the rationale for the introduction of computers in the schools is important in synthesising the nature of problems that prevent teachers from using computers in their schools (Kavagi, 2001). In Kenya, before 2013, the official rationale for computer usage in schools has been the vocational rationale (Kavagi, 2001). However, following the government's one laptop per standard one child, it seems to be tilting the balance towards the social rationale. It's however too early to say whether this is indeed the official rationale and more so if it will indeed take root.

4.0 The Teacher Factor

Advocates of the pedagogical rationale hope to improve the quality and practice of teaching with the aim of improving teacher productivity. According to Makau (1990), computers have the potential of making teachers' work more easily and efficiently. However, this is the most problematic rationale. Either the innovator does not wait long enough for "theory to beget" practice or they totally ignore the worries of the most important factor of change: the teacher. Innovators tend to treat the teacher as both the angel to bring about change and the devil to be changed. It is this simultaneity that triggers off technology refusal (Loveless, 1996).

Teachers normally operate under great pressure from communities in which their schools are located. It is common for parents in some parts of Kenya to lock out the head-teacher whose school does not meet their expectations at national examinations. Against this backdrop we find majority of teachers who would rather use what has passed the test of time in achieving results than fumble with some "unknown technology." For a practice to be accepted, therefore, it must be seen as consistent with the teachers' personality and the way of doing things i.e. what works (regardless of its ethics) is the most important thing to teachers. Secondly, an innovation that seems to originate from within (and is conceived to produce good results for students) is likely to be accepted than if the change is perceived to be coming from 'above.'

Oslon (1988) observed and logged activities of teachers over a length of time and came to the conclusion that teachers tend to cope with new technologies using familiar, well-proven routines and responses. If they happen to accept the technology, they may be doing so only to avoid losing their most cherished position as controllers of learning and to avoid appearing to be old fashioned.

Remuneration of teachers has proved to be a thorny issue pitying the government against the teachers' labour unions since the 1990's, which poses a big challenge to willingness of teachers to embrace introduction and use of computers in schools. The issue is serious given what we discussed before that over 90% of the budget is expended on recurrent budget items mainly salaries. In addition working conditions such as lack of classrooms, crowded classes, and inadequate learning resources make teachers to resent innovations.

There is a marked difference in between male and female teachers on their self-efficacy on the use of computers, with male teachers having higher confidence than their female counterparts, (Kavagi, 2001). This may mean that intervention programmes to build the knowledge and skills of teachers must be gender sensitive by paying special attention to the needs (and fears) of female teachers. The teachers' attitude towards use of computers in school does not depend on one's teaching subject or the number of years of service.

Teacher's knowledge of, and skills on, how to use computers is fundamental to the success of computers in school programmes. However for effective learning this knowledge is not enough. It must be incorporated into new learning/teaching methods. Teachers need support on how to facilitate learning using computers as the medium of instruction. Without this support they become afraid of using the computer lest they appear not in control of the learning; a culture that has ingrained itself among most teachers because of the traditional way of teaching that are bedevilled by acute shortage of learning resources, thereby causing learners to over-rely on the teacher as the source of information and knowledge.

5.0 Conclusions and Recommendations

This paper has argued that the introduction of schools may be demand-driven as evidenced by societal pressure on schools to embrace computer technology. However the high cost of computers makes them out of reach for most schools. The government's initiative to provide computers to schools is thus a welcome move. The paper also argues that introducing laptops at the intended level, class one, is appropriate because research shows that computer learners of tender age can cover the curriculum using computers.

However given the many other factors that need to be taken into account it is not clear why such a level should be prioritised, nor why communal computers should not have been prioritised before attempting a 1:1 ratio. Three factors as discussed in this paper combine to favour communal computing (co-location of computers in schools where learners share the resource): First is the fact that the bulk of the national budget is spent on education, and that most of that share goes meeting recurrent expenditures. Secondly, the cost of computers and software is high thus making it hard to attain the ideal ratio of 1:1

(i.e. one computer per pupil). Thirdly, the level of preparedness of the teachers to handle computer assisted learning is still very low/negligible. There is need to properly train teachers to do this. This cannot be achieved overnight.

It is also not clear why a gradual approach was not adopted. It is argued that the one laptop initiative of the Kenya government should not be rushed, but rather led by careful planning, gradual phased implementation to allow lessons to be applied at the next phase, and monitoring and sharing experiences. There is need to build a computer culture in schools so that teachers do not abandon computers and resort to the well-established method of drill-and-practice using text books and exam past papers. The gradual introduction would also involve re-orienting the curriculum from exam based to a learner-cantered curriculum, and allow time for appropriate well-tested/piloted e-learning content to be developed and vetted.

a) Need for Sound Policy

In spite of consensus that policy should be founded on sound research and led by professionals, most educational innovations continue to be based on political expediency led by non-educationists. Why is this the case? Why is it that, the educational professional is disregarded most of the time? Are the priorities of the educational technologists lopsided and reactive as opposed to being proactive? Is the profession actually recognised as so? What kind of research are we conducting? Is research relevant to the emerging and current issues in education?

It is recommended that schools of education, and educational professionals, play a proactive role in communicating their work to the general public and engaging with policy makers in a language they understand. This profile will require effort and definitely take a long time to build.

b) The Teacher should be at the Fore in the Introduction of Computers

For the one-laptop initiative to be successful the teacher must lead its introduction. However as discussed earlier the teacher will need adequate training in two areas: the first is the general knowledge and skills on how to use computers (computer literacy) and the second is the teaching/learning methodology e-learning. Obtaining buy-in from teachers requires time and confidence building.

c) Software Development and Authentication

Educational software development should not be an afterthought. It should be a well-planned process with appropriate institutional structure for quality assurance and vetting. Training and equipment should be provided to build the capacity of the institution responsible for quality assurance. It must be appreciated that most Kenyan publishers do not have technical capacity nor the advance preparedness to create e-learning content for the official curriculum. At the start of the programme the number of software being submitted by publishers for evaluation will be high, hence create a backlog on the responsible institution.

d) Maintenance

Kenya is known to have a poor culture of maintaining facilities. For a project of such wider magnitude it is important to plan for and incorporate continuous maintenance in the process. Kavagi (2010) identifies three types of maintenance that need to be planned for and conducted: (i) Preventative maintenance where the system is serviced regularly to prevent breakdown, (ii) corrective maintenance in which parts are replaced, and (iii) restorative maintenance involving system upgrade for both software and hardware.

References

Ackers, J., Migolib, J. & Nzomo, J. (2001). Identifying and addressing the causes of declining participation rates in Kenyan primary schools International. Journal of Educational Development. Volume 21, Issue 4, July 2001, Pages 361–374

Admassie, A. (2002). Explaining the High Incidence of Child Labour in Sub–Saharan Africa. African Development Review, Volume 14, Issue 2, p. 251–275, December 2002

Admassie, A. (2003). Child labour and schooling in the context of a subsistence rural economy: can they be compatible? International Journal of Educational Development. Volume 23, Issue 2, March 2003, Pages 167–185

Buchmann, C. (2000). Family Structure, Parental Perceptions, and Child Labor in Kenya: What Factors Determine Who Is Enrolled in School? Social Forces. Volume 78. Issue 4, 2000. Pp. 1349-1378

Edmonds, E.V. & Pavcnik, N. (2005). Child Labor in the Global Economy. Journal of Economic Perspectives. Volume 19, Number 1, Winter 2005 Pages 199–220

Fabry, D.L. & Higgs, J.R. (1997). Barriers to The Effective Use of Technology in Education: Current Status. Journal of Educational Computing Research Volume 17, Number 4, 1997 Pages: 385 - 395

Glewwe, P., Kremer, M., Moulin, S. (2009). Many Children Left Behind? Textbooks and Test Scores in Kenya. American Economic Journal: Applied Economics, Volume 1, Number 1, January 2009, pp. 112-135(24)

Hawkridge, Jaworski and McMahon. (1990). Computers in Third-World Countries. London: The MacMillan Press Ltd.

Jubilee Coalition (2013). Transforming Kenya: Securing Kenya’s Prosperity 2013-2017. Harmonised Manifesto of the Political Parties under the Jubilee Coalition.

Kafu, P.A. (1976). The Elementary Teachers' Rationale Concerning Their Use of Various Instructional Media (Teaching Aids) in Elementary School Teaching in the Bungoma District and Eldoret Municipality of Western Kenya. Unpublished M.Ed. Thesis. Nairobi: University of Nairobi.

Kavagi, L. (2001). The Use of Computers in Secondary school: A Survey of Secondary Schools in Western Kenya. Unpublished M.Phil. Thesis. Eldoret: Moi University

Kavagi, L. (2010). Computers in Schools: Strategies for Introduction of Computers. Nairobi: Jomo Kenyatta Foundation

Kirk, J. & Sommer, M. (2006). Menstruation and body awareness: linking girls' health with girls' education. http://www.wsscc.org/sites/default/files/publications/kirk-2006-menstruation-kit_paper.pdf (accessed 15 June 2013 at 18:12hrs)

Kruger, A.C. (1993). Peer Collaboration: Conflict, Cooperation or Both? Social Development. Vol.2 p.165-182.

Loveless, T. (1996). Why aren't Computers Used More in Schools? Educational Policy. Vol. 10 No. 4.

Makau, B. (1990) Computers in Kenya's Schools: A Case Study of An Innovation in Education. Ottawa: IDRC.

Okolo, C.M., Rieth, H. J. and Bahr. (1989). Microcomputer Implementation in Secondary Special Education Programs: A Study of Special Educators'; Mildly Handicapped Adolescents'; and Administrators' Perspectives. Journal of Special Education. Vol. 23 No. 1. p.107-117.

One Laptop Per Child. http://one.laptop.org/about/mission (accessed 7th June 2013 at 14:02hrs).

Oslon, J. (1988) SchoolWorlds - Microworid: Computers and The Culture of the Classroom. Oxford: Pregamon Press Pic.

The Guardian, Friday 29 July 2011. http://www.guardian.co.uk/global-development/2011/jul/29/ kenya-schoolgirls-sanitary-pads-funding (accessed 10th June 2013 at 17:15hrs).

The Kenya ICT Trust Fund. http://www.kenyaictfund.or.ke/about.html (accessed 19th June 2013 at 07:20hrs

ICT INFRASTRUCTURE AND TEACHER PREPARATION IN THE INTEGRATION OF ICT IN TEACHING AND LEARNING IN PRIMARY TEACHERS COLLEGES

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Introduction

The role of Information and Communications Technology (ICT) in provision of quality education and as a catalyst for economic development cannot be overemphasized. Educators now acknowledge the advantages that ICT provides in classroom teaching and learning. The various forms of ICTs are noted to support, facilitate and make teaching and learning process easier. Researchers have observed that ICT in its own nature is able to process, store and retrieve information (Gutterman et al., 2009; Berhane, 2012 & MOE, 2005). In addition, ICT facilitates acquisition of appropriate and relevant skills for handling complex problems. For instance, it stimulates a new atmosphere where teachers and students are engaged in exchange of ideas. Teaching via ICTs is structured in a way that teachers and students collaborate to learn new skills of understanding the subject matter and solving related complex problems.

Besides, ICTs have become part of necessary tools in running learning institutions. According to Laudon 2003, they are tools for data collection, analysis, storage and dissemination to support decision making in learning institutions. Their relevance in learning institutions has been reinforced more with recent research indicating that technologies provide more opportunities for effective teaching and learning (Ivers, 2003; Gutterman et al., 2009; TIVET, 2011 & Hennessy et al., 2010). ICTs are transforming operations of institutions through innovative e-learning programmes like teleconferencing, use of Internet, projection technology, and music technologies. There has also been growing evidence that ICTs increase efficiency, they are cost effective, and provide skills necessary for job competitiveness. Efficiency is brought about through easy access to student and staff records, data on assets of the institutions as well as efficiency in front office operations and management of key processes like admissions and examinations in schools. The clients of institutions, that is, parents, staff and students now demand more information from the institutions in form of grades, fee payment, class registration, and contract administration which demands automated services from these institutions. This has seen institutions invest in systems that make it relatively easy and cost effective to acquire, store and manage volumes of information about institution's stakeholders.

The noted roles of ICTs have led to increased investments in ICT in education. One area that has received a lot of support has been accumulation of ICT infrastructure to learning institutions. For instance, in Scotland most schools, colleges and other centres' have put up effective infrastructure. In 2007, the Government noted that almost all the institutions have access to broadband Internet connections (Government of Scotland, 2007). The country has upgraded its Internet supply moving to switch-based distribution arrangements capable of delivering data and applications to the desktop at high speed. Furthermore, they have set aside devolved budgets for institutions to be able to procure equipment and software to meet the particular needs of their schools. Students with special needs are taken into consideration with a number of schools having acquired sophisticated equipment to enable and encourage young people with severe learning difficulties to broaden their opportunities to express their feelings and emotions. Scotland ensures that integration of ICT into education starts with foundational classes. Both pre-school and primary institutions are provided with a wide range of ICT infrastructure for learning and teaching. Whilst the efforts of accumulating ICT infrastructure in Scotland institutions are well coordinated, funding constraint remains a barrier. The provided ICT infrastructures are not adequate for all children and teaching staff.

Brazil is another country where ICT has extensively been used to increase access to quality education (Gutterman et al., 2009). The country's national ICT policy makes it a requirement for institutions to integrate technology in education (Muyaka, 2012). The country has adapted an education-rate (e-rate) that ensures that the cost of basic connectivity is affordable for both institutions and citizens. In addition, Brazil has developed centers' to train laboratory coordinators and teachers to ensure long-term success in the learning institutions (Gutterman, et al., 2009). Other than ICT infrastructure, the country allows funding for teachers professional developments in ICTs (Gutterman, et al., 2009).

Availability and access to ICT infrastructure is one important component in integration of ICT in teaching and learning. Effective adoption and integration of ICT in teaching and learning in schools depends on the availability and accessibility of ICT resources such as hardware and software. Access to hardware is not only important but also the use of suitable kind of tools and program to support teaching and learning (Tondeur, Valcke & Van Braak, 2008 in Buabeng-Andoh, 2012). It is evident that presence or absence of ICT infrastructure is becoming a critical factor in teachers' decision to use ICT in teaching.

Pelgrum (2001) who explored practitioners' views from 26 countries on the main obstacles in implementation of ICT in schools highlighted ICT infrastructure as among the main barriers. Out of the ten barriers mentioned four were related to accessibility. These were insufficient numbers of computers, insufficient peripherals, insufficient numbers of copies of software, and insufficient simultaneous Internet access. The other related problem with ICT infrastructure has been the slowness of ICT systems and scarcity of educational software in the school. Even in institutions where ICT facilities are available, poor choices of hardware and software and lack of consideration of what is suitable for classroom teaching are problems that still trouble many teachers (Newhouse, 2002 & Cox et. al., 1999a).

The other noted challenge in integration of ICT in teaching and learning has been the lack of technical support in its use. The availability of technical support in institutions means the use of ICT in teaching without losing time especially in having to fix software and hardware problems. According to Gomes (2005), lack of technical support in integration of ICT in science teaching affects to a great extent the use of ICTs in teaching science subjects. Computer breakdowns leads to learning interruptions and without computer technicians who can give technical assistance, it is likely that the regular repairs of the computer will not be carried out which discourages teachers to use computers to teach. Other than equipment breakdown, sometimes teachers' fear of equipment failure restricts their use. Thus, without technical support for teachers, they become frustrated resulting in their unwillingness to use ICT to teach (Tong &Trinidad, 2005).

ICT and Education in Kenya

The Government of Kenya sees ICTs as critical tools for its development. Through its Master Plan 2008-2012 the Government argued that without tapping ICTs, it would be difficult to achieve Vision 2030. The Vision itself emphasizes on the need to invest heavily in ICT infrastructure to ensure uniform access and reduce digital divide witnessed in the country. As a strategy to provide adequate ICT infrastructure to institutions, the Government came up with the National ICT Sector Master Plan which among other things outlined the process the Government proposed to use to ensure ICTs are widely spread and easily accessed across the country. Among its objectives was to ensure universal access to ICTs for sustainable development by setting up digital villages throughout the country, and to strengthen Kenya's learning opportunities to ensure that the country meets future technological challenges.

The Government further made a commitment of increasing ICT infrastructure that will make Kenya the ICT hub for Africa. As a strategy, it promised to restructure the ICT sector to involve private sectors in accumulating and deploying ICT infrastructure across the country. The partnership was to assist the country in achieving the universal ICT access in every part of the country including schools and villages. In 2006, the National ICT Policy was officially launched through a Government Gazette Notice No. 24. With the ICT competence becoming part of the requirements on the job market, the policy was revised in 2008 recommending a minimum level of computer literacy. According to the policy, universal access to affordable ICT services is desirable for the country to meet its ambitious economic development program of Vision 2030.

In 2008, the Government established the Kenya Information and Communications Technology Board (Kenya ICT Board), which was tasked to position and to promote Kenya as an ICT destination within the region. ICT infrastructure has been one of the targets by the Kenya ICT Board especially with the growing evidence linking the availability of affordable ICT infrastructure with attraction of international business particularly the BPO service industry (Kashorda, Acosta & Nyandiere, 2007). It is further observed that all of the countries that have been successful in attracting BPO services have also developed sophisticated telecommunication infrastructures. Furthermore, Kenya ICT Board was to create and encourage competitive ICT industries in the country by developing, launching and driving a National System of Innovation for Kenya. This would ensure creation of locally manufactured ICT infrastructure that support the local syllabi and content that would enhance use of ICT for teaching and learning in schools. The Board was also to ensure increased ICT access and utilization by all Kenyans by developing nationwide grassroots awareness about ICTs and instituting a national framework for ICT skills development. The country has remained committed in fulfilling its declared objectives especially in access to Internet. In 2009, Kenya was noted to have a minimal international Internet estimated to be about 100Mb/s. The minimum international Internet by then was also provided by satellite links, which normally introduced undesirable delays and high Internet costs. After making it a priority to procure global Internet, in 2010 the Government acquired undersea optical fiber links, which have provided global Internet to the country greatly reducing the delays and the high costs that were associated with the satellite links.

For Kenya to reach that level of universal access to ICTs, there is a need for development of ICT hardware, ICT software, adequate connectivity, and access to broadband infrastructure. The Government acknowledges this and identifies ICT hardware, software and connectivity as the three areas that are key pillars in providing ICT infrastructure for easier access (Kashorda, Acosta & Nyandiere, 2007). Consequently, it has established a number of collaborations with institutions, which include universities and private ICT industry to assist in developing and assembling cheap personal computers. In addition, it has been in discussion with leading software vendors such as Microsoft about software license costs. Other efforts have been the Government considering the use of open source software in educational and Government institutions.

The Challenge of Accumulating ICT Infrastructure in Learning Institutions

Integration of ICT in teaching and learning has posed a number of challenges to learning institutions. The challenges range from inadequate access to the few ICT infrastructure available, poor electricity supply especially in rural institutions, inadequate basic infrastructure especially for classroom teaching, lack of internet supply, lack of quality teachers to apply ICT to the existing education systems due to poor policy frameworks for ICT integration in education (Gutterman et al., 2009; School-Net Africa, 2004; Ogange, 2007 & Condie et al., 2007). The one major impediment in adoption of ICT in education especially in developing nations has been the high costs that are associated with equipping institutions with the necessary ICT infrastructure (Condie et al., 2007). Most developing nations find this task both complex and difficult to achieve. Internet for example, remains unfeasible in most of these countries, as the costs are deemed too expensive and sometimes not prioritized by the respective Governments. This is worsened by the fact that Internet connectivity varies from one region to another. The disparities are attributed to a number of factors among them the nature of the Internet technology. Those owned by the Government have been accused of failing to provide affordable and efficient services (Swarts and Wachira, 2010). Governments are seen controlling the service provision and reluctance in offering a competitive free market for communication services which impedes better connectivity and sustainability (Gutterman et al., 2009). They further argue that insufficient access to computers is one of the main obstacles for ICT in education particularly for rural institutions. This might call for a careful investment plan, which should encompass creative ways of financing and creating networks especially with private sectors.

Many researchers have noted that the Kenyan Government is keen in rolling out ICT infrastructure into institutions (MOE, 2005; TIVET, 2011 and Hennessy et al., 2010). At the Ministry level, the Government adopted its implementation framework on ICT integration in education, which was categorized into two portions. First, efforts of ICT policy review at a cost of 6.3 billion and provision of ICT infrastructure to institutions at a cost of 7.8 billion (MOEST, 2006). Attention has been given to access to ICT infrastructure as seen through its inclusion as one of the indicators of ICT integration in its ICT policy documents.

Facilitation of ICTs has seen the Government look at the various levels of education in the country differently. This is in terms of policy formulation and implementation. For instance, the Government sees training institutions as key partners in providing ICT skills to majority of its population. Consequently, there has been a commitment by the MOE to provide the necessary ICT infrastructure to Primary Teachers Colleges (PTCs). Strategies and initiatives to realize the commitment are many albeit not having been harmonized into a unified Government document. Most of these can be found in a number of documents that include: National ICT Policy of 2006, the National ICT Strategy for Education and Training document, Kenya Educational Sector Support Programme document, Kenya ICT Trust Fund and the 2007 revised Primary Teacher Education (PTE) ICT syllabus prepared by Kenya Institute of Education (KIE). In recognition of the need for Public Private Partnerships (PPPs) in equipping the PTCs with ICT infrastructure, the Government has had a number of collaborations. There is the New Partnership for Africa Development (NEPAD) e-schools programme and the World Summit on the Information Society (WSIS) whose objective was to integrate ICT in the delivery of education curriculum (MOE, 2006). Specific targets that were to be achieved by 2015 were linking colleges with ICTs and adapting curricula to meet the challenges of the information society (MOE, 2006). A significant step was an agreement to digitalize the curriculum under the KIE and NEPAD implementing connectivity to institutions (MOE, 2005). The other important strategy outlined in Farrell (2007) was development of specific e-learning resources that were to address the educational needs of primary and tertiary institutions. The Kenya ICT Trust Fund was established to mobilize and provide ICT resources to facilitate education and training through integration and innovation. Its general objective was to facilitate PPPs to mobilize and provide ICT resources to Kenyan public schools, community resources and learning centres.

Although these initiatives were set up as early as 2000, there has been scanty information on the exact numbers of the ICT infrastructure present in the Kenyan PTCs. The purpose of the paper is to document the available ICT infrastructure in PTCs as one way of contributing to the factors inhibiting integration of ICT in teaching and learning. These are findings on one of the aspects in a broader study carried out to evaluate the implementation of ICT policies in Kenyan PTCs.

Research Methodology

Research Design

The study utilized a descriptive case study design of selected PTCs in Kenya in analyzing implementation of Government ICT policy on provision of ICT infrastructure in PTCs. A case study design is one of the qualitative research strategies that investigate a contemporary phenomenon within its real life context (Yin, 1984: 23). The design was chosen since it allowed the researcher to present the actual nature of the ICT infrastructure in PTCs and how their presence or absence influenced its use in teaching and learning. Both qualitative and quantitative paradigms were utilized in collecting the data. Quantitative methods provided the otherwise non-existent data on the actual numbers of the available ICT infrastructure against the actual enrolments of students and lecturers. Qualitative methods, on the other hand, aided in eliciting the meanings and processes behind the emerging statistical patterns and trends on the ICT infrastructure available in the selected PTCs in Kenya.

Study Sites

The study focused on the PTCs offering courses leading to the Primary Teacher Education (PTE) certificate commonly referred to in the country as ‘P1’ colleges. The selection was based on a consideration that, they represent the basic teacher education institutions training majority of the primary school teachers in Kenya (MOEST, 2004). In 2011 at the time of the study, there were thirty-two (32) PTCs, twenty-one (21) public and eleven (11) private colleges approved by and registered with the MOE (MOE, 2009). At the commencement of the study, PTCs had a student population of 26,285 with a tutors' population of about 1,800 (MOE, 2009).

Out of the 32 PTCs, 4 PTCs, which translated to 12.5%, were sampled to participate in the study. Three public PTCs were randomly sampled representing 14.3% of the 21 Public PTCs. Through balloting, the following colleges were picked: Murang'a, Kilimambogo and Kigari Primary Teachers Colleges. Kamagambo Primary Teachers College was purposively sampled from the eleven private colleges. This is a private primary teachers college in Kenya that had the relevant aspects under investigation with a long history of training primary school teachers.

Target Population

The study targeted 3,810 students (teacher trainees), 226 tutors, 12 ICT tutors, 4 deans of curriculum, 4 deputy principals, 20 heads of departments and 4 principals within the four selected colleges as the informants. Table 1 summarizes the target population.

Table 1.1: Target Population

Type of informant	Number
Teacher trainees	3810
Tutors	226
ICT Tutors	12
Principals	4
Deputy Principals	4
Heads of Departments	20

Sample and Sampling Technique

Members of the teaching staff in the sampled colleges formed part of the informants since they were directly involved in integrating ICTs in teaching and learning. A random sample of 39.8% of the teaching staff was sampled to participate in the study. All the ICT tutors were purposively sampled since they were few and responsible for the teaching of ICT, planning and budgeting for ICT infrastructure. Orodho (2008) observes that if the population is small it might be taken as the sample size. Students formed part of the informants. Stratified sampling was used to classify the students into two groups that is, first years and second years. Then, the researcher while taking into account the respondents' gender; randomly sampled 10.5% of each first and second year students to participate in the study. According to Kilemi & Wamahiu (1995), 10% of the population under study is an appropriate sample size for investigation. Purposive sampling was used to select 6 students (3 male students and 3 female) from each institution to participate in a Focus Group Discussion (FGDs). All the college heads, department and subject heads were purposefully sampled as informants to respond to a semi structured interview.

Research Findings

The study findings established that all the four institutions had a computer laboratories (labs) equipped with computers. It further found out that the teaching of ICT course is done in computer labs. Majority of the students (96.3%) observed that it was done as a discrete subject in computer labs and 3.7% noted that it was used across the curriculum. The 3.7% represents the occasional times when ICT is used in teaching other subjects.

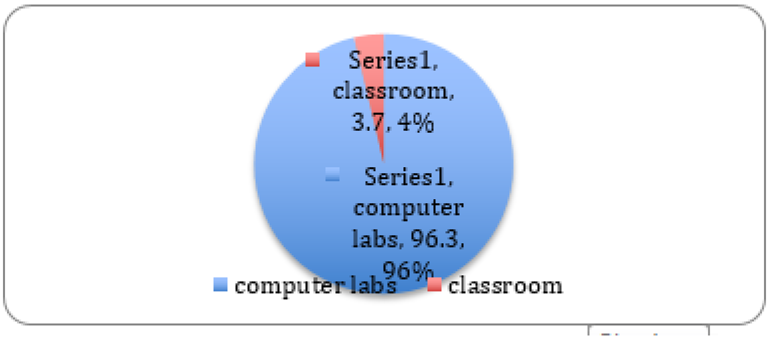

Figure 4.2: Teaching and Applicability of ICT

This was further revealed by the observation schedules by the researcher when he noted computer facilities installed in computer labs with all the classes lacking any form of ICT applicability. In fact some of the classes in some colleges were lacking sockets for connectivity to power supply; an environment that could not allow the use of ICTs in classroom teaching.

All the four computer labs in the four institutions had 'blackboards' which could not allow use of projection technology while teaching. The projection technologies available in the institutions were kept in the college administrator's offices. This meant they were not easily accessed during the normal teaching and learning process.

Although there is no recommended size for such a laboratory, the general requirements are that it should be of adequate size, well ventilated, and spaces that allow easier movements within the room. All the computer labs were of adequate size, well ventilated and adequate spaces. However, they lacked safety gadgets in case of an emergency like fire.

The study further sought to document the available hardware and software in the institutions. It noted a number of inconsistencies in the quality and quantity of the ICT facilities within the sample institutions. Table 1.1 shows the ICT infrastructures that were available in the four institutions.

Table 1.2: ICT Infrastructure Available in the Institutions

ICT Facilities	E-content materials	Furniture	Electricity	Ventil ation	Printers	Internet
Kigari	4 CDs & DVDs of Drama, no ICT guide, TAFAKARI	None	A	Good	2	A
Kilimambogo	Teachers' notes, TAFAKARI e-content	Benches	A	Good	2	NA
Kamagambo	NA	Chairs	A	Good	1	NA
Murang'a	Drama CDs & DVDs and TAFAKARI e- content	Benches	A	Good	2	NA

(A: Available, NA: Not Available, CD: Compact Disks, DVD: Digital Versatile Disk)

Table 1.1 indicates that PTCs lacked appropriate furniture in their computer labs. The available furniture ranged from chairs to benches. The e-content available could not only support use of ICT across the curriculum but also teaching of ICT as a subject. The software ranged from none generic to generic software.

The private college was more deprived of the e-content than the public institutions. For instance, Kamagambo (private college) did not have any learning materials in digital form or converted to e-content. The teaching of the ICT course rotated around the acquisition of ICT literacy skills, which could not equip the teachers with relevant competence for its use in teaching and learning. The institution had one printer that served administration and was not readily available for teaching and learning in the computer laboratory. The public colleges had e-content present as seen in Table 1.1. However, they were irrelevant and inadequate to serve the general purpose of teaching and learning. Every public institution had a printer in the computer lab readily available for teaching and learning. Institutions lacked adequate and specific e-content and supportive facilities for ICT integration in education

The researcher further looked at the ICT infrastructure ratio as shown in table 1.3.

Table 1.3: ICT Infrastructure Ratios in the Sample Institutions

Facilities	No. of students	Working computers	Computer-student ratio	Lab technician	Total no. of computers	scanners	Projectors
Kigari	1300	48	1:28	2	100	2	2
Kilimambogo	980	45	1:22	None	70	1	2
Kamagambo	769	20	1:39	None	40	1	1
Murang'a	720	35	1: 21	None	50	1	2
Population	3769	148	1: 25	2	255	5	7

Source: Computer Labs and Relevant Offices within the Institutions

The Table reveals that there was a low computer-student ratio of 1: 25 in the sample institutions. This was associated to lack of support from the MOE with all the four institutions indicating that most of the computers were the initiatives of the institutions.

Furthermore, 1(25%) of the institutions had Internet supply connected to 15(31.3%) of the available computers used as an extra resource base for teaching and learning. For effective sharing of information, there was need for creation of Local Area Networks (LANs), or Wide Area Networks (WANs) by the institutions to facilitate information sharing and collaboration. The study established that Internet supply in 3 (75%) institutions was lacking.

It was only in one of the institution (Kigari TTC) where Kenya Data Network (KDN) supplied Internet. In addition, the same institution had 2 computer technicians whose roles ranged from maintaining and servicing the computers, teaching computer packages to community members, and managing the internal network while the other 3 colleges lacked technician(s). Generally, the public colleges had better computer student ratios than private colleges. From table 1.2, Kamagambo (private college) had the highest computer-student ratio of 1:39 compared to the average ratio of 1:25 of the sample. They had the least number of the available ICT facilities with only one printer, a projector and a scanner for the entire institution mainly used by the administration. They pointed to lack of support from the Government in the use of ICT in teaching and learning yet accumulating ICT infrastructure is such an expensive course to be left to the college alone.

Access to the few ICT facilities by both students and lecturers ranged from average to poor. The researchers sought to find out how easy it was to access computers within the institutions. From the findings, 74.8% the teacher trainees indicated that they access computers within their institutions with only 24.5% indicating otherwise. For the lecturers, 46.8% indicated easier access with 50.1% indicating otherwise. Although 74.8% of the teacher trainees and 46.8% of the lecturers had indicated easier access, it was corrected by interviews. Teacher trainees through Focus Group Discussions indicated that they only accessed computers during ICT lessons. They lacked an allocated time within the school timetable when they could freely access computer labs. To enforce practice, students were expected to have free time when they could access the facilities and put to practice what they had learned.

The 46.8% of lecturers who agreed were those who carry their own laptops to schools and mathematics and science lecturers who had computers installed through Science departments through Strengthening Mathematics and Science in Secondary Education (SMASSE). This was contrary to the provision of the policy that required that tutors were to be provided with computers in the ratio of 1:1 (MOE, 2005).

Most of the staff rooms and departments offices had supply of electricity. However, the offices lacked sockets to allow use of electricity. This was more evident in Kilimambogo where majority of the departments that participated in the study lacked sockets for connectivity to power.

For proper functioning of ICT facilities there is a need for technician(s) to provide maintenance. Unfortunately, 3 (75%) of the sample institutions lacked a laboratory technician(s). This left many teachers to double up as technicians although their training had little to do with maintenance or hardware. This might be the explanation for the so many computers that had broken down in most of the institutions. In the sample, for example, out of the 255 (100%) computers that were available in 2009, only 148 (58%) were in working condition. In a period of 2 years, 42% of once working computers had broken done.

Figure 4.4: Broken Down Computers in a Computer Lab in one of the TTCs

The available computers in most of the institutions belonged to the teacher trainees. The institutions noted that computers available were few that left the computer lab(s) occupied by teacher trainees throughout the week. Consequently, teachers had no designate computers for teaching and learning. In Kilimambogo and Murang'a, teachers were not allowed at any time to use the students' computers in the computer labs. In Kigari, and Kamagambo, although the impression was that teachers access the ICT facilities in the computer labs, they were allowed during odd hours after classes and since most of them commute, very few accessed the facilities. Introduction of computer packages for community members in Kigari seemed to have taken the limited time the computers were free for lecturers and teacher trainees. This was evident the time the researcher visited the institution, there was a community class in computer lab 3 and yet it was early in the morning, the time the school community should have been utilizing the ICT facilities.

Other than the hardware, the institutions lacked software applications and information systems. The software ranged from none to generic software. This is well captured in the excerpts below.

> So far the e-content material is limited. However, there is a programme that is trying to address this - that is -‘TAFAKARI’- which has supplied some e-content but is not relevant to our syllabus. This was a South African programme having 6-8 different sessions each lasting for 20 minutes. They were about 6- 8 but again not in harmony with our PTE syllabus. ”
>
> Dean of Curriculum in one of the PTCs.

Discussion

Analysis of the policy on ICT infrastructure in PTCs in Kenya demands that PTCs be equipped with the necessary ICT infrastructure to facilitate integration of ICTs into classroom teaching and learning. Among the recommendations are: PTCs to have networked desktop computers at a ratio of 1 computer for each lecturer and at-least 1 computer laboratory with 20 computers for every 300 students (MOE, 2005). This translates to computer-student ratio of 1:15 and computer- lecturer ratio of 1:1. Further analysis of the policy reveals that it is silent on the availability and number of other ICT infrastructure. They are left to the discretion of the individual institutions. It should, however, be pointed out that the process of providing quality and relevant ICT competencies to teacher trainees in PTCs require specific facilities and equipment other than computers. Relevant and adequate facilities enhance acquisition of specific ICT skills by teacher trainees that equips them with competence and confidence needed to mainstream technology into teaching and learning.

The findings show that all the four institutions had computers, which varied from one institution to the other. However, only 1(25%) had Internet supply connected to 15(31.3%) of the available computers in computer laboratory 3. The limited connectivity established in PTCs in the country is a hindrance to the use of Internet as an extra resource base for teaching and learning. Consequently, the teaching of Internet as a topic in PTCs is done theoretically and students are denied learning the surfing skills that are necessary for empowering independent learners. In addition, computer-student ratio was 1:25 and there were no designate computers for tutors. It was only 1(25%) out of the 4 institutions that had 2 technicians. The findings are in harmony with a number of studies, which reported majority of the institutions lacking adequate ICT facilities for integrating ICT in teaching and learning (Oredo, 2008; TIVET, 2011; School-Net Africa, 2004 & MOE, 2005).

There were further inconsistencies in the quality and quantity of the ICT facilities within the sample institutions. All of these computers were installed in a computer lab where the teaching of ICT course was done as a subject. This is contrary to the international practices where ICTs are now integrated in classes to allow its use in classroom teaching and learning. Apparently, the use of computers in computer labs means PTCs still prepare teacher trainees who view ICT as a subject and not as an educational tool as expected by the general ICT policy. These findings are supported by a number of earlier studies on ICT infrastructure in PTCs (Farrell, 2007 & KENET, 2010). Most of these studies pointed out ICT infrastructure as the major challenge in mainstreaming ICTs in education (Farrell, 2007; School-Net Africa, 2004; Gutterman et al., 2009 & MOE, 2005). The problem is exacerbated by the fact that most of the institutions had computers as the only available ICT infrastructure.

The high computer student ratio of 1: 25 had influenced the choice of appropriate teaching pedagogies that were adopted while teaching ICT course. Although ICT teachers agreed that the given teaching pedagogies in the teaching guide were sufficient for the set objective, the low number of ICT facilities could not allow them to use learner-centered approaches. The facility ratio forced most of the lecturers to adopt lecture methods in delivery of ICT content. Given the practical nature of the ICT course many teacher trainees did not get the hands on skills on how to integrate ICT in teaching and learning.

The findings further revealed that PTCs did not have adequate e-content for use of ICT in teaching and learning. The study established that other than the hardware, the only software present were generic that did not support the PTE curriculum in any way. They could not, for instance, provide the relevant materials to support teaching and learning of the PTE curriculum through ICTs as the computers do not come pre-packaged with relevant teaching content. The e-content that was available was irrelevant to the current PTE syllabus as it was not locally produced hence lacked the basis of the PTE curriculum.

Although technicians are to provide assistance in the use of ICTs for teaching, it is only 1 institution (25%) that had employed a technician. PTCs lecturers require assistance on use of technology in teaching and learning, and, in maintaining the general ICT infrastructure. Tutors should focus on delivery of the curriculum through ICTs and not maintaining and repairing ICT infrastructure. The number of computers that had broken down within the short period of time that had been in use was alarming. Out of 255 computers in the sample institutions, 107(48%) had broken down in a span of two years. This further restricted use of ICT in teaching and learning as the damages reduced the number of available computers for teaching.

The MOE (2005) through Kenya Educational Sector Support Progamme noted that development of e-content materials for delivery of the curriculum in the 14 subjects was an immediate strategy to facilitate delivery of the curriculum through ICTs. However, the study established that the institutions had not been supplied with any e-content.

Conclusion

The findings indicate that PTCs do not have adequate ICT infrastructure to enhance use of ICTs in teaching and learning. The few facilities available have forced the institutions to adopt a laboratory approach where facilities are put in a central point for teaching and learning of ICT subject. However, this does not provide a good model of integrating ICTs in the teaching and learning process for their students since they see ICTs as tools separate from normal teaching and learning.

Recommendations

First, the Government should be involved in proper management of the available ICT infrastructure by devising sustainability plans since machines (hardware) and software require refurbishing. This will assist the institutions in management and repair of the accumulated ICT infrastructure and prevent the breakages that were witnessed in the current study. Secondly, Kenya Institute of Education (KIE); the body responsible for developing curriculum materials should develop and supply the Primary Teachers Colleges with relevant e-content in all the 14 subject areas to ensure delivery of curriculum through ICTs. When planning the curriculum, KIE should ensure that it is in harmony with the educational vision, the culture and context of learning. In this case the e-content should be locally manufactured to be responsive to the local needs of the PTCs and in harmony with the current syllabus. This will avoid provision of e-content that is irrelevant to the PTCs training or those, which do not directly support the curriculum as observed with 'Tafakari project'. Lastly, the study established a deficit in ICT infrastructure in the colleges. Consequently, it recommends MOE to initiate partnerships with private sectors to equip PTCs with ICT infrastructure. Internet provision was lacking in 75% of the institutions. The government can reconsider an education rate (e-rate) for installing Internet to PTCs through partnership with private sectors to pay for the substantial costs to ensure Internet connectivity to primary teachers training colleges. This will ensure that PTCs are supplied with an extra resource base other than books for teaching and learning.

References

Buabeng-Andoh, C. (2012). Factors Influencing Teachers Adoption and Integration of Information and Communication Technology into Teaching: a Review of the Literature. International Journal of Education and Development Using Information and Communication Technology (IJEDICT), 2012 (8), 1: 136-155

Berhane, Aradom &Tedla (2012). Understanding the importance, impacts and Barriers of ICT on Teaching and Learning in East African Countries. International Journal for e-Learning Security (IJeLS), Vol 2, Issues 3/4 2012.

Condie, R., Munro, B., Seagraves L., & Kenesson, S. (2007). The Impact of ICT in Schools- a Land- Scape Review. United Kingdom: University of StrathClyde.

Farrell, G. (2007). Survey of ICT and Education in Africa: Kenya Country Report. Washington, DC: World Bank.

Gutterman, B., Rahman, S., Supelano, J., Laura, T. & Mai, Y. (2009). Global Alliance for ICT and Development: New York.

Government of Kenya (GOK). Kenya ICT Trust Fund Strategic Plan 2006-2011. Nairobi: Government Printer.

Hennessy, S., Onguko, B., Harrison, Ang'ondi, Namalefe, Naseem & Wamakote. (2010). Developing use of ICT to enhance teaching and learning in east African Schools: A review of the Literature. Cambridge, UK and Dar es Salaam, Tanzania: Faculty of Education, University of Cambridge and Aga Khan University, Institute for Educational Development-Eastern Africa.

Ivers, K. S. (2003). A Teacher's Guide to Using Technology in the Classroom. USA: California State University.

Khalid, Adullah Bingimlas. (2009). Barriers to the Successful Integration of ICT in Teaching and Learning Environments: A review of the Literature. Eurasia Journal of Mathematics Science and Technology Education, 2009, 5(3), 235-245.

Kenya Institute of Education (KIE). (2004). Primary Teacher Education (PTE) Syllabus Vol. (1): Nairobi: Kenya Institute of Education. Information and Communications Technology Teaching Guide for Primary Teachers Training Colleges (Revised PTE Syllabus 2004). Nairobi: KIE.

Kilemi, M. & Wamahiu, S. (1995). Issues in Educational Research in Africa. Nairobi: East African Educational Publishers.

MOE. (2005). Session Paper Number 1 of 2005: A Policy Framework for Education, Training and Research. Nairobi:

Government Printer. (2006). National ICT Strategy for Education and Training. Nairobi Government Printer. MOE Strategic Plan 2006-2011. Nairobi.

Teachers Service Commission. (2009). Education Facts and Figures. Nairobi: Government Printer.

MOEST, (2005). Kenya ICT Education and Option Paper of 2005. Nairobi

Orodho, A. (2008). Techniques of Writing Research Proposals and Reports in Education and Social Sciences. Maseno: Kanezja Publishers.

Scottish Government. (2007). Improving Scottish Education: The Use of ICT in Learning and Teaching. HM Inspectorate of Education. Scotland

Swarts, P & Wachira, E. (2010). Tanzania: ICT in Education Situational Analysis. Global Schools and Community Initiative, Tanzania.

TIVET ICT Baseline Survey Report. (2011). Tivet Institutions in Kenya. MOEST, Nairobi.

Yin, R. (1984). Case Study Research: Design and Methods, 1st ed. Beverly Hills, CA: Sage.

INTEGRATION OF INDIGENOUS AND SCIENTIFIC TECHNOLOGY IN DISASTER RISK REDUCTION EDUCATION IN KENYA; A FRAMEWORK FOR SUSTAINABLE DEVELOPMENT

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Abstract

Vision 2030 aims at transforming Kenya into a newly industrialized, middle income country, providing a high quality life to all the citizens in a safe and secure environment by the year 2030. The vision stands on three pillars, social, political and economic with Science, Technology and Innovation as their foundation. Hydro-meteorological disasters in fragile ecological zones in Kenya have destroyed all the development made in a long time. Disaster risk reduction education is the inoculation to the havoc that these disasters cause. Disaster risk reduction is a multi-sectoral facet and aims at reducing peoples' vulnerability to disasters that exacerbate poverty, providing a just society, clean environment and upholding human rights. A lot of effort has already been put in place by state and non-state actors to reduce Budalangi flood plains community vulnerability to floods. However, indigenous knowledge on flooding and River Nzoia regime and the soil science have not been factored in the intervention measures. The scientific technological knowledge on early warning signs, vulnerability analysis, and mapping of the flooding given to the community is differentiated and does not integrate the indigenous technological knowledge. There seems to be disconnect between the community's indigenous knowledge and modern scientific technology given to them in terms of early warning signs and development of resilience to floods. Furthermore, there is no framework for hybridization of indigenous and scientific technology in disaster risk reduction education. This study has recommended a nexus of indigenous and modern scientific knowledge and technology as the antidote to the continuous suffering of the communities in fragile hydro-meteorological climatic zones for sustainable development.

Key words: Disaster risk reduction; Hydro-meteorological climatic zones; Indigenous knowledge; scientific technological knowledge; Sustainable development.

Background to the Study

The relationship between Indigenous Knowledge (IK) and disasters has developed more interest in recent years. Due to the massive size of the Indian Ocean Tsunami, the experiences of communities such as the Simeuleans and the Moken, who both relied on IK for survival, received enormous international attention. Their stories continue to be disseminated and celebrated through UN publications, newspaper articles and television news programs. This has initiated some discussion on the possibility of improving disaster risk reduction (DRR) education and incorporating IK into early warning systems and DRR.

Specifically, the UN has triggered this consideration in several of its publications. For example, Priority 3 of the Hyogo Framework for Action 2005-2015, which focuses on education and knowledge, considers IK as a means of building a culture of safety and resilience. It designates one of its key activities to the importance of information management and exchange, and highlights the use of "relevant traditional and indigenous knowledge and cultural heritage" to be shared with and adapted to different target audiences. Further, as is stated in the UN publication on Lessons For a Safer Future: Drawing on the experience of the Indian Ocean Tsunami Disaster: "It is important to incorporate traditional wisdom and local knowledge into future disaster risk reduction strategies and to ensure that such knowledge continues to be communicated through generations and to migrants and new comers to the affected areas." In addition, the World Conference on Science-Framework for Action, held in Budapest on 26th June – 1st July 1999, emphasized the need for governments to support collaboration between traditional knowledge holders and scientists as a means of exploring the relationships between the different knowledge systems and foster mutually beneficial linkages.

In the Asia-Pacific region, the consideration of IK to inform and improve disaster risk reduction has accelerated in recent years, marked by the work of several organizations. UNESCO has performed substantial work relating to IK through their cross cutting programme entitled Local and Indigenous Knowledge Systems (LINKS). Their Andaman Pilot Project aims to preserve IK of the Moken people living in the Surin Islands off the coast of Thailand and Myanmar, focusing on incorporating that knowledge into natural resource management and disaster risk reduction policies. UN/ISDR, in collaboration with Kyoto University have a publication compiling cases from the region where IK was used to survive, cope or reduce risk from natural disasters. The publication is entitled IK for Disaster Risk Reduction: Good Practices and Lessons Learned from Experiences in the Asia-Pacific Region.

The SAARC regional center, in collaboration with ADRC, has begun an initiative, which will collect valuable IK practices in the South Asian region. Finally, many NGOs throughout the region have been working to explore and document IK in an effort to better encourage the integration of this knowledge into disaster risk reduction policies. Despite the growing efforts and enormous achievements relating to IK and DRR, there has been a further demand for more synergy between organizations and researchers working on the topic, as well as a greater effort to integrate IK with Scientific technological knowledge then link practice to policy.

As Kenya strives to achieve the Vision 2030, the first five-year medium term has just been completed and evaluation of the same is expected. Vision 2030 is the country’s blue print covering the period 2008-2030. It aims at transforming Kenya into a newly industrialized, middle-income country, providing a high quality life to all citizens in a safe and secure environment. It is expected that Vision 2030 through the social, economic and political pillars with Science, Technology and Innovation as their foundation, will lead to the realization of the Millennium Development Goals. The social pillar seeks to build a just and cohesive society with social equity in a clean and secure environment. The economic pillar aims at improving the prosperity of all Kenyans through economic development. The political pillar aims at realizing a democratic system founded on issue-based politics, respecting the rule of law and protecting the rights of every individual Kenyan society.

Disasters destroy all the developments that have taken years to build. Hydro-meteorological disasters are perennial in most parts of Kenya and cause massive destruction of lives and livelihoods exacerbating poverty. The communities that live in fragile ecological zones such as Budalangi flood plains are vulnerable to the disasters; floods in particular. If not put under check, hydro-meteorological disasters can make the realization of Vision 2030 a pipe dream. Disaster risk reduction education is a multi-sectoral facet and aims at reducing poverty, building a just society, a clean environment and upholds human rights. It is therefore the inoculation to the havoc that disasters cause. A nexus of indigenous and modern scientific technology through the culture of disaster risk reduction is the antidote to the continuous suffering of the communities in hydro-meteorological climatic zones like Budalangi flood plains.

A study done by Mukuna (2013) on evaluation of the integration and implementation of the disaster risk reduction education in Budalangi flood plains primary schools revealed that perennial floods that have made the community to become poor and vulnerable are caused by several factors. Among them is lack of knowledge on building resilience against floods so as to inculcate the culture of safety in the community, slow pace of implementation of the Education in Emergency policy on changing the primary school curriculum attributed to leadership and political will, no continuous professional development of teachers on integration of DRR into the curriculum, non-examination of DRR in national examinations, no specific policy by the Ministry of Education on integration of DRR into the primary school curriculum. It also emerged that a lot of effort has been put in place by state and non-state actors to reduce people's vulnerability to disasters and poverty.

However, indigenous knowledge on flooding, River Nzoia regime and the soil science have not been factored in the intervention measures. The scientific technology on early warning signs using Remote Sensing satellites, vulnerability analysis and mapping using Geographic Information Systems and Geographic Positioning Systems on floods, given to the community is differentiated and does not integrate the indigenous technology from the local community. There seems to be disconnect between the community's indigenous knowledge and modern scientific technological knowledge especially on early warning signs on flooding. Furthermore, the IPCC report (2007) and Mutimba et al, (2011) have warned that satellite reports on climate change have indicated that the lake region will experience increased rainfall by 2015. Research on land use patterns along River Nzoia by Onywere (2011) and River Nzoia mouth morphology (2012) indicate that flooding will continue for a long time. Disaster risk reduction education therefore needs to be embraced by the community. There is a great need for hybridization of indigenous and scientific technological knowledge to enrich DRR education being given to the community. As for now, there is no framework to integrate indigenous and scientific technological knowledge in DRR education so as to reduce people's vulnerability and poverty for sustainable development. For sustainable development, Indigenous knowledge and scientific technological knowledge need to be integrated.

In Kenya, there is little or no documentation on the existence and importance of indigenous knowledge and strategies related to DRR education. This paper is suggesting a framework for the two technologies as an effective tool for DRR education and alleviation of poverty for sustainable development. The framework has used existing indigenous and scientific knowledge in Budalangi flood plains to enhance the ability creating a culture of safety and reducing the community's vulnerability to floods. It is hoped that this framework will lead to increased collaboration among stakeholders and lead to organized DRR planning.

Linking Indigenous Knowledge to Disaster Risk Reduction

Due to the increasing threat from natural hazards, many local, national and regional organizations have devoted themselves to developing early warning systems, to encouraging governments to prioritize disaster management, and to increasing communities' resilience to the future threats from disasters. However, despite recent progress and accomplishments, organizations and governments are still looking to improve disaster reduction strategies by learning from current disasters and the experiences of affected communities.

In 2005, in Kobe, 168 governments adopted the Hyogo Framework for Action to build resilience of nations and communities to disasters by 2015, underlining thus the urgent need to shift efforts from only preparing for disaster response to focusing on reducing risk and vulnerability, and spelling out the specific responsibilities of governments, international and regional organizations on how to do so. The UN/ISDR, which serves as the centrepiece of the United Nations efforts to reduce the growing impact of natural hazards, brings together governments, civil society groups, academics, regional institutions, and the private sector to ensure a coherent approach to disaster risk reduction.

The Priority 3 of the Hyogo Framework for Action (HFA) focuses on education and knowledge, which considers indigenous knowledge as well to build a culture of safety and resilience. As one of the key activities under the HFA Priority 3, the importance of information management, exchange and highlight the use of "relevant traditional and indigenous knowledge and cultural heritage" to be shared with and adapted to different target audiences. Examining additional communities who have also used indigenous knowledge to survive difficult situations will provide an in depth understanding of what indigenous knowledge can provide to disaster risk reduction and why it is so successful in reducing risk.

Many international scholars have increasingly highlighted the importance of local knowledge and practices in relation to environmental hazards and disasters (Mercer et. al, 2007). However, while in theory the importance of such work has been recognized, within the international community, the practical application generally only occurs on a small scale within communities of developing countries. This has resulted in NGOs and other organizations working with communities threatened by environmental hazards to promote indigenous knowledge as a great contribution to DRR education (Mercer et.al, 2007).

Indigenous knowledge is referred to as a number of ways of including but not limited to indigenous knowledge, local knowledge, traditional knowledge, indigenous technical knowledge and traditional environmental knowledge. It is a body of knowledge existing within or acquired by local people over a period of time through accumulation of experiences, society-nature relationships, community practices and institutions and by passing down from one generation to another.

Indigenous knowledge is composed of technical ecological and historical knowledge. Practices are done at the individual, household and community level and dependent on socio-cultural belief systems of respect, reciprocity, sharing and humility. State and non-state actors influence all these processes. Indigenous knowledge uses observation, forecasts, and adaptation and communication strategies. Indigenous knowledge is oppressed in a number of ways as a result of marginalization, powerlessness, violence and denial of existing knowledge. Indigenous knowledge is qualitative and geographically specific in contrast to scientific knowledge, which is quantitative and more general

(Dekens, 2007). On the other hand, scientific knowledge is global and very dynamic in nature. In most cases, indigenous knowledge is hidden and dismissed by scientific knowledge as inferior.

A deeper understanding of indigenous knowledge, its characteristics and controversial elements are essential if this knowledge is to be used to improve Disaster Risk Reduction education. The relationship between the local community and its specific natural environment is crucial when discussing natural disasters. Furthermore, the extended period of time a community has existed in a given environment expands the knowledge that comes from experience and practice. Indigenous knowledge and scientific knowledge provide a more "rounded understanding of natural and cultural environments and sustainable development potentials (Siltoe, 1998). DRR experts, practitioners and the international aid community as a whole have slowly come to the realization that the standard approaches to DRR, which focus on technological solutions (e.g. better surveillance techniques, high tech warning systems and stronger infrastructure), could be improved by taking indigenous knowledge into account.

Several studies have emerged which examine the value of indigenous knowledge for DRR in different situations. Some of these studies examine the specific knowledge of the community, extracting particular strategies to be used in other communities. Other studies make general arguments for the importance of indigenous knowledge as a whole, citing the benefits all indigenous knowledge has for the community and DRR projects working in that community. DRR now considers the value indigenous knowledge provides for the field.

First, a shift in thinking about DRR introduced the vulnerability approach to reducing risk, taking into account specific elements of the affected community. Secondly, DRR has increased its ties with the international development and sustainable development discourses, which have already recognized the value of indigenous knowledge (as early as the 1970s). Finally, several cases have emerged from large disasters (such as the Indian Ocean Tsunami in 2004), which show the success indigenous knowledge has had for reducing community vulnerability to disasters. Experts agree that the links between DRR and indigenous knowledge have seldom been made in either literature or practice (Denkens, 2007a). The consideration of social science perspectives i.e. knowledge originating within the communities, conflicts with the accepted position that advanced geophysical knowledge and technical systems are the most effective disaster response mechanisms (Denkens, 2007b). Specific practices and strategies which indigenous knowledge teaches can have added value to existing strategies.

Secondly, indigenous knowledge increases the participation of the affected community and empowers them to take the leading role in DRR. Thirdly, the knowledge contained in indigenous knowledge can help improve DRR project implementation and, finally, indigenous knowledge is disseminated by non-formal educational means, which provides a successful model for other education on DRR. The role of indigenous knowledge in the participatory approach has two main values. First, using indigenous knowledge employs information the community already possesses which is valuable to DRR. In most disaster-prone areas, the community has a history of experience with disasters, leading to an accumulation of information regarding how to predict, react to or recover from their impacts (Battista & Baas, 2004).

Further, recognizing indigenous knowledge is part of a shift from emergency management done for (and sometimes to) indigenous communities, to emergency management done in partnership with indigenous communities (Denkens, 2007a). Second, the recognition and use of indigenous knowledge can provide improved self-confidence for the community and allow it to deal with disasters on its own. Recognizing and sharing indigenous knowledge will confirm that its knowledge is valuable and will give its members authority over the process of risk reduction. This, in turn, will provide the enhanced security needed to respond immediately to incoming threats from disasters, since local community members are the first-responders.

A third argument for the value of indigenous knowledge for DRR is its help in improving project planning and implementation (Denkens, 2007b). Respecting and accounting for indigenous knowledge provides an understanding of local practices and context. A project will be more effective if it takes into account the local peoples' economic, political, social and cultural understanding, to know what is acceptable and what is needed (Denkens, 2007a).

Thus, in order to successfully educate and communicate with an affected community, local beliefs, perceptions, knowledge and understandings must be considered through an examination of their indigenous knowledge and views of disasters (UNESCO, 2005). Further, the HFA asserts that indigenous knowledge is important in the context of information management and exchange. The one reference to indigenous or traditional knowledge in the text encourages nations to include indigenous knowledge in any information used in DRR education material (UNISDR, 2006). Indonesia and Lao PDR have integrated indigenous knowledge into DRR education so as to make curricula flexible and relevant to their contexts (UNISDR, 2011). This study investigated if indigenous knowledge has been integrated in the formal and informal curriculum development in Budalangi flood plains primary schools.

Methods of Integrating Indigenous Knowledge into DRR Education

Indigenous knowledge is often passed down orally through stories and songs. This method of dissemination has proven to be very successful and emphasizes the importance of non-formal education, the dissemination of information through alternative methods outside of formal schooling, such as songs, stories, art and theatre (Baumwoll, 2008). DRR education, however, is often done by integrating information on disasters, vulnerability, and response strategies into formal education via school curricula. In recent years, DRR information has been increasingly disseminated in non-formal ways as well, including the use of stories, songs, folk art and performances as well as utilizing community leaders, religious organizations, community organizations and extra-curricular clubs.

Several international organizations and NGOs are involved in promoting the inclusion of DRR into the non-formal education sector. Examples from the Asia Pacific region include UNDP's work in India (UNPFII), Red Cross programs in Indonesia and Vietnam (UNISDR) and projects by Action Aid, Thailand (UN, 2004). CDBM is also a method of non-formal education since it educates the community about DRR policies and strategies outside of the formal education sector. Each of these arguments illustrates an important value of indigenous knowledge for DRR and more work is still needed to determine how to better integrate them into existing policies and practice. Nonetheless, the arguments do not provide a specific way to use the knowledge to help all communities affected by disasters.

Older members of the society who are respected by their community, often referred to as elders, are considered key knowledge carriers since many have extended experience in a location and have observed changes that have occurred throughout their lifetimes. Along with the memory of past events, elders provide the wisdom to interpret rare events. Their knowledge does not simply reflect the existing environment, but also grasps its historic development and its interaction with social and cultural changes within the community (Battista & Baas, 2004; UNESCO, 2005).

Many indigenous communities have a strong oral tradition, representing a primary way its knowledge is passed down through generations. One way this oral tradition manifests itself is in the form of these cultural traditions, which often contain lessons and teachings. Cultural traditions can include stories, legends, songs, proverbs, ceremonies or rituals, which both represent and are encouraged by the culture of a society. For example, many indigenous communities have created and re-created stories, which relay the legend of how everything began (Siltoe, 1998). These stories often contain lessons about human behaviour or explanations of why certain things are the way they are. Indigenous knowledge systems often provide a sense of belonging to a location, an identity, which involves the place and an ability to relate specifically to that place (Baumwoll, 2008). These characteristics allow for a more integrated approach to the environment, in that social and environmental relationships are interlinked and there is a deep kinship between the people and their local environment. In this study, the strategies of imparting the indigenous knowledge were established.

Types of Indigenous Knowledge Necessary for Integration into DRR Education

Baumwoll (2008) has categorized the various forms of indigenous knowledge that need to be integrated into DRR education. Ecological knowledge holds particular value for DRR because it provides an ability to recognize and interpret warning signs, which can help to predict incoming disasters. Through identifying impending disasters, people can adapt to the changing circumstances and respond to disasters before it is too late. In the context of disasters, respecting and preserving the environment allows communities to reduce potentially harmful actions leading to disasters. By maintaining an awareness of the environment and not exploiting it or causing degradation, the potential for disasters to occur is much lower. She reports that the strong cultural and oral tradition of indigenous communities, manifesting itself in the form of stories, proverbs, legends and songs. These traditions reduce community vulnerability by educating the people on local risks, how to recognize warning signs, the impact of disasters and how to respond to impending disasters.

A second category of cultural traditions, which can help reduce vulnerability to disasters, includes ceremonies and rituals. Ceremonies and rituals educate people about local environmental threats, can further foster an environmental ethic and help create social resilience within a community. Cultural traditions are important ways to share information about disasters because they receive more emphasis, more authority within the everyday lives of most people, and there is a stronger commitment to continue disseminating this knowledge. Ceremonies and rituals can also help encourage an environmental ethic. Many indigenous communities perform ceremonies, which honour the spirits of the plants, animals and supernatural creatures, such as offerings. Ceremonies and rituals can also strengthen the social resilience of a community, maintaining close ties between community members who can depend on one another when a disaster strikes. If a community's identity is closely linked to place, there is more incentive to care for this place (Turner, 2005).

A strong commitment to remain in that place is also an advantage to DRR education. A commitment fosters a desire to dedicate time and energy to finding solutions to the problems posed by disasters. Communities may be more willing to invest in strategies to reduce risk or they may even develop their own innovative ways given the long-term commitment. If there is no feeling of a connection to place, the community may move somewhere else where the disaster threat might not exist. In many cases today, communities do not have the choice to move away from their disaster-prone home, due to economic or social obstacles. However, several important challenges to keep in mind when exploring transferable IK are: The value of IK is affected by changing environments due to climate change or development. Much IK is being lost since it is held solely by elders or men who are migrating away from the locality. Much of this knowledge is site specific and cannot be replicated in other contexts and many of the traditional strategies are less valuable for regional hazards, such as earthquakes, droughts and epidemics, which produce widespread and lagged interactive and cascading effects.

In management of River Nzoia basin, several factors have to be put in place in regard to indigenous knowledge; Climate, river regime and geo morphology, experience of particular type of disaster, cultural context, socio economic context and the globalization. Key elements, which belong to IK, include housing, food, environment, health, livelihood and land use. Both modernization and climate change have and will contribute to many shifts in the environment, which will affect IK related to DRR education. Examples of these changes include increasing rainfall, higher temperatures, globalization, seasonal fluctuations, flash floods and increased information technology.

In regard to DRR policy emphasis needs to be put on hybridization of two different stakeholders, those of IK (individual, community, civil society, CBOs and local government), and those of scientific knowledge (scientists, researchers, technicians, government, institutions and external agencies). These two groups of stakeholders will need to work together in order to incorporate both types of knowledge into DRR policy. A dialogue is needed between the two in order to determine the best strategies. In addition, a community as a whole does not always hold the IK, sometimes there are specific groups or rural experts which are the only holders of this knowledge. These people must be identified in order to manage disasters IK for water resource management.

Methodology

This study adopted a qualitative methodology with a case study design. It employed various data collection tools such as Focus Group Discussions for parents in schools, In-depth interviews for NGO representatives, government officers and head teachers. Document analysis on school documents, textbooks, minutes of staff meetings, notices and memos, stakeholders' meetings. Data was collected on the Budalangi community's engagement in disaster risk reduction, vulnerability factors such as land use practices along the R. Nzoia, livelihoods, history of floods, housing. More data was collected on the type of indigenous and scientific knowledge available in the community especially on early warning signs to floods and social protection.

Results and Discussion

General Impacts of Floods on Budalangi Flood Plain-Vulnerability Analysis

Integration of DRR education into the primary school curriculum cannot happen in a vacuum. There are facilitative and impeding factors to this noble course. The curriculum change stakeholders were asked if floods affect education and education programs in any way. Their responses were as follows:

> The impact of floods on education is enormous. Floods destroy human life and livestock, damage personal property and rural infrastructure. This is a big setback to development programme in this area. For example, look at our classes and toilets, they have big cracks and can collapse any time. We are yet to repair them and soon we shall have more floods… (Headteacher Rugunga Primary).
>
> The floods cause a lot of suffering. Most of our pupils turn to absenteeism due to water borne diseases during and after the floods. There is also disruption of family life (Head teacher, Sibuka Primary school).
>
> As a woman I can say floods first of all burden women. They are overburdened with domestic chores in the IDP camps. They have to queue for clean water from the tanks, fetch firewood which in most cases is wet, take care of ailing members of their families, look for food if the relief food delays and in some cases most of the women turn to prostitution so as to provide for their families. You know most of the local leaders are men and they also appoint men to be in charge of relief food. Some of the food distributors threaten women that unless they befriend them

then they won't get their supplies. This forces some women to become prostitutes during their stay in IDP camps and it increases chances of HIV/AIDS. Again we sometimes do not get family planning services in time especially those who use Depo provera and those who use contraceptive pills. Moreover, since most of us are poor. We use rags as sanitary towels. When in our own homes we wash and air them in the sun but in the camps this privacy is not there. Besides, there is a lot of rain. Sanitary towels are only given to the school going children. Most women end up getting fungal infections due to these in hygienic practices (Parent at Budalangi Primary school).

If I may add something… apart from sexual exploitation of women, the girl child also suffers a lot. Some are forced into early marriages so as to run away from the poverty and suffering in their homes. This leads to high dropout rates of our girls. Others dropout and they are sent away from home as housemaids so that they can be sending money back home to their parents (Teacher, Budalangi Primary School).

At Mudembi, which was an IDP camp in December 2011, it was very overcrowded. Boys and men were separated from girls and women. After the floods, most girls especially in classes 5 to 8 did not return to school because they were pregnant. They lacked close monitoring from their parents. While in the camps there is a lot of immorality. People take advantage of the unattended children. Most children learn about sex when they are in these camps and engage in sex too early. Even those who don't get pregnant don't concentrate in class because their minds are polluted. This could be causing poor performance in this area (Parent Igigo Primary School).

In this Bunyala irrigation scheme, the dropout rate is very high. In Rwambwa primary school, children drop out to go and work in the rice fields and get some money instead of staying in school and going to sleep hungry at home. On the other side of the river, boys leave school to become fishermen. They are forced by circumstances. During floods, the children’s families remain with nothing and the only option is fishing (PTA chairman, Rwambwa Primary).

In this school, there is a high dropout rate and early marriages attributed to flooding. Most of the couples are standard seven boys who marry class five girls. Since they are unemployed, they opt for fishing (Head teacher, Igigo Primary).

School children are the greatest risk to these floods. Like in December 2011 when we had floods, by January this year some children were still in the camps. Their houses had been severely damaged. Some homes were inhabitable especially just behind the dykes. Even if the school is a host centre like Budalangi primary here, no learning goes on. This negatively affects curriculum implementation. At other times the floods come when KCPE is in progress. Pupils are forced to sit for exams in host schools, which are also IDP centers and strange environment, which is not conducive atmosphere for exams. It affects their overall performance. To make matters worse, at that time some children are separated from their parents who should be taking care of them and supporting them. It makes the performance poor since the children are stressed. Also the hosting schools are usually congested and facilities overstretched. Psychologically it affects the child who is a learner. This eventually leads to poor performance (DEO Bunyala District; Head teacher, Budalangi Primary School).

The floods have lead to high dropout rate evident in our records that you can see here. The trend in Budalangi flood plain is such that the enrolment rate is high

> but as the children reach class 6, the dropout rate is very high especially for the girls. I can say that this trend is made worse by the socio-economic position that children find themselves in. they are forced to go out of their way to fend for their families through activities like fishing, child prostitution and other income generating activities. Apart from property, the children's life in IDP camps is distressing. Normal family life is disrupted. For example, our office had many reports of girls dropping out of school due to pregnancies, many of which they got while in camps.
>
> In the camps, the close interactions the pupils have with people coupled with lack of supervision of the children due to family separation gives them too much freedom to indulge to immoral behaviour. In the camps there is no privacy in those taurblins. A parent has to talk to a neighbour to allow the daughter to sleep in the next tent. You can't know what will happen to your daughter in such circumstance. In the process, parents lose control of their children. Thus lack of parental monitoring and control. I can also add that culture and poverty influence these trends of high girl-child dropout rate. When the family livelihood is destroyed, priority is given to boys to continue with education while girls are married off (DEO, Budalangi District).

These results indicate that the flooding disaster negatively affects efforts to implement the curriculum in Budalangi flood plain schools. The narratives above point out that the education of the children is negatively affected not only due to absenteeism but poverty, social problems like child prostitution and child labour, the separation of families, early marriages, early pregnancies lack of parental monitoring of children, the life in IDP camps, immorality and hunger and/or food insecurity. The children also develop psychosocial problems because of the circumstances they experience in the camps and back at home when they return, the girl-child is the most vulnerable in this case. There is gender-based sexual violence as indicated from these stories. This is heightened by the cultural beliefs of the community wherein boys are given preference in families to stay in school while girls drop out. These findings reveal the untold stories about the suffering in Budalangi flood plain’s IDP camps.

Boys consist of almost twice the number of girls (4307 to 2306). Inadequate role models for girls in the community could also aggravate this scenario. The female teachers form a quarter of the total staff in Budalangi flood plain’s primary schools (34 compared to 103). Most female teachers find it hard to hang on and teach in these difficult circumstances. During the Focus Group Discussions most of the respondents were men and the women often kept quiet. Culture therefore, is a great contributory factor to increasing sex and/or gender based violence in Budalangi flood plain’s schools, making the girl-child the most vulnerable in these circumstances. These findings resonate with what Kim (2008), Sinclair (2002) and Wisner et al. (2006) found out about women and girls being the most vulnerable in the event of a disaster.

In regard to teaching and learning facilities, floods are causing a lot of harm to the infrastructure. The latrines and classrooms are totally destroyed. A report on the destruction that the December 2011 floods caused on schools’ infrastructure from the DEO’s office was presented. This is evidence of the havoc that floods cause on the schools’ infrastructure but at the same time, it is a pointer to our not having embraced the Hyogo Framework for Action’s (2005-2015) tenets. It is an indicator of the lack of knowledge on disaster risk reduction. It is proof that the schools are not safe for the learning of children. They are not child-friendly. It therefore implies that standard building codes are not in place seven years after our government signed and adopted in accordance with the requirements of implementing the Hyogo Framework for Action (ISDR, 2011; UNICEF, 2010; Wisner, 2004). Further interviews with other curriculum stakeholders on what they thought were the impacts of floods on education/schools elicited the following responses:

> During floods, children become more vulnerable. When their schools are submerged, the children are forced to move to schools on higher grounds. When they get to these hosting schools they lose self-esteem, which exacerbates their vulnerability. They can't settle to concentrate in their classrooms. Their teachers also suffer the same loss of identity, stigmatization and loss of confidence. Their sense of ownership and prestige of being in their own schools is lost. They develop an inferiority complex, which demoralizes them to perform to the best of their potential. This movement in general impedes the effective implementation of the curriculum. The syllabus is not covered in time (Head teacher, Sibuka primary school).

> Whenever we have climate and weather related problems, children become more vulnerable because their immunity system is very low. At times, they may not be able to withstand the harsh climatic conditions. They develop malaria, scabies, pneumonia, dysentery, cholera amoebiasis etc. the water wells usually get contaminated and this low quality water increases the children's vulnerability (Parent, Igigo Primary School).

> After the floods there are a lot of challenges in schools for example the infrastructure in the school is destroyed. Children are not able to get the same facilities that they had earlier; for example toilets collapse, water wells are contaminated, classrooms have cracks or are tilted. All these are health hazards to the children (Head teacher, Rwambwa Primary School).

> I think hunger is a major problem that affects our children's learning in the IDP camps and immediately after. We had a feeding programme for our school in

the flood plain when Hon. Gumo Fred was the Assistant Minister for Education but nowadays we do not have. This school-feeding programme kept our children in school. Even during floods, at least they concentrated because they had food (Parent Budalangi Primary School).

It is true… the relief food is not enough. In fact we starve in these camps. Our children suffer more. The relief food in IDP camps is not like the relief food given to refugees' camps where there is standard provision of food. Here the government talks of providing relief food, which are maize, beans and cooking fat. That lasts for only three weeks yet we stay in the IDP camps for at least 8 weeks. After providing the relief food, we are forgotten for a month. This causes untold sufferings to the families. Children often despair and drop out of school to engage in child labour, fishing or to do activities that their parents are expected to do as parents look for food. This also affects their academic performance (Parent, Mudere Primary School).

We don't know whom to blame for our suffering. Our children's education gets affected adversely. The teachers who are posted to this area run away because of suffering. In fact most of the ones teaching in these schools are here on disciplinary grounds. They regard it as a punishment and don't focus on their work. Even teachers absent themselves very much. The high turnover of teachers depresses the learners (Parent Mukunda Primary School).

During evacuation in schools, teachers, parents and pupils collaborate to pack most of the crucial teaching and learning facilities. The teachers are also traumatized. At first, they save lives, then property. Female teachers especially opt to transfer to other stations. It is not automatic that when one is transferred, a suitable replacement is got. This means that children end up being untaught. There

> is a lot of trauma and stigma for teachers who teach in Budalangi flood plain (Head teacher, Bugunga Primary School).
>
> In St Annes' girls' school, most of the students lost their property. Their parents are too poor to replace the lost property. Partners have brought them mattresses and blankets to replace their lost property but the attachment they had to their former property traumatizes them (DEO, Budalangi district).

The head teachers' in-depth interviews confirmed what parents said on the effects of floods on education in Budalangi flood plain. It emerged that teachers and pupils of Budalangi flood plain's schools who get displaced due to floods and go to higher grounds suffer from stigma and psychological trauma. This not only affects the children's' performance in schools but does not provide room for the integration of DRR education into the curriculum. The high staff turnover, absenteeism of teachers and negative attitude of teachers towards their job only makes it worse. The teachers are further demoralized by not being given any special allowances or incentives for teaching under these difficult circumstances. These teachers who experience post-trauma stress are ill-equipped and ill-prepared to address the psycho-social needs of the depressed children as well as meet their learning needs. Generally, the teachers are emotionally disturbed, fatigued, tired, exhausted and uncomfortable due to too much work. The teachers have difficulties adjusting to the new environment, teaching large classes and getting the attention of pupils.

The classrooms are used as evacuation centres, which disrupt classes, leads to misuse of the schools' facilities, some schools become dirty and the children and their families are disturbed. A lot of time is wasted during displacement and resettlement. All these affect the children's concentration leading to their poor performance. The teachers have difficulties holding classes in tents.

The learning environment in general, is not child-friendly. Some teachers reported the disruption of classes caused by evacuees quarrelling and making noise in the school compound, especially during the distribution of relief food. They also reported lack of concentration of the pupils due to uncontrolled movements in and out of the school. Further, teachers also reported lack of concentration by pupils who slept in class due to lack of sleep at night. All these problems, compounded together may be contributing to the poor performance of pupils in KCPE examinations in Budalangi flood plain's primary schools. The self-esteem that both the displaced children and the teachers need for active learning is taken away from them while in the IDP camps. Such school communities may lack the enthusiasm to take action for the good of the community.

Teachers were asked to respond to an open-ended question that required them to state if the standards of construction of schools in disaster prone areas followed laid down regulations.

> I don't think so. If they were, then the school buildings would not have cracks. In fact before they are repaired, other floods are coming in June. I think this infrastructure is a health risk. We have forwarded the report that the QASO made on the damage to infrastructure to the ministry so that they can give us additional funding to do the repairs. I think the contractors will build the schools. Should be trained to build strong buildings that are high enough not to allowing water to destroy them. The teaching and learning materials were also destroyed. We really need the government's intervention (DEO, Budalangi district).

Teaching and learning materials are often lost or swept away during floods. The classrooms are not flood resistant. Modern technology building codes have not been implemented. A lot of time is lost during evacuation and resettlement after floods. All these spoil the chances for integration of DRR education into the primary school curriculum.

In regard to health, water borne diseases, hunger and lack of a school feeding programme also add to the drawbacks of implementing the teaching of DRR education in primary schools in the flood plain. Other than infrastructural damage, health needs in schools are very high. These findings resonate with other studies done on education in emergencies (Kim, 2008). Post-Traumatic Stress Disorder (PTSD) is a health hazard and needs urgent attention for victims of disasters.

It is strange that families that live near schools do not construct toilets. This further aggravates the prevalence of water borne diseases. Health is a key pillar of DRR education. It is also a key component of child friendly schools. While taking inventory of how healthy their school environment was for the children and the teachers, it emerged that toilets were few and damaged. The Kenya Red Cross Society had installed water tanks in schools to harvest rainwater to be used when wells were contaminated; they had also in scripted good hygiene practice messages on classroom walls; UNICEF, MOE, Action Aid International and the World Bank had sunk boreholes in all schools and covered them securely with pumps. These water wells were high enough to prevent water contamination during flooding. However, teachers and head teachers still reported that raging floods often contaminate the wells, leading to outbreaks of water borne diseases. The children are the most vulnerable. It makes many children stay out of school as they receive treatment. When asked how the community health needs are met, a member reported thus:

> Yes …….we are given tarpaulins per household with blankets, clothes and relief food. We are also given anti malaria drugs, mosquito nets and drugs for treating water, however most people use the nets for fishing or making kitchen garden fences.

What about people living with AIDS? Do they get their drugs in time?

> Yes…the health officers ensure that they get them although they refuse to take them because the drugs increase hunger yet there is no food in the camps. Many of them fall very sick due to the conditions in the camps, hunger and lack of comfort. Their children get very affected psychologically. Some of them opt to drop out of school to look for jobs so as to support their ailing parents (Parent, Mudembi Primary school).

Curriculum stakeholders were asked how the health of the children in Budalangi flood plain's schools could be improved. Their responses were:

> Budalangi area is a hardship area and all civil servants shy away from working here. We need more health workers trained in psychosocial counselling to help in settling children after the flooding disaster, we can use this health workers in DRR education advocacy campaigns. This will also improve child survival in this flood plain. During flooding young children below the age of 10 years die due to water borne diseases (DEO, Budalangi district).
>
> The public health workers, together with technicians, should be deployed to this flood plain, especially those trained about water borne diseases. We also need nutritionists to advice parents on how children can learn effectively. Food security is a chronic problem in this place because floods sweep away all the food crops. However, NGOs are training farmers on using short-season and early maturity seeds, flood resistant crops and food storage facilities (BUCODEV representative).
>
> Public health workers need to attend parent-teacher conferences and train them on hygiene education, use of safe water management and maintenance of mobile toilets, de-wormers, anti-malarial like. All these will improve the health status and make children learn for better results. To reduce the spread of HIV and prevent our daughters and wives from exploitation, I suggest that during evacuation,

families should stick together. It may not completely stop sexual violence but will reduce it to a great extent. We have seen how the separation of families accelerates immorality and affects children's learning, especially the girl child (PTA Representative, Sibuka Primary).

Other Effects of Floods on the Community Include:

- On families when we are evacuated, families get disrupted. When we are separated to go and live in different camps or tents as husbands and wives, some people get other sexual partners in the camps where they go. This causes disharmony in their respective families. It also leads to the high prevalence in HIV/AIDS that is already high (Parent, Igigo Primary School).

- Life in the camps is so hard. To survive some people engage in immorality. Dependence on relief food that is not adequate makes people to look for alternatives of which illicit sexual affairs become part of the survival tactics. Mamas who are burdened with their children find this a quick solution (FGD, Male Respondent).

- During floods our children usually suffer, others drop out of school and decide to become house helps or join fishermen or work in rice fields so as to send their parents some money to use. Those who remain in school suffer most because when it floods mothers are too stressed. They don't know where and how to start (Parent, Rwambwa Primary School).

In regard to provision of clean water for use, curriculum stakeholders were asked who is responsible for provision of clean water during floods. It was found that Lake Victoria water services bring water to the centres. Kenya Red Cross Society in conjunction with UNICEF has sunk boreholes for schools and villages. All the boreholes are raised up to six feet from the ground and covered with a suction pump so as to remain clean. In case floods enter the boreholes, the NGOs organize to provide water in the IDP camps. Document analysis from the school registers in most schools indicated that during floods, many pupils could not go to school. The teachers lost about four weeks of teaching in evacuation and resettlement after the disaster. This, of course, lowered the quality of education. The reports also indicated that, for the schools whose infrastructure is destroyed, an additional disbursement of funds by the Ministry of Special Programmes is allocated. However, this money is not enough because after the repairs, the next floods cause worse damage. This has been evident in Makunda, Bubango and Rwambwa primary schools. The parent-teacher minutes for conferences confirmed that some of the pupils perform poorly in school due to the poverty situations that they live in at home.

Indigenous Knowledge on Disaster Risk Reduction

The primary school teachers were asked to identify indigenous knowledge that can be useful in DRR education in Budalangi flood plain. Their responses were: history of floods and the river pattern of River Nzoia; early warning signs such as croaking of frogs, types of fruits, presence of ants, shedding of leaves of some trees and wind patterns; informal social protection measures like harmonious relationships with relatives who live on higher grounds, this relationship is a safety net for the safe keeping of documents, food and shelter during flooding; swimming lessons, especially for boys before flooding; food types, i.e. early maturity seeds and flood resistant crops like sorghum; food storage i.e. high/raised granaries and finally, type of houses, i.e. simple temporal structures that can be rebuilt any time.

When asked if the indigenous knowledge is documented, 100% (n=96) answered in the negative stating that the knowledge is passed down from generation to generation through, stories, myths and parables. A further explanation given was that there are special elders in the community who have this knowledge and that they train young people close to them to be specialists in the river's temperament. They are the ones who predict the weather and give early warnings signs. About 48% (n=46) of the teachers were not sure if the indigenous knowledge had been documented but 52% (n=50) accepted that researchers and NGOs working in the area had documented the indigenous knowledge. The only problem was that there was not a single book or report that had been published on the same. This implies that transferability and preservation of this IK is at risk. Most, 86% (n=83) of the teachers felt that indigenous knowledge on floods in Budalangi should be published in a book for all curriculum stakeholders to use while 64% (n=61) of the teachers agreed that integrating indigenous knowledge on floods with scientific knowledge would enrich the DRR curriculum taught to pupils in primary schools.

Communicating knowledge and information on disaster risks, prevention mitigation, interventions or adaptations is the nerve centre of DRR education. Early warning of the impending disaster saves lives and destruction of property. An open-ended questionnaire was posed to instructional supervisors seeking to know how they get information about the impending floods in the community. Some of the responses were as follows:

> These responses indicate that knowledge and information sharing on early warning signs in Budalangi flood plain takes various forms that combine both scientific and indigenous technology. These include monitoring of the water level on river Nzoia by both the local leaders and the Kenya Meteorological department; use of the local radio station (Bulala radio station) to announce the early warning; local leaders, including the District Commissioner, announcing the weather changes from the district weather station at Budalangi and DEO writing memos to schools warning about the onset of floods and preparation for evacuation to higher ground schools, this corresponds with what other researchers found out on information sharing on early warning signs (Wisner, 2004; ISDR, 2010; Izadkhah, 2008).

Role of NGOs in Disaster Risk Reduction Education in Budalangi Flood Plain

The in-depth interview with some of the NGOs' officials on the knowledge base theme and gaps regarding DRR education in Budalangi flood plains revealed that the NGOs were the pillar of DRR education. Non-state actors all over the world have played a very important role in disaster risk reduction education. There are several NGOs in Budalangi flood plain, each with its own Vision and Mission but all geared towards the same goal of reducing people's poverty and vulnerability caused by the flooding disaster and increasing their resilience or adaptation to disasters. The teachers, QASOs, DEOs head teachers and PTA representatives had all indicated that NGOs are the ones that had trained them on DRR education. The in-depth interviews gave an insight into the indigenous and scientific technological knowledge on disaster risk reduction in Budalangi flood plain.

In regard to IK on early warning signs on impending floods, the BUCODEV officer reported that:

> Yes … particularly when it comes to flooding. All over the world in flood prone areas, the communities have a wealth of knowledge in this disaster. However some of the scientists do not value this knowledge. But I can tell you that, indigenous knowledge is the most reliable information you can rely on in disaster management. In 2011 a population of about 25,000 people was marooned in floods but we did not lose any life because of indigenous knowledge. Our people have done drills and they know how to swim, they know how to walk when it has flooded for example they can gauge the depth of the water using a walking stick. They also know that when a current is moving in one direction you have to move to the opposite direction. We also have a council of elders that monitor the river regime and sound early warnings of impending floods.

> We also have other monitoring indicators like fruits, stars appearing in February to March in a single line called "nyajinja." This also indicates that we are going to have a bumper harvest. Fruits that flower but don't bear seeds indicate a bumper harvest thus the flooding water brings alluvial to the flood plain to add fertility to our soil. When we have a lot of mangoes, it is an indicator that God is going to supplement our food. There are some species of trees too that when they shade their leaves, it indicates that rains are coming. Voices of frogs too indicate the river will rise or fall. We also have certain species of birds that when they migrate to Budalangi it indicates that there is going to be heavy rains (crested crane).
>
> The council of elders also watches "Masaba" (Mount Elgon) and if they cannot see it when they climb on top of dykes then it means we shall have floods. It means that it is raining heavily upstream of River Nzoia. The United Nations incorporate the indigenous knowledge of the community with the Kenya Meteorological departments' information on early warning. They have point persons in several places along the river channel whom they liaise with. For example, they watch if the river waters submerge some particular stones upstream in Mumias (Mr Thomas Mango, Programme Officer BUCODEV).

Budalangi floods plain's community has indigenous knowledge on flood preparedness and adaptation. Community elders own this knowledge and transmit it informally to the next generation. The community members combine the indigenous knowledge with the scientific knowledge, especially on flood preparedness and early warning signs. These findings resonate with deliberations at the Global Platform (2009) conference on integration of indigenous knowledge into disaster risk reduction. This practice ensures the sustainability of DRR education strategies.

Concerning housing as a major factor in disaster risk reduction, indigenous housing includes local materials, locally available technology and artisans, evolved over time, and influenced by local conditions such as culture and climate. Influences on housing can be local, including local resources, culture, the community's lifestyle and existing skill/technologies, as well as external, perhaps relating to the economy. Housing does not stand alone, with regards to preservation of this IK, its holistic property may make it difficult to transfer from place to place, and even from generation to generation, given the changing environments, the impacts of modernity and the way people live in their house over time. IK on housing is done with an objective of reusing existing local wisdom in order to reduce community vulnerability, which may be increased with changing conditions. It helps promote sustainable development, especially with the integration of indigenous and modern technologies. It also allows for successful transition into modern societies. Finally, this knowledge is part of a cultural identity, which should be preserved and celebrated.

However, IK on housing also faces certain challenges. These challenges include: the limited knowledge of disaster-safe practices among communities; the influence of modern material usage without professional knowledge; and the inability of local people to afford disaster-safe houses. That a multi-hazard approach must be taken for housing, utilizing the post-disaster phase for improving existing housing practices. There is need for research and development to improve performance further, proper documentation of all techniques, and education in communities about the importance of local traditional approaches for disaster-safe construction practices. Emphasis should be put on the importance of community control over their natural resources in order to allow inhabitants to adapt to changing environments.

Housing should be seen as a process rather than a product, where indigenous people build together and the knowledge develops into the house itself. Some participants emphasized the need for a national standard or building code, which would take into account IK Since modern housing has a high status in many communities there is no respect for the traditional life styles. In addition, indigenous artisanship to carry out these IH techniques is fading. In many cases, a traditional form is being transferred, but it is either incompatible with the materials and technologies used or it is not applied in the correct way (such as applying the wrong orientation or location). There is a need for an increase in research and development as well as training and education relating to IH. Local tourism should be encouraged, which could help develop an interest in IH and generate good employment for local artisans who hold indigenous techniques. There is a need for increased awareness about this knowledge and its value. Local resource management and decentralization of many of these processes should be improved in order to support the cultural identity of IH and utilize the indigenous techniques.

An NGO representative from LABET Kenya reported the following on housing and DRR education in Budalangi flood plains:

> Our role is to empower individuals and small neighbourhoods on disaster risk management. We concentrate on community participation so as to build a culture of safety and ensure sustainable development for all. We therefore train the community through our capacity building programme on community based risk assessment, mitigation, planning and implementation processes including building confidence and pride in being able to make a difference, pursue a disaster preparedness, mitigation as well as development issues at the local level. We also do resource mobilization and innovative mitigation solutions that are cost effective and sustainable. We do this by using traditional organizational structures i.e. formal and

> informal. We involve local leaders in the capacity building activities. We also do public awareness in the local dialect. The CBOs and FBOs in Budalangi flood plain have been helpful in this regard.
>
> Our other objective is to resettle the community back to their homes from the IDP camps. We have embarked on a housing construction project that is sustainable. We focus on people's knowledge more than physical infrastructure. The knowledge we have given to the community has brought confidence on house construction. The local masons have been trained on flood resistant building technology. We have gone further and established a mason's guild as an alternative livelihood option. We have incorporated indigenous knowledge on soil science and river regime in the construction process. We have incorporated local leaders and government practitioners in this endeavour.
>
> Other than this, we encourage community members to build the dykes because the government sometimes takes long to repair them. We embrace the indigenous and scientific technologies in flood forecasting and warning. We also build the community members capacity on disaster preparedness, planning, response and evacuation. We have plans for embarking on a land use project together with the ministry of agriculture and lands. (Programme officer, LABET-KENYA)

LABET-Kenya is involved in various disaster risk reduction activities in Budalangi flood plain, ranging from capacity building of the community to building confidence in them that they can manage the situated at hand to reconstruction of dykes by the community members. They are also involved in building safe environments by training masons on resilient housing. They integrate indigenous and scientific knowledge in early warning, planning, response and evacuation. This NGO has also not specifically targeted the school community to create awareness on Disaster Risk Reduction but housing construction as well.

Integration of Scientific Technological Knowledge into DRR Education

Another in-depth interview with the program officer of Community Disaster Management Initiative (CODMI) sought to find out the role that CODMI had on disaster risk reduction education in Budalangi flood plains. This NGO integrated indigenous knowledge and scientific technological knowledge in DRR. The officer narrated;

> CODMI started in 2007 with a desire to assist the Budalangi community members to reduce their vulnerability to the current floods and increase their resilience in the presence of disasters. We work with Western Kenya Community Driven Development and Flood Mitigation Programme (WKCDD&FMP) to do a vulnerability and capacity analysis of floods on the community using GIS and GPS. We also do mapping on flood preparedness in collaboration with Map Action (UK). We are heavily engaged with flood awareness campaign in partnership with the provincial administration. We do this through Bulala radio station and also public barazas (Mr. Canute Agwanda, Programme Officer).

From the foregoing in-depth interview, community vulnerability analysis on the impact of floods on them has been made a priority. The identification of risks through mapping the flood prone areas leads to flood awareness campaigns. This strategy has been used in India and America (Katrina) (Wisner, 2004).

Further interviews with the Map Action NGO on their role in DRR education revealed the following:

> Our NGO focuses on Geospatial methods for disaster risk reduction in Budalangi flood plain. We have taught communities at the village level. We work in conjunction with WKCDD&FMP to implement a flood warning system, which was

> initially based on reading from a network of gauges to build forecasts. Today, we have Bulala and RANET radio stations, which offer warning signals and disseminate any other relevant information on flooding in the flood plain. Map Action has also trained community members on fundamentals of Geographic Information Systems (GIS) and Geographic Positioning Systems (GPS). This is guidance on geospatial techniques for disaster risk reduction and response to disaster. This has helped the most vulnerable villages like Makunda, Najodi, Ragunga, Sibuka, Udeti, Naliasyong'o and Sigingi to be well prepared for the flooding disaster. The training has helped them to investigate the nature of the flooding, study vulnerabilities of the community and form strategies of mitigating the risks. It has helped to make village disaster response strategies to be more efficient and proactive. Restoring the community back to normalcy has also been made easier due to the baseline data before every flood and after floods. This data has helped to map out the most vulnerable villages (Program Officer- Map Action).

This revelation points out that the most vulnerable villages have been targets of capacity building in scientific technology as an early warning sign to flooding. These villages have people trained in GIS, GPS and in weather forecasting as well. They have village weather stations although there is neither mention of the site of the weather stations nor training of school community members in DRR education. This strategy has been used in Cambodia in DRR awareness and advocacy (RCC, 2009).

Another NGO working in Budalangi flood plain on disaster risk reduction is the Western Kenya Community Driven Development and Flood Mitigation Project (WKCDD&FMP). This NGO focuses on Remote Sensing.

> The WKCDD&FMP has developed an elaborate system of floods warning for Budalangi community. Flood bulletins are produced on a daily basis and

disseminated immediately to various stakeholders including the community. Hydromet data is collected from the field by the community data monitors and is relayed to the project headquarters daily for flood forecasting and archiving. The data monitors are provided with mobile phones and monthly airtimes to enable them communicate with the project data analyst everyday at 9.30 am. This data is received at the project flood diagnosis and forecasting centre situated at Kenya Meteorological Centre (KMD) headquarters in Nairobi where modeling and analysis is done to produce the flood warnings. The warnings are packaged in a bulletin and sent to stakeholders who include the provincial administration, government ministries, humanitarian organizations, community based organizations etc. Since 2008, these bulletins are sent at 12 noon on a daily basis during the rainy season and they have helped stakeholders to prepare for impending floods.

The system is being upgraded with state of automatic data transmission equipment for monitoring the weather and river levels. This will help provide efficient warnings with the required lead-time to warn the community to be prepared. Weather patterns from 20 stations, 15 run by the project community monitors and 5 by KMD and river level data from three gauging stations run by the Ministry of Water and Irrigation, report data daily to flood forecasting centre. To produce warnings, additional evaporating data and rainfall forecast are provided by the KMD. The data collection is done between 8.30 and 9.30 am. A daily and monthly bulletin is then produced.

To reach stakeholders, the project is still designing and developing more especially on how to package the warnings to the affected community. Currently the project is using the KMD radio installed at Budalangi (RANET) emailing system to all stakeholders displaying on the World Wide Web emailing to the Bunyala DC office and direct emailing to the Lake Victoria North Water Resources Management Authority (LVNWRMA).

Presently the project and KMD are upgrading the data collection and transmission in the region with the procurement and installation of automatic telemetric gauges for weather and river levels for reporting the condition in the basin in real time. The automatic telemetric river gauging stations and an acoustic Doppler Current Profiler (ADCP) are sending data to the forecasting centre by use of General Packet Radio Services (GPRS) technology. The flood warning team evaluates and calibrates the equipments. WKCDD & FMP has formed a stakeholders forum for Budalangi together with UN agencies (UN-OCHA, UNICEF and World Food Programme) international and local NGOs. They have also trained Trainer of Trainers (TOT) in disaster risk reduction for Budalangi community at Fair view hotel Busia in 2009 (WKCDD&FMP-Early Warning Systems Officer at Kakamega).

From the above in-depth interviews, it is clear that NGOs have taken a leading role in training the Budalangi flood plain community members in DRR education but they have not particularly zeroed-in on primary schools. It is also true that different NGOs have disseminated different knowledge on DRR. This could probably be due to their policies and funders. Sponsors of NGOs target specific problems. In as much as all of them aim at reducing people’s poverty and vulnerability and increasing resilience and sustainable development, their work is not uniform. None of the NGOs has used schools as stipulated in the Hyogo Framework for Action’s article 3. This means that DRR education in the community is inadequate, scarce and sporadic. The NGOs do not have a uniform curriculum that they are using. Addressing this problem through schools is the best solution to perennial floods that have made Budalangi flood plain's communities very vulnerable and poor.

A visit to the Kenya meteorological department also revealed very positive measures towards disaster risk reduction. The document analysis revealed that there is an established flood forecasting and dissemination mechanism. This network encompasses the National Disaster Management Authority (NADIMA), Disaster Operation Centers (DOCs), water management authority, chief flood forecasting office in Nairobi, Kenya Meteorological Department (KMD), rainfall stations, the national meteorological department on River Nzoia, disaster management committees and Bulala radio station. Varying scientific technological knowledge is employed.

Recommendation; the Framework

This study has recommended a framework that will alleviate the suffering of the Budalangi flood plains community to flooding if adopted and implemented in totality. We realize that floods don't just happen but are as a result of poorly managed interactions between the environmental hazards and the community that does not have adequate knowledge and skills on coping with the risks. Other vulnerability aspects emerge from the interaction with external pressures such as climate change, land use practices, topography of the flood plain, the River regime, the soil science, general education of the community, political will to implement environmental management policies, political will to recommend change of the primary teacher training and primary school curriculum to integrate disaster risk reduction. The hybridization of indigenous and scientific knowledge will identify strengths in both arms so as to empower communities in fragile ecological zones affected by hydro-meteorological disasters to build resilience, which will in turn reduce their vulnerability and poverty. This will lead to sustainable development and achievement of Vision 2030.

The framework has identified four steps:

STEP 1: Community engagement to establish their knowledge base and gaps on disaster risk reduction. This will encompass the involvement of all stakeholders including government and non-governmental actors, schools, Ministry of Education and other related ministries. The community involvement will also assess their interest and aspirations in developing resilience to floods.

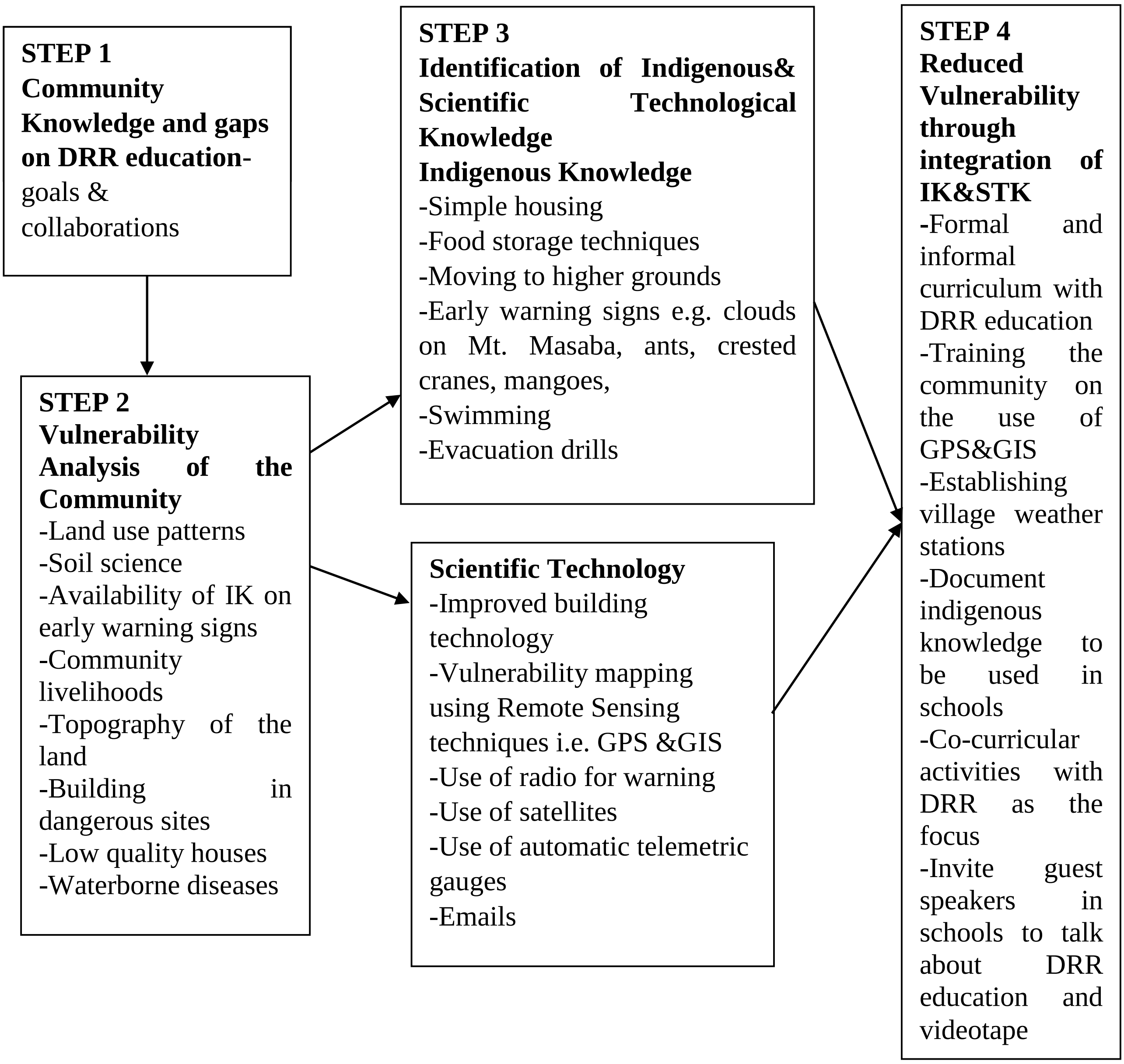
STEP 2: Do a vulnerability analysis of the community. This involves finding out factors in the community both internal and external that exacerbate their vulnerability. These factors include a study of the land use patterns, soil science, availability of indigenous knowledge on early warning signs and adapting to flooding, the community livelihoods, informal social protection and community cohesiveness, topography of the land and morphology of R. Nzoia's mouth, climate change, quality of houses, proximity to hazards and risks, limited education of the community, construction of homesteads in dangerous places, waterborne diseases among others.

STEP 3: Identification of indigenous and scientific technological knowledge on disaster risk reduction. The indigenous knowledge includes building simple houses, food storage techniques including planting early maturity crops, informal social protection thus moving to higher grounds and keeping valuables for relatives who are affected by flooding, merry go rounds and sending children to work in urban places so they can send cash home. Early warning signs to floods like the croaking of frogs, appearance of certain stars in the sky, appearance of mangoes, clouds on Mt. Elgon, and the elders' knowledge on the history of floods and River Nzoia regime. Adaptation measures like water storage and purification techniques, innovative energy saving techniques, walking with a stick to know the depth of water, learning to swim, evacuation drills among others.

Scientific technological knowledge includes all knowledge that is not local and use of Information Communication Technology (ICTs). This knowledge includes modern land use practices to prevent soil degradation, improved building technology for flood resistant houses, introduction of high breed short-season crops, vulnerability mapping using GPS and GIS, use of Bulala radio station to warn the community to evacuate, use of satellites in the Kenya Meteorological Department for forecasting and dissemination of information on early warning, establishment of village weather stations, Bulletins on early warning that are emailed to various destinations, use of automatic telemetric gauges for weather and river levels, Acoustic Doppler Current Profiler and use of general packet radio services.

STEP 4: This is the final step in this framework. It involves integrating the indigenous and scientific knowledge best practices to reduce the community's vulnerability. The recommended best practices include use of formal and informal education. For formal education, the strategy is to integrate DRR education into the primary teacher training and primary school curriculum. This will lead to revision of the current curricular and development of new syllabus and textbooks. There will also be capacity building workshops for all stakeholders on the integration of DRR into the curriculum. As for the informal curriculum, co-curricular activities will have DRR as the main theme. These include drama and music festivals, sports days, open days to display pupils work on various themes on DRR education, invite guest speakers from the community to schools to talk to children about the indigenous knowledge, digitalize and document these events for future reference. Other strategies include training the community on the use of GPS and GIS for vulnerability mapping analysis and establishing weather stations. Train the community on constructing flood resistant houses, water purification techniques, innovative energy saving techniques and constructing modern toilets. Train the communities to harmonize use of both indigenous and scientific technological knowledge for early warning signs and adaptation to flooding so as to reduce their vulnerability to flooding and build resilient communities.

Model of the Framework Showing Integration of Indigenous and Scientific Technological Knowledge in DRR education



I highly recommend further research on this model in Kenya and beyond for all the other hydro-meteorological disasters. Remote sensing data should be combined with the traditional early warning signs for floods. Budalangi flood plain was a case study but can be adopted and tested in other fragile ecological zones. There is compelling evidence for Kenya to recognize and strengthen its wealth of IK for providing local solutions to global problems of increasing disasters and climate change impacts

References

Battista, F. & Baas. S. (2004). The role of local institutions in reducing vulnerability to recurrent natural disasters and in sustainable livelihoods development. In Rural Institutions and Participation Service, Food and Agriculture Organization (2004). Consolidated report on case studies and workshop findings and recommendations. Rome: Rural Institutions and Participation Service, Food and Agriculture Organization

Baumwoll, J. (2008). The value of indigenous knowledge for disaster reduction: A unique tool for reducing community vulnerability to natural disasters. Unpublished Master of International Relations Thesis. United Kingdom: Webster University.

Denkens, J. (2007a). The snake and the river don't run straight: Local knowledge on disaster preparedness in the Eastern Terai of Nepal. Kathmandu, Nepal: International Centre for Integrated Mountain Development (ICIMOD).

Denkens, J. (2007b). Local knowledge for disaster preparedness: A literature review. Kathmandu, Nepal: International Centre for Integrated Mountain Development (ICIMOD).

Izadkhah, Y. O. & Hosseini, M. (2005). Towards resilient communities in developing countries through education of children for disaster preparedness. International Journal of Emergency Management, 2005, Vol. 3(2), pp. 138-148. Mukuna T (2013). A Methodological Framework for Integration of DRR Education into the Primary School Curriculum; Eldoret. A PhD Thesis (Unpublished), Moi University.

Mutimba et.al, (2011). Climate Change Impact in Kenya

Onywere, S. M., Getenga, Z. M., Mwakalila, S. S., Twesigye, C. K. & Nakiranda, J. K. (2011). Assessing the challenge of settlement in Budalangi and Yala Swamp area in Western Kenya using Landsat satellite imagery. The Open Environmental Engineering Journal 4, 2011, pp. 97-104.

Otunga, R. N., Odero, I. I. & Barasa, P. L. (2011). A handbook for curriculum and instruction. Eldoret: Moi University Press.

RCC (2007). Integrating disaster risk reduction into school curriculum: mainstreaming disaster risk reduction into education. Sri Lanka.

Sinclair, M. (2002). Planning education in and after emergencies. Paris: UNESCO & International Institute for Educational Planning.

Sillitoe, P. (1998). The development of indigenous knowledge: A new applied anthropology. Current Anthropology 39, No. 2, pp. 223-252.

UNESCO (2011). Risk management training handbook. Paris: UNESCO.

UNISDR (2010). Disaster risk reduction: An instrument for achieving the millennium development goals. Inter-Parliamentary Union.

UNISDR (2011). Education in emergencies: A resource toolkit. Regional Office for South Asia and New York Headquarters.

United Nations Development Program (2004). The concept of indigenous people. Background paper prepared for workshop on data collection and disaggregation for indigenous peoples. New York, 19–21 January 2004. Retrieved from: http://www.un.org/esa/socdev/unpfii/documents/PFII%202004%20WS.1%203%20Definition.doc.

United Nations International Strategy for Disaster Relief (2005). Hyogo Framework for Action (2005-2015), Retrieved from: http://www.unisdr.org/eng/hfa/hfa.htm. Retrieved: 13th November 2012.

United Nations' Children Fund (2010). The two faces of education in ethnic conflict. Geneva: UNICEF.

United Nations' Development Programme (2004). Report of special rapporteur on the right education, UN doc E / C N/ 4/2004 Child Protection Internal Displacement Monitoring Centre (IDMC). Retrieved from: http://www.internal_displacement.org/idmc/wesite/countries.nsf Retrieved: 24th August 2009.

United Nations' International Strategy for Disaster Relief (2006a). Disaster risk reduction begins at school: World disaster reduction campaign. Geneva: United Nations' International Strategy for Disaster Relief. Retrieved from: http://www.unisdr.org/knowledge-education Retrieved: 13th November 2012

United Nations' International Strategy for Disaster Relief (2006b). The Hyogo Framework for Action, relevance for water-related disasters. ICHARM commemorative Symposium. Tokyo.

Wisner, B (2004). School seismic safety: Falling between cracks? London: Sage.

Wisner, B. (2006). Let our children teach us: A review of the role of education and knowledge in disaster risk reduction. ISDR System Thematic Cluster/Platform on Knowledge and Education. Retrieved from: www.unisdr.org/knowledge-education Retrieved: 13th November 2012.

TASK BASED LEARNING AS AN ALTERNATIVE APPROACH TO THE TEACHING OF LANGUAGES IN KENYAN SCHOOLS: TOWARDS BEST PRACTICES

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Abstract

Although language syllabi in Kenyan primary and secondary schools encourage teachers to involve learners in their own learning, actual classroom practices reveal that this is not fully implemented for various reasons. Nevertheless, one of the approaches to the teaching of languages advocated for by language specialists is Task Based Learning (TBL), in which the central focus is completion of tasks that involve learners in language use in real life situations. In so doing, learners develop excellent communication and social interaction skills. The idea is for learners to learn the target language by being exposed to meaningful task-based activities. They perform tasks in pairs or in small groups after which they compile a report and present their findings to the class in written or spoken form. The research on which this paper is based investigated the use of TBL as an alternative to the teaching of English in Kenyan primary schools. A school in Nyeri County, Kenya, was purposively sampled. Learners in the experimental class were taught using TBL while those in the control class were taught using the Presentation, Practice and Performance (PPP) approach. A pre-test and a post-test were administered before and after the teaching. Afterwards, the scores were tabulated and analyzed quantitatively and the emerging patterns discussed. The findings revealed that many benefits are derived from the adoption of TBL in the language classroom. Thus, we recommend that TBL be adopted in the teaching of languages in Kenyan schools and that language teachers be trained on this approach.

Key words: Task based learning, language teaching, methodology, Language activities.

Introduction

Linguists and educationists have for a long period of time explored on the best pedagogical approaches beneficial to language teaching and learning (Crookes & Gass, 1993). These approaches have broadly been categorized as either form based (content based) or meaning based (Nunan, 1989). Whereas content based instruction like Presentation, Practice and Performance (Production), PPP or 3Ps, focuses on subject matter content (Long, 1998), task-based instruction focuses on a whole set of real-world tasks (Skehan, 1999). Ellis (2003) refers to PPP as the Present-Practice-Produce procedure, which is mainly directed at the linguistic forms of the target language. On the converse, the task-based language teaching, sometimes simply referred to as TBL (Task-Based Learning), TBLL (Task-Based Language Learning), Task Based Approach (TBA) or TBLT (Task-Based Language Teaching) (Crookes & Gass, 1993), has lately gained currency among linguists as discussed later in this paper. This research will employ the abbreviation TBL and PPP henceforth for the two approaches of language learning.

Task-based learning (TBL) was first developed by Prabhu in Bangladore, Southern India who opined that, students might learn more effectively when their minds are focused on the task, rather than on the language they are using (Prabhu, 1987). A Task, according to Ellis (2003), holds a significant position in second language acquisition research and in language pedagogy. Thus, a task-based curriculum involves "an integrated set of processes involving, among other things, the specification of both what and how (Nunan 1989, p.1). Skehan summarizes succinctly the difference between PPP and task based learning as follows:

> A PPP approach looks on the learning process as learning a series of discrete items and then bringing these items together in communication to provide further practice and consolidation. A task-based approach sees the learning process as one of

> learning through doing – it is by primarily engaging in meaning that the learner's system is encouraged to develop (Skehan 1996, p. 21).

Willis (1996) also contributes to the debate and argues that TBL is a learner-centered approach, in which students discover the target language through self-directed, task-based and project-based group investigations. In TBL, language learning becomes "a process that requires opportunities for learners to participate in communication, where making meaning is primary" (Skehan, 1996, p.38). TBL, therefore, employs interactive tasks, which require meaningful communication and interaction among learners (Nunan, 2004). According to Ellis (2003, p. 65), 'TBL is mostly about the social interaction established between learners as a source of input and means of acquisition, and involves the negotiation of meaning, communicative strategies, and communicative effectiveness.' TBL employs normally familiar tasks to a learner, which may involve simulation of activities like visiting the doctor, conducting an interview, or calling customer services for help (Ellis, 2003). On the other hand, Skehan (1998) points out that the PPP is one of the traditional and most influential approaches of organizing language teaching. PPP analyses the language into an inventory of forms, which can then be presented to the learner and practised as a series of discrete items (Nunan, 1989). The two approaches can be employed effectively by language teachers to teach lexical items in English like nouns, adjectives and prepositions.

Naskar and Bandyopadhyay (2006) claim that a preposition is a word placed before a noun to show in what relation the noun stands with regard to the other noun and verb words in the same sentence. Syntactically, prepositions can be categorized into three types: simple prepositions (for example, in, at, from and over, compound prepositions and phrase prepositions. A compound preposition is made up of words (for example, in spite of, in front of and apart from). A phrase preposition, on the other hand, is a simple preposition preceded by a word from another category, such as an adverb, adjective, or conjunction (for example, instead of, prior to and according to).

According to Cho (2002), the acquisition of English prepositions is one of the current topics of study in the field of lexical acquisition. Cook (2007, p.25), for example, notes that English is a very important language in the whole world as it “is now taught as the main foreign language in virtually every country and is used in business and education.” Prepositions are less likely to be acquired compared to open-class items such as nouns and verbs (Trask, 1996). Jackendoff (1977) clearly points out that “people seem never to have taken prepositions seriously.” The purpose of this study, therefore, was to analyze the effectiveness of TBLL and PPP as instructional approaches in the acquisition of English prepositions by standard four learners in the Kenyan Primary School educational system.

Statement of the Issue

One of the challenges facing language teachers is how to capture the interest of learners and to stimulate their motivation to learn (Nunan, 1989). Thus, the proponents of task-based instruction and the PPP have been embroiled in an unresolved debate on the most effective methodology towards the teaching of language (Ellis, 2003). Each of the approaches has attracted criticism and plaudits in almost equal measure. PPP, has for example, been criticized for viewing language as a series of “products” that can be acquired sequentially as “accumulated entities” (Ellis, 2003, p.). Skehan (1998) claims that the PPP approach is commonly used because it maintains teachers’ feelings of professionalism as it places the teacher firmly in charge of the teaching context. On the other hand, the opponents of TBL approach claim that TBL promotes learner centredness at the expense of teacher-directed instruction (Swan, 2005). However, Oxford (2006) says that TBL is an exciting field that offers great riches if explored by teachers in their dual roles as instructors and action researchers. This paper, therefore, intends to teach English prepositions to Grade

4 learners in a Kenyan Primary classroom in order to find out the best methodology of teaching the lexical items.

Rationale

First, there are various language instruction approaches such as Content-Based Second Language Instruction (Brinton, Snow and Wesche, 1989), Presentation, Practice and Production (Long, 1998), and Task-Based Language Instruction (Prabhu, 1987). Our choice of TBL approach is founded on the fact that TBL has received the most attention in the literature (Prabhu, 1987). Moreover, TBL offers the possibility of combining 'the best insights from communicative language teaching with an organized focus on language form' and thus avoiding the drawbacks of more narrowly form-centred or communication-centred approaches (Willis, 1996). Ellis (2003) points out that the overall purpose of a task-based approach is to create opportunities for language learning and skill development through collaborative knowledge building. Conversely, the PPP approach, among various objectives, lends itself to accountability since it generates succinct and tangible goals, precise syllabuses for the evaluation of the effectiveness of a learning model. That is why this study zeroed in on the TBL, a modern perspective, vis-à-vis, PPP, a traditional perspective.

Secondly, Edmund (2005) claims that although various scholars have documented the complexity of preposition usage, there is a paucity of studies on prepositions. While nouns, verbs and adjectives have received considerable focus in terms of lexical semantic language resource development (Mahesh 1996) and automatic ontology construction (Lin 1998), little work has been done on the teaching of English prepositions as second language. Romaine (1995) claims that prepositions are a difficult grammatical category to acquire and understand for native speakers of a given language, and yet more difficult for second language speakers. Since they are difficult to acquire by second language learners

(Romaine, 1995), prepositions are a valuable medium to test the permeability of grammar. That is why it is imperative that this study is undertaken and more specifically to learn the acquisition of prepositions in a multilingual setting.

Our choice of English is based on the fact that it is accessible to a considerable proportion of the world's population (Cook 2007, p.25). English in Kenya is learned throughout the Primary school. In Grade one to three, English is taught as a subject, while mother tongue languages are used as the media of instruction. In Grade four to eight, English is taught as a subject and it is used as the medium of instruction in other subjects (Kenya Institute of Education, 2002). Thus, the acquisition of prepositions is critical to the successful teaching and learning of English by standard four learners.

Theoretical Framework

Presentation, Practice and Produce Approach

The PPP model of language teaching (Presentation, Practice, Performance (Production) is based on the assumption that a language is best presented to learners as a syllabus of structures, and that through controlled practice a fluent and accurate performance of the 'structure of the day' can be achieved (Foster, 1999). Errors are, therefore, evidence of poor learning, requiring more PPP treatment (Foster, 1996). Skehan (1998) claims that the PPP approach is commonly used because of the following reasons: first, as mentioned above, it maintains teacher's feeling of professionalism as it places the teacher firmly in charge of the teaching context and secondly, it lends itself neatly to accountability since it generates clear and tangible goals, precise syllabi, and a comfortingly itemizable basis for the evaluation of effectiveness.

Presentation, the first stage in PPP, often focuses on a single point of grammar, usually presented clearly in a context. This stage is assumed to develop an understanding of the language point in the learner. Presentation is followed by practice, which is presumed to help learners to use and automatize the newly grasped rule or pattern. At the production stage, often called the ‘free stage,’ the learner is expected to reproduce the target language more spontaneously and flexibly (Skehan, 1998). Willis (1996, p.135), however, notes that final P, Production, is often not achieved. Either learners ‘conform’ to teachers’ wishes (Willis, 1996) and focus primarily on form, making sentences with the new item or they focus primarily on meaning and often accomplish the task successfully without embracing the new item at all. PPP, therefore, assumes that learners will learn what is taught in the same order in which it was taught, but there is no evidence that this happens (Skehan, 1996, p. 18). PPP is largely adopted in the traditional teaching of languages and will be applied in the teaching of English in the control group.

Task Based Language Learning Approach (TBL)

Definition of the term “task”

There is no agreement among linguists as to what constitutes a task (Long, 1985). Willis (1996: 53), for example, defines a classroom task as ‘a goal-oriented activity in which learners use language to achieve a real outcome.’ Thus, examples of tasks include filling out a form, buying a pair of shoes, making an airline reservation, borrowing a library book, taking a driving test, typing a letter, writing a check, finding a street destination and helping someone across the road, creating a crossword puzzle, making a video, preparing a presentation or drawing a plan. Tasks may also be complex, for example, creating a school newspaper or something easier such as making a hotel reservation (Lightbrown and Spada, 1999).

Prabhu (1987, p. 24) defines a task as "an activity, which requires learners to arrive at an outcome from given information through some process of thought, and which allows teachers to control and regulate that process". Nunan (1989, p. 10) defines a task as “a piece of classroom work which involves learners in comprehending, manipulating, producing or interacting in the target language while their attention is principally focused on meaning rather than form". Skehan (1996, p. 38) defines a task as an activity in which: i) meaning is primary; ii) there is some sort of relationship to the real world; iii) task completion has some priority; and iv) the assessment of task performance is in terms of task outcome. There are several common features that can be identified from these definitions. First, the definitions emphasize the importance of focus on meaning. Second, tasks are oriented towards goals, and the third is that tasks entail an active role of the participants (Long, 1985).

TBL, therefore, is teaching and learning a language by using language to achieve open-ended tasks (Ellis, 2003). TBL is compatible with a learner-centered educational philosophy (Ellis, 2003). It advocates for content-oriented meaningful activities rather than linguistic forms (Carless, 2002; Littlewood, 2004). Breen (1987:23) defines task based language learning as ‘any structured language learning endeavor, which has a particular objective, appropriate content, a specified working procedure, and a range of outcomes for those who undertake the task.’ The experimental group was taught using the TBL approach.

The Phases / Stages of the Task Based Learning

According to Willis (1996), Prabhu (1987) and Nunan (1985), the TBL framework consists of three main phrases for language learning. These are pre-task, task-cycle (task) and post-task stages (language focus). These components are carefully planned to create most favourable conditions for language acquisition, and thus provide rich learning opportunities to suit different types of learners (Willis, 1996).

The Pre-task Stage

The pre-task stage generally refers to the stage where the learners prepare for the task completion (Willis, 1996; Ellis, 2006 and Skehan, 1996). One of the activities in this stage is exposing the learners to the target language or providing the learners with language support (Willis, 1996). The language support that is given can be vocabulary and/or form that are necessary for the task completion. Willis (1996, p.1) claims that, “the aim of tasks is to create a real purpose for language use and to provide a natural context for language study." In the pre-task, the teacher introduces the class to the topic and the task activating topic-related words and phrases (Frost, 2004). The pre-task stage can also contain playing a recording of people doing the task. This gives the students a clear model of what will be expected from them. The students can take notes and spend time getting prepared for the task (Ellis, 2003).

The Task-stage

In this stage, the learners perform the activity by themselves (Prabhu, 1987). The learners carry out the task in pairs or small groups while the teacher monitors from a distance (Ellis, 2003). This cycle gives them speaking and writing contact with opportunities for students to learn from each other. The learners then plan how they will tell the rest of the group what they did and how it went, and then they report on the task either orally or in writing, and compare notes on what has happened (Willis, 1996). Linguists normally argue that there are three components of a task cycle: the task (activity), planning (where learners plan their reports effectively and maximize their learning opportunities) and report. In the same vein, Candlin and Murphy (1987) argue that tasks can be effectively organized based on systematic components including goals (the general aim for the task), input (verbal or non-verbal materials that learners can manipulate), setting (environment in which the task is performed), activities (the things participants will be doing in a given setting), roles of both the teacher and learner, and feedback of the task evaluation.

The Post-task stage / Language Focus

The post-task stage is the phase after the main activity is completed (Willis, 1996). The post-task stage allows a closer examination and analysis of some of the specific features occurring in the language used during the task cycle (Skehan, 1996). First, the learners may do a public performance (Willis, 1996 and Skehan, 1996), where they perform the task again with the class or with another group, or teacher as the audience. The learners, therefore, have another opportunity to interact in the target language. Secondly, learners may have language focus activities such as consciousness-raising activities (Willis, 1996), practice of words, phrases, patterns, and sentences (Willis, 1996). Thirdly, the learners can be involved in correction of both content and language. Finally, the teacher may give feedback with regard to the learners' language accuracy.

Research Methodology

Research Design

This is an action research project in which two approaches, TBL and PPP, are applied to an existing classroom system in a Grade four Kenyan primary school. An action research normally takes place when a teacher works with her/his own class as she/he feels the need to improve her teaching/learning experiences (Cohen and Manion, 1980). The study was designed to investigate the relationship between an independent variable (the efficacy of prepositions in the teaching of English and the linguistic dependent variable (the performance of learners in English). This research was conducted using a pre-test/post-test paradigm. It could be argued that "methodology becomes the central tenet of task-based pedagogy," since the goal is to allow learners to navigate their own paths and routes to learning (Kumaravadivelu 1993, p.73). Therefore, the most important thing in a TBL is not what the learner will learn, but how they will learn (Nunan, 2004). That is, the 'what' and the 'how' of teaching are merged in a TBL (Nunan, 2004). In a PPP, however, the focus is on what the learner will learn.

Sites, Population and Sample Size

Karindundu Primary School in Nyeri County, Kenya, was purposively sampled for this study. To achieve the aims of the study, data were collected from learners of Grade 4 classes studying English as a Second Language. The underlying principle of purposive sampling method entails identifying in advance the target variables. The researcher visited the school for permission from the head teacher to undertake the research as well as to ascertain that the learners had not been introduced to the prepositions in Grade 4. Two Grade 4 classes, 4 West and 4 East were used for the study. Each class had a research sample of 25 learners.

Data Collection Procedures & Methods for Quantifying the Linguistic Dependent Variables

The researcher administered a pre-test on prepositions on the first day to the two Grade 4 classes (cf. Appendix A). The test contained thirty questions. The test was developed based on the revised English syllabus (Kenya Institute of Education, 2002). The researchers made sure that the tasks were intellectually challenging enough to maintain the learners' interest. This is in line with the tenets laid down by Prabhu (1987). The pre-test was marked and scores entered. On the second day, the researcher introduced prepositions to Grade 4 West, the experimental class, using the TBL approach for a period of 35 minutes. The experimental class was divided into 5 equal groups of 5 learners. Ellis (2003) recommends mixed groupings (for example, in terms of language level) over homogeneous ones.

The learners were involved in different tasks in the experimental class. The learners discussed what happens when travelling. For example, boarding a bus, the conductor asking for money, the change they get, arrival at destination, how many buses they change, etc. Secondly, the students were given pictures to discuss and report what they saw in them (cf.

Appendices C and D). Thirdly, the students also discussed what they do during their birthdays, the places they visit, when they close school, among other topics. This exercise focused on prepositions of time. The students also discussed about the placing of an object such as besides, under, on and opposite to practice place prepositions. The teacher asked each group to give a report on the outcome of the task. The teacher then highlighted relevant parts from the text of the recording for the students to analyze. The teacher also highlighted the language that the students used during the report phase for analysis. Finally, the teacher selected language areas to practice based upon the needs of the students and what emerged from the task and report phases. The learners then did practice activities to increase their self-confidence and make a note of useful language. According to Long (2000), TBL is a pedagogy that encapsulates the principle of "learning by doing."

For the control class, Grade 4 East, the traditional method of presenting the prepositions, doing exercises and performance was employed for a period of 35 minutes. The researcher took an active role in the teaching process while the learners were passive participants. The researcher defined the term prepositions, gave examples of prepositions, gave exercises on the same and marked the learners' books to check on their performance. A post-test, the same test administered as a pre-test, was given to the two classes. The researchers scored the post-tests and generated quantitative data, which have been analyzed for comparison.

Data Analysis

Quantitative data was analyzed using the Statistical Package for Social Sciences (SPSS). Specifically, the Levene's Test for Equality of Variances demonstrated whether the observed differences between two sample means were purely random or whether there were real differences between the means. In the application of the Levene's Test for Equality of Variances, the researchers wished to see whether variability in the dependent linguistic variables was statistically significant so that it could be concluded that the means were different. The results were then presented in tables showing means and standard deviations and levels of statistical significance.

Literature Review

A Review of Studies on Task Based Language Learning

An enormous growth of interest in task-based language learning and teaching has been seen in recent years (Ellis, 2000, 2003; Skehan 2003 and Littlewood, 2004). For example, Nunan (2004), in his study based on interviews with teachers, teacher educators, and ministry officials, notes that TBL has emerged as a central concept from a study of curriculum guidelines and syllabi in the Asia-Pacific countries.

Barnard and Nguyen (2010) carried out an in-depth study of teacher cognition in Vietnamese high schools using 'a multi-methods' of data collection. Specifically, teachers were asked to write reflective comments about their attitudes towards TBL in Vietnamese, and their recent experience of applying TBL in their classroom. Barnard and Nguyen (2010) note that TBL is an effective model of language learning in schools. Pham (2000, p. 23), however, argues that "modern teaching methods should be applied with a close and careful consideration of the cultural values of Vietnam.'

Richards and Rodgers' (2001) conclude that the Malaysian English as a Foreign Language (EFL) secondary curriculum is a task-based communicative curriculum based on their examination of the general English use objectives for EFL oral communication. In the same vein, Sidek (2012) analyzes the reading instructional approach as reflected in an EFL secondary school curriculum in Malaysia by examining the curriculum in terms of theories of Second Language Acquisition (SLA), theories of L2 reading as well as learner roles in relation to Communicative Task-Based Language Teaching (CTBLT) characteristics. The study found out that the majority of reading tasks in the selected EFL secondary reading curriculum are highly lacking CTBLT characteristics. Other studies, for example, Mackey (1999) have shown that performing tasks can also assist the acquisition of grammar.

Studies on Prepositions

Huddleston (1984) defines a preposition as a word that indicates a relation between a noun or pronoun it governs and another word, which can be a verb, an adjective or another noun or pronoun. A preposition is a word that typically goes before a noun phrase or pronoun to express a relationship of meaning between two parts of a sentence, most often showing how the two parts are related in space or time. Most of the common English prepositions such as at, in, and for are simple; that is, they consist of one word. Other prepositions, consisting of more than one word, are called complex prepositions. Examples include in view of, according to, away from, as for, on account of. Quirk et al., (1985) note that a preposition in English expresses meanings of space, time, instrument and even cause. The following examples in Quirk et al., (p. 669) illustrate examples of such pronouns

(a) My car is at the garage (space)

(b) He came on Friday (time)

(c) Everyone ran for shelter (purpose)

(d) They left by plane (means)

(e) I am glad you are coming with us (accompaniment)

Prepositions have been studied extensively from both linguistic and computational perspectives (Jackendoff, 1977). For example, cognitive theorists have examined the polysemous nature of prepositions and explored the conceptual relationships of the polysemy, proposing the graphical mental images (Lakoff and Johnson, 1980 and Langacker, 1987). Fauconnier (1994) has also looked at the pragmatic aspects of prepositions. A recent semantic study of prepositions for computational use is analysed by

Voss (2002), with a focus on spatial prepositions. The semantics of spatial prepositions has also been dealt with (Voss, 2002).

Tanaka (1997) also notes that Japanese learners of English have a tendency to search for a one-to-one correspondence or direct translation equivalent in Japanese. Garcia (1995), on the other hand, analyzes the preposition en in a corpus of Spanish in San Antonio, Texas and finds out that en used in locative senses is the most frequently occurring usage, followed by its usage in temporal constructions. Dorr (1997) undertakes a lexical semantic analysis of English prepositions and classifies 165 English prepositions into 122 intransitive and 375 transitive senses using the lexical conceptual semantics framework.

Learners of English as a second language face difficulties in the learning of prepositions in the English language (Njoroge, 2011). This state of affairs can be explained from the point of view of the influence of African indigenous languages. Many African languages have very few prepositions that correspond to the English ones (see Jibril, 1991). Instead, they make do with a few general-purpose particles, which are less specific in their reference to temporal and spatial relations than the English prepositions. For example, in Gikuyu language, the particle na is used as both a preposition and a conjunction. Thus the study's focus on preposition is rationalised as preposition forms a major topic in the English syllabus for Kenya primary schools.

Findings

The tables below present the results of data analysis and the interpretation and the discussion of the emerging patterns is based on these results.

Table 1: Group Statistics (pretest)

Type		N	Mean	Std. Deviation	Std. Error Mean
pretest	control	25	16.74	3.347	.644
	experimental	25	16.89	3.166	.609

Table 2: Independent Samples Test for pretest

	Levene's Test for Equality of Variances		t-test for Equality of Means						
								95% Confidence Interval of the Difference	
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
pre - test Equal variances assumed	.194	.662	-.167	52	.868	-.148	.887	-1.927	1.631
Equal variances not assumed			-.167	51.841	.868	-.148	.887	-1.927	1.631

Plot Area

Tables 1 and 2 show the descriptive statistics for the pretest scores of the control class, c and the experimental class, e. There are no significant differences in standard deviations and means. The results of carrying out an independent t test and measuring the Levene's Test for Equality produced the results above with a significance level of 0.662. The t test therefore fails to reveal a statistically reliable difference between mean pre-test scores that the control class has (M=16.74, s=3.34) and the ones that the experimental class has (M=16.89, s=3.166), t (52) = .167, p= .662, α= .05.

Table 3: Differences between pre-test and post-test scores

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Diff	Equal variances assumed	.553	.460	-3.975	52	.000	-1.815	.457	-2.731	-.899
	Equal variances not assumed			-3.975	48.220	.000	-1.815	.457	-2.733	-.897

The p value is .460 which is greater than α= .05, hence we reject the null hypothesis that there is a statistically significant difference between the variances of the control group, c (M = 2.89, s = 1.423) and the experimental group e (M = 4.7, s = 1.898). Assuming the equal variance, we therefore take the values on the top row giving us t = -3.975, df = 52 and sig. (2 tailed) = .000. Since the significance level is less than .05 we conclude that the difference between the means could not have occurred by chance. The reason for the difference could be because of the application of Task Based Language learning method that was used in the experimental class.

Table 4: Score differences between pre-test and post-test for the control and experimental groups

Increment	Control	Experiment
Below 0	3	2

Between 1-3	13	2
Above 3	9	21

In the experimental class, majority of the pupils showed remarkable improvement in the post test scores with 21 out of 25 pupils (84%) improving by over 3 scores. Only 9 pupils (36%) in the control class were in the above categories. The graph below gives a pictorial representation of the pattern.

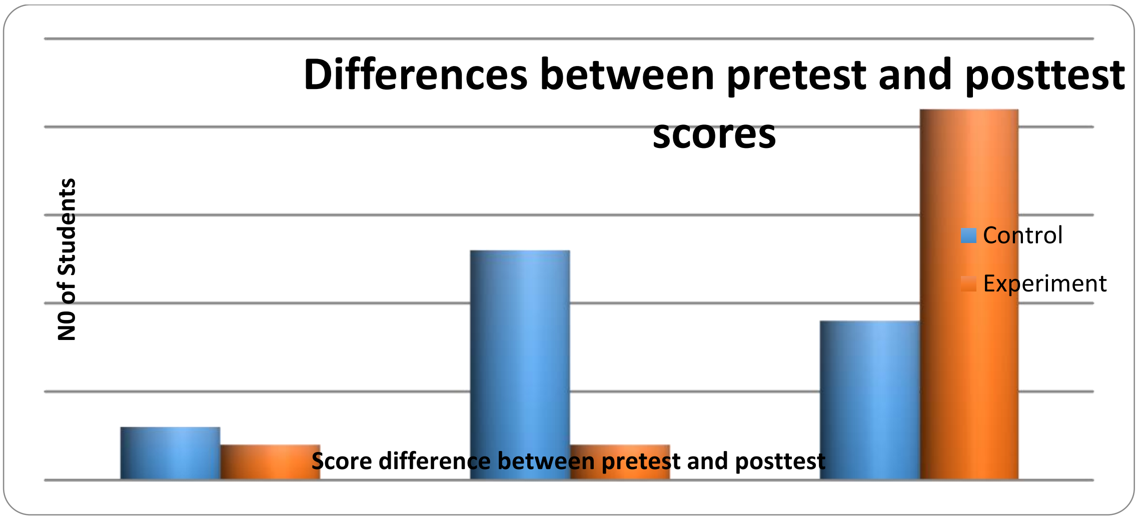

Fig. 1: Score difference between pre-test and post-test

Discussion of Findings

The general finding of the study indicates that the use of Task Based Language learning method (TBL) in the teaching of prepositions is effective and subsequently influences performance. The statistics show that the learners who were exposed to the TBL method did much better in the post test than their colleagues who went through Presentation, Practice and Performance (PPP) method (cf. Table 4) This finding suggests that TBL method may have contributed to the improvement of performance since at the pretest stage, both groups' scores were similar (see Table 1).

The finding points to the many advantages of the TBL as a method of language learning. First, learners get to enjoy learning the target language because they are involved in their own learning. The tasks that they are engaged in enable them to DO, and make their language learning a memorable experience. The fact that TBL involves the learners in the use of language in real life situations whose goal is to promote the use of the target language encourages them to communicate in the target language. For successful accomplishment of the task, the learners must communicate in the target language, thus getting essential practice of the language structures that the teacher wishes to introduce to the learners.

Second, the learners get to use the skills they have acquired and apply these skills in developing competence in the target language. The main strength of TBL is that the concern is on the learner. The tasks are learner centered; the goal is for the learner to achieve a specific goal by the use of the target language, for they must use what they have learned of the language to perform the particular task assigned to them during Task Based Language learning method. By the time the learner is being exposed to the TBL, it is assumed that the learner will have been exposed to a variety of lexical items and language structures in the target language to be able to communicate during the the task assigned to him or her. The teacher is expected to produce and supply meaningful tasks that will give the learners opportunities to experiment and guide the learner in the language learning process.

Third, the TBL gives the teachers an opportunity to plan in advance the tasks that will optimally help the learners in achieving the set goals. As he or she selects the tasks that will motivate the learners and at the same time enhance their language development, the teacher is given a chance to reflect on the entire lesson long before the actual teaching takes place. This gives the teacher an upper hand while monitoring the performance of the tasks by the students for the tasks are not performed for the sake of it: they have set objectives and the teacher should ensure that the learners are guided if the set goals are to be realized.

In addition, the learners get a chance to see language learning from a practical perspective. It is not all abstract and theoretical. They learn moving from the known to unknown. Thus another advantage of TBL is to take language learning from abstract knowledge to real world application of knowledge. The learners will no doubt find language learning much fun and this will ultimately improve their performance. The teacher too gets a chance to vary the teaching style and methodology and all this will help to create a good and conducive atmosphere in the classroom. Further, learners learn the art of working with others as a team, more so if the teacher keeps changing the group members every time a new task is being introduced to the class.

Conclusion

The findings have clearly indicated that, the class that used TBL as a method of language learning did better in the post-test which points to the need for the teachers of languages to apply this method in their teaching more often instead of the traditional PPP approach that is usually used in the language classroom. The paper has also highlighted the advantages of TBL as a method of language teaching/learning. Despite the fact that TBL requires a lot of time to prepare the tasks, and then implement them in the classroom, the benefits that may be accrued from the method far outweigh the time taken. The finding in this study implies that teachers of languages should utilize TBL in their language classrooms for maximum enjoyment and acquisition of various language structures being focused on. In so doing, teachers will be creating a warm learning atmosphere for their learners and this in turn will help in the improvement of learners' performance in the target language.

References

Barnard, R. and Nguyen G. (2010). Task-based language teaching (TBLT): A Vietnamese case study using narrative frames to elicit teachers' beliefs1 language education in Asia, Volume 1, 77 - 86.

Brinton, D.M., Snow, M.A. and Wesche, M.B. (1989). Content-based second language teaching. Boston: Heinle & Heinle Publishers.

Breen, M. P. (1987). Learner contribution to task design. Englewood Cliffs, NJ: Prentice Hall.

Candlin, C., & Murphy, D. (Eds.). (1987). Language learning tasks. Englewood Cliffs, NJ: Prentice-Hall International.

Carless, D. (2002). Implementing task-based learning with young learners. ELT Journal, 56(4), 389-396.

Cho, K. (2002). A cognitive linguistic approach to the acquisition of English prepositions. JACET Bulletin, 35, 63-78.

Cohen, I. and Manion, L. (1980). Research methods in education. New York: Routledge.

Cook, G. (2007). Languages in the contemporary world. In Applied Linguistics. Oxford: Oxford University Press, 3, 21-30.

Crookes, G. & Gass S. (1993) （Eds.) Tasks and language learning: Integrating theory and practice. Clevedon: Multilingual Matters.

Dorr, B. (1997). Large-scale dictionary construction for foreign language tutoring and interlingual machine translation. Machine Translation, 12(4), 271–322.

Edmunds, P. (2005). Usage of the Spanish Preposition en in Monolingual and Contact

Varieties. In D. Eddington (Ed), Selected Proceedings of the 7th Hispanic Linguistics Symposium, (pp. 22-30). Somerville, MA: Cascadilla Proceedings Project.

Ellis, R. (2000). Task-based research and language pedagogy. Language Teaching Research, 4 (3), 193-220.

Ellis, R. (2003). Task-based language learning and teaching. Oxford: Oxford University Press.

Ellis, R. (2006). Researching the effects of form-focused instruction on L2 acquisition. In K. Bardovi- Harlig and Z. Dörnyei （Eds.), Themes in SLA research. AILA Review,19, 18–41. Amsterdam: John Benjamins.

Fauconnier, G. (1994). Mental spaces. Cambridge: Cambridge University Press.

Foster, P. (1999). Task-based learning and pedagogy. ELT Journal, 53, 69-70.

Foster, P. and Skehan, P. (1996). The influence of planning on performance in task-based learning. Studies in Second Language Acquisition, 18, 299-324.

Frost, R. (2004). A Task-based approach. On line Documents at http://www.teachin5. genglish.org.uk/think/methodology/task_based.shtml. [15.12.2006]

García, M. (1995). En los sábados, en la mañana, en veces: A look at en in the Spanish of San Antonio. Spanish in four continents: Studies in language contact and bilingualism. In C. Silva- Corvalán, (Ed.), (pp.196-213). Washington, DC: Georgetown University Press.

Huddleston, R. (1984). Introduction to the Grammar of English. Cambridge: Cambridge University Press.

Jackendoff, R. (1977). The architecture of the language. Cambridge, MA: MIT Press.

Jibril, M. (1991). The Sociolinguistics of Prepositional Usage in Nigerian English. In

J. Cheshire (Ed.), English Around the World: Sociolinguistic Perspective (pp. 519-544). Cambridge: Cambridge University Press.

Kenya Institute of Education (2002). Revised English syllabus for Kenya primary schools. Nairobi: Kenya Literature Bureau.

Kumaravadivelu, B. (1993). The name of task and the task on naming: Methodological aspects of task-based pedagogy. In Crookes, G. and Gass, S.M.

(Eds.) Task in a Pedagogical Context: Integrating Theory and Practice. Clevedon, Avon: Multilingual Matters, Ltd.

Lakoff, G. and Johnson, M. (1980). Metaphors we live by. Chicago: University of Chicago Press.

Langacker, R.W. (1987). Foundations of cognitive grammar: Theoretical prerequisites (Vol, 11). Stanford, California: Stanford University Press.

Lightbrown, P. M. and Spada, N. (1999). How Languages are Learned. Oxford: Oxford University Press.

Lin, D. (1998a). Automatic retrieval and clustering of similar words. In Proc. of the 36th Annual Meeting of the ACL and 17th International Conference on Computational Linguistics (COLING/ACL-98), Montreal, Canada.

Littlewood, W. (2004). The task based approach: Some questions and suggestions. ELT Journal 58(4), 319-326.

Long, M. H. (2000). Focus on form in task-based language teaching. In R. L. Lambert & E. Shohamy (Eds.), Language policy and pedagogy (pp. 179-92). Philadelphia, PA: John Benjamins.

Long, M. H. (1985). A role for instruction in second language acquisition: Task-based language training. In K. Hyltenstam and M. Pienemann (Eds.), Modelling and assessing second language acquisition (pp. 77-99). Clevedon: Multilingual Matters

Long, M. H. (1998). Focus on form in task-based language teaching. University of Hawaii Working Papers in ESL, 16, 49-61.

Mackey, A. (1999). Input, interaction and second language development: an empirical study of question formation in ESL. Studies in Second Language Acquisition, 21, 557–87.

Mahesh, K. (1996).Ontology development for machine translation: Ideology and methodology, Tech. Rep. MCCS-96-292, Computing Research Laboratory, NMSU.

Naskar, S. and Bandyopadhyay, S. (2006). Handling of prepositions in English to Bengali Machine Translation. Proceedings of the Third ACL-SIGSEM Workshop on Prepositions, (pp 89–94). Trento, Italy.

Njoroge, M.C. (2011). Linguistic variation in a multilingual setting: Evidence from Kenya, Africa. VDM Verlag Publishers.

Nunan, D. (1985). Language teaching course design: Trends and issues. Adelaide: National Curriculum Resource Centre.

Nunan, D. (1989). Designing tasks for the communicative classroom. Cambridge: Cambridge University Press.

Nunan, D. (2004). Task-based language teaching. Cambridge: Cambridge University Press.

Oxford, R. L. (2006). Task-based language teaching and learning: An overview. Asian EFL Journal.

Pham, H. H. (2000). Traditional versus modern teaching methods. Teacher's Edition, 2, 20-23. Prabhu, N. S. (1987). Second language pedagogy. Oxford, Oxford University Press.

Quirk, R., Greenbaum, S., Leech, G. and Svartvik, J. (1985). A Comprehensive

Grammar of the English Language. London: Longman.

Richards, J. and Rodgers, T. (2001). Approaches and methods in language teaching. Cambridge: Cambridge University Press.

Romaine, S. (1995). Bilingualism. Oxford: Blackwell. Sidek, H. (2012). Efl reading instruction: communicative task based approach. International Journal of Instruction, Vol.5, No.2, 109-128.

Skehan, P. (1996). A framework for the implementation of task-based instruction. Applied Linguistics 17: 38–62.

Skehan, P. (1998). Task-based instruction, Annual Review of Applied Linguistics, 18, 268-286.

Skehan, P. (2003). Task-based instruction. Language Teaching, 36, 1-14.

Skehan, P. and Foster, P. (1999). The influence of task structure and processing conditions on narrative retellings. Language Learning, 49(1), 93-120.

Swan, M. (2005). Legislation by hypothesis: The case of task-based instruction. Applied Linguistics, 26 (3), 376–401.

Tanaka, Y. (1996). The comprehension and acquisition of relative clauses by Japanese High School students through formal instruction. Unpublished Ed.D dissertation, Temple University Japan, Tokyo.

Trask, R. L. (1996). The Semantics of Prepositions: An exploration into the uses of "at" and "to"" Historical linguistics. New York: St. Martin's Press, Inc. Snider,

Todd, (2010). Dietrich College Honors Theses. Paper 61.

Voss, C. (2002). Interlingua-based machine translation of spatial expressions. University of Maryland: Ph.D. Dissertation.

Willis, J. (1996). A framework for tasked-based learning. London: Longman.

APPENDIX A: TEST 1

Use the correct preposition

When the book is ----------------- the table you may not see it (under/in/on/over).

The teacher placed the radio---------------- the table thus we all saw it (in/on/over/through/under).

My friend sat -------------- me and I was happy (beside/besides).

When travelling to Nairobi ------------------------ (with/in/on/by/through/over) car, the journey takes one hour.

The teacher wrote ---------------------------- (in/on/over/to/through) the board.

Insert the correct preposition

If you want to go [ ] bus, you have to go [ ] the bus stop.

Then you wait [ ] your bus.

When the bus arrives, you get [ ] the bus.

When you arrive [ ] your destination, you get [ ] the bus.

Sometimes you even have to change buses [ ] another bus stop.

Complete the exercise with the correct prepositions

I got these photos [ ] my friend Jane.

These photos were taken [ ] her boyfriend, who is a hobby photographer.

[ ] these pictures you can see a giraffe.

So, these are pictures [ ] a giraffe.

Look [ ] these pictures. Aren't they wonderful?

Fill in the correct prepositions.

Peter is playing tennis [ ] Sunday.

My brother's birthday is [ ] the 5th of November.

My birthday is [ ] May.

We are going to see my parents [ ] the weekend.

[ ] 1666, a great fire broke out in London.

I don't like walking alone in the streets [ ] night.

What are you doing [ ] the afternoon?

My friend has been living in Canada [ ] two years.

I have been waiting for you [ ] seven o'clock.

I will have finished this essay [ ] Friday.

Complete the exercise according to the picture.

[ ] the picture, I can see a woman.

The woman is sitting [ ] a table.

She is sitting [ ] a chair.

There is another chair [ ] the woman.

Her feet are [ ] the table

APPENDIX B: MARKING SCHEME

Preposition

Use the correct preposition

When the book is -----under------------ the table you may not see it (under/in/on/over).

The teacher placed the radio-----on----------- the table thus we all saw it (in/on/over/through/under).

My friend sat ------beside-------- me and I was happy (beside/besides).

When travelling to Nairobi ------by----------------- (with/in/on/by/through/over) car, the journey takes one hour.

The teacher wrote ----------on----------------- (in/on/over/to/through) the board.

Insert the correct preposition

If you want to go [by] bus, you have to go to the bus stop.

Then you wait [for] your bus.

When the bus arrives, you get [on] the bus.

When you arrive at your destination, you get [off] the bus.

Sometimes you even have to change buses [at] another bus stop.

Complete the exercise with the correct prepositions

I got these photos [from] my friend Jane.

These photos were taken [by] her boyfriend, who is a hobby photographer.

[In] these pictures you can see a giraffe.

So, these are pictures [of] a giraffe.

Look [at] these pictures. Aren't they wonderful?

Fill in the correct prepositions

Peter is playing tennis [on] Sunday.

My brother's birthday is [on] the 5th of November.

My birthday is [in] May.

We are going to see my parents [at] the weekend.

[In] 1666, a great fire broke out in London.

I don't like walking alone in the streets [at] night.

What are you doing [in] the afternoon?

My friend has been living in Canada [for] two years.

I have been waiting for you [since] seven o'clock.

I will have finished this essay [by] Friday.

Complete the exercise according to the picture

[In] the picture, I can see a woman.

The woman is sitting [at] a table.

She is sitting [on] a chair.

There is another chair [opposite] the woman.

Her feet are [on] the table.

APPENDIX C: TASK 1

APPENDIX D: TASK 2

APPENDIX E: THE CONTROL GROUP

	Test 1		
NAME	**Pretest**	**Posttest**	**diff**
Learner 1	20	24	4
Learner 2	18	22	4
Learner 3	22	27	5
Learner 4	17	21	4
Learner 5	21	24	3
Learner 6	19	23	4
Learner 7	18	22	4
Learner 8	10	09	-1
Learner 9	17	21	4
Learner 10	13	16	3
Learner 11	12	12	0
Learner 12	19	22	3
Learner 13	16	20	4
Learner 14	15	18	3
Learner 15	11	13	2
Learner 16	15	15	0
Learner 17	16	19	3
Learner 18	22	26	4
Learner 19	12	15	3
Learner 20	15	17	2
Learner 21	13	15	2
Learner 22	17	20	3

Learner 23	18	21	3
Learner 24	21	25	4
Learner 25	20	24	4

APPENDIX F: THE EXPERIMENTAL GROUP

	Test 1		
NAME	Pretest	Posttest	Diff
Learner 1	17	24	7
Learner 1	18	23	5
Learner 1	20	26	6
Learner 4	19	23	4
Learner 5	16	21	5
Learner 6	17	23	6
Learner 7	21	27	6
Learner 8	19	24	5
Learner 9	12	20	8
Learner 10	15	20	5
Learner 11	14	19	5
Learner 12	18	23	5
Learner 13	19	23	4
Learner 14	23	29	6
Learner 15	19	24	5
Learner 16	16	22	6
Learner 17	10	17	7
Learner 18	13	12	-1
Learner 19	18	22	4
Learner 20	17	21	4
Learner 21	18	18	0

Learner 22	19	24	5
Learner 23	12	15	3
Learner 24	11	15	4
Learner 25	20	23	3

	Test 1		
NAME	Pretest	Posttest	Diff
Learner 1	17	24	7
Learner 1	18	23	5
Learner 1	20	26	6
Learner 9	12	20	8
Learner 10	15	20	5
Learner 11	14	19	5
Learner 12	18	23	5
Learner 13	19	23	4
Learner 14	23	29	6
Learner 15	19	24	5
Learner 16	16	22	6
Learner 17	10	17	7
Learner 18	13	12	-1
Learner 19	18	22	4
Learner 20	17	21	4
Learner 21	18	18	0
Learner 22	19	24	5
Learner 23	12	15	3
Learner 24	11	15	4
Learner 25	20	23	3

Plot Area

KENYAN SECONDARY TEACHERS' INTEGRATION OF TECHNOLOGY INTO THEIR TEACHING PRACTICE

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Abstract

Teaching is a complex practice that requires teachers to draw upon their content knowledge, pedagogical approaches and strategies, and knowledge about learners in order to support learning. Integrating technology into the teaching and learning practice of a classroom is a strategy that many teachers are drawing upon. When integrated effectively, technology can support student learning and lead to deeper conceptual understanding and procedural fluency (Bransford, Brown, & Cocking, 2000). However, the use of technology in classrooms may have negative or neutral effects (Kozma, 2003). In this research study, we are using questionnaire and classroom observation data to examine how Kenyan secondary teachers are attempting to integrate technology into the teaching and learning practice of their classroom, and to examine what factors assist and what factors inhibit this integration. We are analyzing these teachers' classroom practices in light of research literature in this area, while being open to other factors and patterns emerging within the context in which we are investigating. We are collecting data through questionnaires, individual interviews, and classroom observations. In this paper, we report on a subset of our data set as we examine the technology integration in 11 classroom lessons in a variety of subjects in western Kenya.

Introduction

Teaching is a complex practice that requires teachers to draw upon their content knowledge, pedagogical approaches and strategies, and knowledge about learners in order to support learning. Integrating technology into the teaching and learning practice of a classroom is a strategy that many teachers are drawing upon. When integrated effectively, technology can support student learning and lead to deeper conceptual understanding and procedural fluency (Bransford, Brown, & Cocking, 2000). However, the use of technology in classrooms may have negative or neutral effects; the impact depends on how teachers use technology in their teaching practice (Kozma, 2003).

Some research studies have found a negative relationship between the use of technology and student achievement (Pelgrum & Plomp, 2002; Wenglinski, 1998), while some studies have found that certain uses of technology have a positive impact on learning (National Center for Educational Statistics, 2001; Wenglinski, 1998). Some researchers have documented that some teachers have used technology to change their pedagogy and change the curriculum (e.g., Means & Olson, 1995).

Kozma (2003) led a group of researchers who examined what these changes might look like in classrooms in the Second Information Technology in Education Study Module 2 (SITES M2; www.sitesm2.org), which was a project of the International Association for the Evaluation of Education Achievement. This project "involved research teams from 28 countries in Europe, North America, Asia, Africa, and South America" (p. 2), which developed criteria and selected cases of teachers using innovative practices in their classrooms. The research teams examined 174 cases evenly spread across primary, lower secondary and upper secondary grades.

The teams found that technology is supporting significant changes in teaching and learning practices, with almost 90% of the teachers engaged in "advising and guiding their students' work" (Kozma, 2003, p. 5), nearly 59% of the teachers collaborating with other teachers, in only 25% of the cases were teachers lecturing, and in 83% of the cases students were collaborating with each other. The analysis of the cases indicated that many of the innovations in the cases involved the "use of productivity tools (78%), Web resources

(71%), e-mail (68%) and multimedia software (52%)” (p. 5). The study also examined the ways different practices were used together by teachers in their classrooms and pointed to the need for more research to examine teachers’ classroom practices in using technology to support student learning.

The Use of Technology in Kenyan Classrooms

While technology began being introduced in Kenyan classrooms in the 1980s, the use of technology in Kenyan schools received a boost when the Kenyan government, through the Ministry of Information, Communication and Technology, developed a national technology policy that sought to “facilitate sustained economic growth and poverty reduction, promote social justice and equity, mainstream gender in national development, empower the youth and disadvantaged groups, stimulate investment and innovation in [technology], and achieve universal access to [technology]” (Republic of Kenya, 2006, p. 2). The government of Kenya is aiming to achieve these goals by:

- Promoting the development of e-learning resources;
- Facilitating public-private partnerships to mobilize resources in order to support e-learning initiatives;
- Promoting the development of an integrated e-learning curriculum to support ICT in education;
- Promoting distance education and virtual institutions, particularly in higher education and training;
- Promoting the establishment of a national ICT center of excellence;
- Providing affordable infrastructure to facilitate dissemination of knowledge and skill through e-learning platforms;
- Promoting the development of content to address the educational needs of primary, secondary and tertiary institutions;

- Creating awareness of the opportunities offered by ICT as an educational tool to the education sector; and
- Facilitating the sharing of e-learning resources between institutions. (Republic of Kenya, 2006, pp. 12-13)

The National ICT Innovation and Integration Centre (NI3C) was established in Kenya in 2011. As part of this centre, teachers referred to as “champions” have been trained in the use of technology and specifically on integrating technology into classroom teaching and learning. Thus far, one champion teacher has been trained for each of the 210 constituencies in Kenya. The champion teachers work with teachers at other secondary schools in their constituencies that have technology equipment. The champion teachers also approve the purchase of technology for schools when the Kenyan government allocates money for technology.

Part of the NI3C’s mission is to conduct research on teachers’ use of technology in teaching and learning and so researchers from Syracuse University and Kenyatta University, through the Kenyatta University-Syracuse University Partnership funded by the United States Agency for International Development (USAID), have recently joined with researchers at the NI3C to begin examining how Kenyan secondary teachers are using technology in their classroom practice. Our research questions in this study are: (1) How do Kenyan secondary school teachers perceive their use of technology? and (2) How do Kenyan secondary school teachers use technology in their classroom practice? In this paper, we report on data collected from Kenyan secondary teachers. These data are part of a larger data set for which the data collection and data analysis is still ongoing.

Methods

In this research study, we are using questionnaire and classroom observation data to examine how Kenyan secondary teachers are attempting to integrate technology into the teaching and learning practice of their classroom, and to examine what factors assist and what factors inhibit this integration. We are analyzing these teachers' classroom practices in light of research literature in this area, while being open to other factors and patterns emerging within the context in which we are investigating. We are collecting data through questionnaires, individual interviews, and classroom observations. In this paper, we report on the findings from data collected through questionnaires and classroom observations of 11 classroom lessons in a variety of subjects in western Kenya.

We drew on questionnaires and classroom protocols developed by others (Tanzania Ministry of Education and Vocational Training, 2012; Texas Teacher Technology Competencies Certification (http://www.texasttcc.net/teacherchecklist.html); Western Australia Department of Education and Training, 2006) to develop the questionnaire and observation protocol that we used in collecting data. Each teacher completed our questionnaire and we observed each of these teachers teaching one or two lessons in which the teacher used technology as an integral part of the lesson.

Our participants were eight male teachers (no female teachers volunteered to be observed). The eight participants (we observed three of the participants teach a lesson in two different subject areas) were teaching at three different schools, all in rural areas. Two of the schools were boarding schools and one school was a day school. The two boarding schools were boys' schools while the day school was a mixed school (both boys and girls). The 11 lessons we observed were in the areas of Biology (1 lesson), Chemistry (1 lesson), English (1 lesson), German (1 lesson), Mathematics (3 lessons), and Physics (4 lessons).

The participants' range of teaching experience was from 1 to 30 years (1, 1.5, 9, 11, 12, 22, 24, 30). One teacher was less than 24 years old, four teachers were 30 to 39 years of age, one was 40 to 49 years of age, one was 50-59 years of age, and one was 60 years or older. It is important to note that these participants were chosen because they frequently use technology in their teaching. The lessons that we observed each of the participants teach did incorporate the use of technology in some manner.

Findings

In general, the participants reported having access to and using basic technology; seven out of eight participants reported having access to a computer for personal use, having a personal email account, using the Internet, having access to an LCD projector, and having computers for students to use in their schools. Seven out of eight participants reported having basic training in the use of computers, word processing, spreadsheets, presentation software and integrating technology into lessons.

Four participants rated their overall skill in using educational technology as high, while four rated their skill as medium. All of the participants reported being somewhat comfortable or very comfortable with navigating a computer desktop, saving and retrieving files, using different types of files (e.g., text, graphic, image, video, audio), connecting to and searching the Internet, sending and receiving email messages, opening attachments sent via email, as well as basic managing of peripherals (e.g., connecting a keyboard to a computer, connecting a mouse, importing photos from a digital camera to a computer). All but one of the participants reported being comfortable with creating and manipulating word processing and spreadsheet documents (e.g., applying font formats, checking spelling, saving as, adding bullets, setting tabs, creating columns, inserting graphics or tables).

All eight participants reported that they were at least somewhat comfortable with presentation software (e.g., creating a PowerPoint presentation, entering text on a slide, insert an image on a slide, changing the background and style), as well as using material on a CD or DVD or from the Internet in teaching. Five of the participants reported that they were at least somewhat comfortable with using a learning management system and four stated they were at least somewhat comfortable with using clickers. Six participants reported being at least somewhat comfortable using interactive whiteboards in their teaching and six of the participants reported being at least somewhat comfortable with using mobile technology in teaching.

All eight of the participants reported that they agreed or strongly agreed that ICT provides valuable resources and tools to support student learning and they like the challenge of exploring technology and its possibilities. Six of the participants chose the statement “Having an extensive impact on what students learn and how they learn” to be the one that best described the extent to which they used ICT in their teaching practice. One participant chose the statement “A useful resource impacting on some areas of the curriculum” to describe his use of ICT and the other participant chose “Having little impact on student learning”. Another choice, that no participant chose, was “Improving student skills in the use of ICT.”

Two of the participants reported engaging students in using ICT to achieve learning outcomes daily, five reported engaging students weekly while the eighth participant reported usage at least once a term. Seven participants reported using ICT for personal/professional use daily and the other participant reported using it at least once a term. When asked what factors would increase the participants’ use of ICT in their classrooms, all participants reported having Internet access and more ICT equipment.

Our observations of the participants’ lessons confirmed that most of them were comfortable in using a laptop and projector. In all 11 lessons, participants used a laptop connected to an LCD projector. All of the teachers used a PowerPoint presentation as part of their lesson, with two of these teachers also incorporating a video clip and two other teachers incorporating animations.

We observed that most participants seemed to have fair to good technological knowledge and that all of the participants were able to use the technology that they had chosen for the lesson without difficulties.

All of the teachers spent some time presenting information during the lessons as well as engaging students in thinking about the ideas being presented by asking questions. Two teachers had several students present problem solutions at the board, and one of these teachers presented a task and had students work in small groups for approximately 20 minutes while he circulated around the room, observing and listening to the student discussions.

We observed that the student participation was active in five of the classes, moderate in four of the classes, and passive in two classes. The specific benefits of technology to support the teachers' pedagogy and content in the classes were to illustrate concepts that would have been difficult without technology and to save time. ICT supported interaction in the classroom by providing the content to be discussed, and allowing teachers to illustrate concepts that are difficult to show otherwise.

Discussion

These data show snapshots of these eight participants' teaching in general, and integration of technology in particular. We need more observations and discussions with these participants in order to have a more complete picture of their practice integrating technology into their classroom teaching. The picture we have from this preliminary analysis is that these participants are fairly comfortable in using technology and in using technology in some ways in teaching. Except for one participant, we observed these teachers use lecture combined with questioning for their instructional approach. Our observations did not align with the cases of innovative practice in Kozma (2003) where students collaborated with each other in 83% of the cases. We also did not collect data to indicate whether these participants collaborated with other teachers; however, this does not mean that they did not. We did find similar usage of productivity tools, Web resources and email that Kozma (2003) found. As Kenya continues to expand upon its growing mobile network (http://www.time.com/time/magazine/article/0,9171,2080702,00.html), and the Kenyan government continues to support ICT integration in education, teachers will grow in their knowledge and usage of technology to support teaching and learning. We anticipate that as we continue to collect data on these participants and others, we will learn more about teachers' practices in integrating technology into their teaching and what factors support and inhibit these practices.

References

Bransford, J., Brown, A., & Cocking, R. (2000). How people learn: Brain, mind, experience, and school. Washington, DC: National Academic Press.

Kozma, R. B. (2003). Technology and classroom practices: An international study. Journal of Research on Technology in Education, 36(1), 1-14.

Light, D. (2010). Multiple factors supporting the transition to ICT-rich learning environments in India, Turkey, and Chile. International Journal of Education & Development Using Information & Communication Technology, 6(4), 39-51.

McMillan Culp, K., Hawkins, J., & Honey, M. (1999). Review paper on educational technology research and development. New York: Center for Children and Technology.

Means, B., & Olson, K. (1995). Technology's role in education reform: Findings from a national study of innovating schools. Washington, D.C.: United States Department of Education, Office of Educational Research and Improvement.

National Center for Educational Statistics (2001). The connected school: Technology and learning in high school. San Francisco, CA: Jossey-Bass.

Ogwu, E. N., & Ogwu, F. J. (2010). Technologies and utilization in schools: Its implications to learning. Journal of Technology Integration in the Classroom, 2(1), 49-57.

Pelgrum, W., & Plomp, T. (2002). Indicators of ICT in mathematics: Status and covariation with achievement measures. In A. E. Beaton, & D. F. Robitaille (Eds), Secondary analysis of the TIMSS data. Dordrecht, The Netherlands: Kluwer Academic Press.

Republic of Kenya (2006). National information and communications technology (ICT) policy. Nairobi: Government Printer.

Silicon savannah: Mobile phones transform Africa (2011, June 30). Time Magazine, Retrieved on January 15, 2013 from http://www.time.com/time/magazine/article/0,9171,2080702,00.html.

Tanzania Ministry of Education and Vocational Training (2012). Monitoring and evaluation tools. Dar es Salaam: Author.

Texas Teacher Technology Competencies Certification. Retrieved on January 15, 2013 from http://www.texasttcc.net/teacherchecklist.html.

Wenglinski, H. (1998). Does it compute? The relationship between educational technology and student achievement in mathematics. Princeton, NJ: Educational Testing Service.

Western Australia Department of Education and Training (2006). Teacher ICT skills. East Perth: Author.

EFFECTS OF ATTITUDE ON STUDENTS' PERFORMANCE IN CHEMISTRY: THE CASE OF KWALE COUNTY PUBLIC SECONDARY SCHOOLS, KENYA

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Abstract

This paper reports the findings of a study, which set out to investigate the causes of persistent poor performance of students in Kenya Certificate of Secondary Examination (KCSE). A sample of 482 form three students from 9 public secondary schools was randomly selected using both simple and stratified random sampling to participate in a descriptive survey to ascertain the attitudinal causative factors for persistent poor performance in the County. The students and their chemistry teachers responded to questionnaires. Data from Chemistry teachers, school Principals and the District Quality Assurance and Standards Officers [DQASO] were collected through interview schedules. Results obtained showed that Chemistry teachers' negative perception of their learners' abilities was the most predominant factor responsible for the persistent poor performance of students in Chemistry. It is recommended that the Ministry of Education through its various agents should enhance supervision of curriculum implementation in schools. School managements in conjunction with other stakeholders should enhance teacher motivation; provide more and better teaching and learning facilities and resources. Chemistry teachers should be in-serviced to build their capacity in use of practical approaches in their teaching.

1. Introduction

Attitude is important in understanding human behaviour. Many attempts have been made to define what exactly an attitude is. Generally it is defined as a complex mental state involving beliefs (Hussain, Ali, Khan, Ramzan & Qadeer, 2011). It is an individual's prevailing tendency to respond favourably or unfavourably to an object, person or group of people, institutions or events (Barros & Elia, 1997). The word is defined within the framework of social psychology as a subjective or mental preparation for action. It defines the outward and visible postures and human beliefs. Attitudes determine what each individual will see, hear, think and do. They are rooted in experience and do not become automatic routine conduct. Attitudes can be positive (values) or negative (prejudice). Attitude towards science denotes interest or feeling towards studying science. It is the students' disposition towards 'like' or 'dislike' in science. Attitude in science means the scientific approach assumed by an individual for solving problems, assessing ideas and making decisions in the sciences (Olatunde, 2009).

The purpose and programs of the educational system must be designed to meet the needs of each individual child (Eshiwani, 1983). The characteristics of the student and the educational objectives must both be employed as guides in the design of maximally effective environments for learning for better achievement. According to Driver (1989), the role of education in our society is to train children to be creative and self-reliant. When motivational factors such as interest, attitude and aspiration are inculcated in the learners, they tend to spend more time studying the particular subject. This translates into higher achievement in sciences. Students understand better when they spend more time studying Chemistry and will therefore achieve to expected standard (Twoli, 2006). This is only possible when they have a positive attitude toward a particular subject.

Educationists and employers know that it is essential to motivate learners and employees so that they can work hard to produce good results in whatever they do (Kithinji 2007, as cited in Twoli, Maundu, Muindi, Kiio, & Kithinji, 2007). Teachers' attitudes and motivation play a pivotal role in the teaching and learning process. They have a decisive role in any educational system and their competencies do not automatically ensure positive attitudes towards the teaching process. To put it simply, teacher attitudes are important because they affect the student. Teacher attitudes play a significant role in shaping the classroom environment which has an impact on a student's self efficacy which in turn influences the student's behaviour. All of these factors which can be loosely categorized as environmental, personal factors, and behavioural interact and play off each other in a cyclical way (Woolfolk, 2007). According to Kwale SMASSE District INSET-2004, although Science and Mathematics teachers may have positive attitude, they are beset with problems that frustrate their efforts to teach effectively and efficiently. They play a significant role during the learning process and can directly or indirectly influence students' attitudes toward science which in consequence can influence students' achievement. Teachers are, invariably, role models whose behaviours are easily mimicked by students. What teachers like or dislike, appreciate or disapprove and how they feel about their learning or studies could have a significant effect on their students. By extension, how teachers teach, how they behave and how they interact with students can be more paramount than what they teach (Kwale SMASSE, 2004).

In relation to science subjects, Halladyna and Shanghnessy (1982) concluded that a number of factors have been identified as related to students' attitudes. Such factors include: teaching methods, teachers' attitudes, influence of parents, gender, age, cognitive levels of pupils, career interest, societal view of science and scientists, social implications of science and achievement. Empirical studies have revealed the influence of methods of instruction on students' attitude towards science. Kempa and Dube (1974) worked on the influence of science instruction; the result was that attitude becomes more positive after instruction. Long (1981) also concluded that diagnostic-prescriptive treatment promotes positive attitude. Hough and Peter (1982) further found out that groups of learners who scored significantly high in science achievement test also scored significantly high in attitude test. Gibbons, Kimmel and O'Shea (1997) opined that students' attitudes about the value of learning science may be considered as both an input and outcome variable because their attitudes towards the subject can be related to educational achievement in ways that reinforce higher or lower performance. This means that those students who do well in a subject generally have more positive attitudes towards that subject and those who have more positive attitudes towards a subject tend to perform better in the subject (Olatunde, 2009). Akinmade (1992), confirmed that students' attitude toward science are sine qua non for higher achievement in science.

Student beliefs and attitudes have the potential to either facilitate or inhibit learning. Burstein (1992) in a comparative study of factors influencing Mathematics achievement found out that there is a direct link between students' attitudes towards Mathematics and student outcomes. Studies carried out have also shown that the teachers' method of teaching mathematics and his personality greatly accounted for the students' positive attitude towards Mathematics and that, without interest and personal effort in learning Mathematics by the students, they can hardly perform well in the subject (Olatunde, 2009).

Students' attitudes toward the learning of Chemistry (a science subject), is a factor that has long attracted the attention of researchers. Ojo (1989) and Adesokan (2002) asserted that in spite of realization of the recognition given to Chemistry among the science subjects, it is evident that students still show negative attitude towards the subject, thereby leading to poor performance and low enrolment. According to Bassey, Umoren and Udida (2008), students' academic performance in Chemistry is a function of their attitude. Papanastasiou (2001) reported that those who have positive attitude toward science tend to perform better in the subject. The affective behaviours in the classroom are strongly related to achievement, and science attitudes are learned (George & Kaplan, 1998).

The poor performance in Sciences especially in Chemistry has continued to be a major concern for the Government of Kenya and other education stakeholders. The trend in performance has been more pronounced in rural areas such as Kwale County. The poor performance has led to low mean grades for most candidates and thus jeopardised their chances for upward social mobility. At the national level the poor performance has led to low uptake of careers in science and technology. In an effort to reverse the trend, the government adopted a number of interventions targeting pupils, teachers and the overall teaching and learning environment. Despite these interventions, the poor performance in Chemistry in Kwale County continues with lower mean than the national averages being recorded year after year.

The continued poor performance in Chemistry has been attributed to a number of attitudinal factors including students' attitude towards Chemistry, teachers' attitude towards students' abilities and poor teaching methodologies among others. However, it is not clear which of these factors are responsible for the poor performance of Chemistry in Kwale County. The study therefore sought to isolate the factors which could have been responsible for Kwale County students' poor performance in Chemistry.

2. Research Questions

The study sought to answer the following questions:

i) What are the students' attitudes towards Chemistry?

ii) What are the effects of students' attitude towards Chemistry on its performance?

iii) How do Chemistry teachers perceive their learners' ability in Chemistry?

iv) What are the effects of teacher's perception of the learner ability on the learner's performance in Chemistry?

3. Methodology

3.1 Research Design

The research design used for this study was a descriptive cross sectional survey design. The design was used since it enabled the researcher collect data across the sampled population using the same instruments at the same time. The survey design also enabled the researcher obtain information concerning the determinant factors for performance and assess the opinions of principals, Chemistry teachers and students on how these factors contribute to performance in Chemistry (Best & Kahn, 1992; Gay, 1992).

3.2 Target population and Sampling Procedure

The target population for this study consisted of head-teachers, Chemistry teachers and the students of all the 32 registered Public secondary schools of Kwale County, which had been registering candidates for KCSE for at least 4 consecutive years. For this study, a sample of 9 out of the 32 schools was selected through stratified and simple random sampling. This means that about 28.125% of the schools were selected to participate in the study. The 32 schools were first stratified into provincial and district schools. Then, members of each stratum were further stratified into boys', girls', and mixed schools. After stratification, simple random sampling was used to identify schools to participate in the survey through picking of lots. In schools with more than one stream, each with 45 or more students, lots were used to identify the stream to participate in the study. All the students in the selected stream were allowed to take part in the study. The principal of each of the participating schools was requested to take part in the study as well as the form three Chemistry teachers. In schools with more than one Chemistry teacher teaching the Form 3 classes, the longest serving teacher was selected hence the more experienced teacher was requested to participate in the study. A total of 9 principals, 9 Chemistry teachers and 482 students were selected for the study.

3.3 Instruments

The instruments designed by the researchers for the study included Observation guide (OG), Students Questionnaire (SQ), Teachers Questionnaire (TQ), Teachers' interview schedule (TIS), Principals' interview schedule (PIS) and the District Quality Assurance and Standards Officer interview schedule (DQASO IS). Each of the questionnaires had two parts. Part I contained profile of the respondents and Part II contained respondents' views on the determinants of poor performance in Chemistry. The (SQ, TQ) were validated using Cronbach's alpha coefficients. The calculated values were 0.75 and 0.70 respectively.

3.4 Data Analysis

A one way Analysis of Variance (ANOVA) data analytical technique was used to investigate the interrelationship between the factors that affect performance in Chemistry in Kwale County.

4. Results and Discussion

4.1 Research Question One

What are the students' attitudes towards Chemistry?

Eleven items were used in the questionnaire to assess Kwale County students' attitude towards Chemistry. To achieve this objective, the study sought to inquire whether students considered Chemistry as an important subject or not, whether or not they enjoyed both the theory and practical lessons of the subject, who influenced their choice of the subject and the amount of time, they invested in studying the subject among others. The summary of the analysis is represented in Table 1.

Majority of the students responded positively to ten out of eleven items, which were used to test for students' attitude towards Chemistry in Kwale County. The results showed that the students generally scored positively for the items with a mean rating of 67.92% on the elements of attitude showing that they had a positive attitude towards Chemistry.

4.2 Research Question Two

What are the effects of students' attitude towards Chemistry on its performance?

A one way Analysis of Variance (ANOVA) test was used to assess effects of Kwale County students' attitude on their performance in the subject and the findings were as presented in Tables 2 and 3. The results in Table 2 shows that the respondents (students) who scored 75% and above had the highest score (40.5) on the elements of attitude followed by those who scored between 45% and 59% (38.67), then 60% to 75% (38.59), followed by those who scored 30% to 44% (37.53) and lastly those who scored less than 30% (36.97) in that order.

The ANOVA results {F=4.535; df=4; 470; 474; P=0.001} in 3 shows that the observed mean difference was significant at 0.05 level of significance. This therefore means that the students who scored high marks in Chemistry also tend to have a positive attitude towards the subject. Hough and Piper (1982) from their study similarly found that groups of students who scored significantly high in science achievement test also scored significantly high in attitude test. The study finding agrees also with that of Serin and Mohammadzadeh (2008); Oluwatelure and Oloruntegbe (2010) who found out in their studies that there was a significant relationship between students' attitude towards science and their science achievement. This assertion had also been proved by Bassey, Umoren and Udida (2010) who found out in their study on secondary school students' attitude and performance in Chemistry in Akwa Ibom state - Nigeria that there is a significant positive relationship between students' attitude towards Chemistry and their performance in Chemistry. Kan and Akbas (2006), also in their research on affective factors that influence Chemistry achievement found out that students attitude towards Chemistry course on its own is a significant predictor of achievement in Chemistry and explains a significant proportion of variance of Chemistry achievement.

4.3 Research question three

How do Chemistry teachers perceive their learners' ability in Chemistry?

To test for Kwale County Chemistry teacher's perception of their learners' abilities and thus infer on its impact on their performance in the subject, 6 statements were used a summary of which is presented in Table 4. The results that Kwale County Chemistry teachers' attitude towards their learners' ability in the subject was found to be negative. For instance, 78% of the Chemistry teachers sampled for the study believed that their Chemistry students choose the subject because they lacked a better option; a majority consider that the students have poor Mathematical and English language background to enable them perform well in Chemistry among others. This negative attitude towards their learner ability could be affecting the Chemistry teachers output and therefore the performance of the students negatively.

A comparative analysis of the students and teachers perception of the Kwale Chemistry teacher's attitude towards learners' ability in Chemistry yields a contradictory scenario. According to data obtained from each of the two respondent categories, while the students have a more pronounced positive attitude of their Chemistry teacher in terms of intentions for the learner, teaching and learning practices, the teacher on the other hand manifest a negative attitude towards their learners' abilities in Chemistry. The teachers may therefore be said to exhibit a lack of understanding of their students. They may be going about their duties mechanically with the notion that the student is incapable of performing well in the subject due to their weak background and perceived negative attitude towards the subject. This misdirected understanding of the students' attitude towards the subject may be one of the major causes of students' poor performance in Chemistry as the teachers may not be giving their best during the teaching and learning process. According to Kithinji (2007), as cited in Twoli, et al (2007), teacher's attitude and motivation play a pivotal role in the teaching and learning process. The motivation of the learner to achieve may be enhanced or damaged by the teacher's attitude towards the students and how he or she interacts with them (Flanders, 1970; Anderson, Ryan & Shapiro 1989).

4.4 Research question four

What are the effects of teacher's perception of the learner ability on the learner's performance in Chemistry?

An ANOVA test was done to verify the effects of teachers' perception on the students' trend of performance and the results were as is given in Tables 5. Table gives a summary of an ANOVA (Descriptive) of Chemistry teacher's perception of their learners' abilities in Chemistry. The results shows that the effect was greatest on students whose scores improved significantly in the last 3 end of term Chemistry tests since they had the highest score (27.404) on the elements of attitude followed by students whose scores had improved slightly (26.700), then those whose scores declined slightly (25.791), followed by those whose scores in Chemistry remained the same (24.738) and lastly those whose performance declined significantly (23.600) in that order. The ANOVA results {F=4.415; df=4; 475; 479; P=0.002} in Table 6 shows that the observed mean difference was significant at 0.05 level of significance. The Chemistry teachers had a positive perception towards students whose performance had improved significantly. The teachers' negative attitude towards their learner ability could be affecting the Chemistry teachers' output and therefore the performance of the students negatively. This research findings echo the findings of Edomwonyo-out & Avaa (2011) who found during their study on challenges of effective teaching of Chemistry that teachers attitude reflects on the way they teach and this ultimately have adverse effects on students' performance. Attitude of students can be influenced by the attitude of the teacher and his method of teaching (Olatunde, 2009). Studies done by Obadara (2008) however indicated that there was no significant relationship between teachers' attitude to job (teaching) and students' academic performance.

5. Conclusion

From the foregoing discussion, it can be concluded that the poor performance of students in Chemistry in Kwale County can be attributed to the teacher's negative perception of their learners' abilities. It is therefore recommended that the school management/administration should expand existing facilities like classrooms to lower the class population and hence enhance subject teacher class control, provide more teaching and learning facilities to adequately cater for the large student population, provide for innovative ways to help motivate Chemistry teachers like taking them for more capacity building courses and providing them with other incentives, hire more teachers with the help of the government to help reduce teachers work load and enable the teachers have increased contact hours with their learners' hence meaningful teacher-student interaction, organise more motivational talks by Chemistry professionals to help manage the perceived negative attitude of students towards the subject and work closely with the teachers and parents in counselling the students to help counter the existing negative peer influence.

Chemistry teachers on their part should organise excursions to Chemistry-based industries and Chemistry symposia as a way of motivating the students to have positive attitude towards the subject, adopt a more practical approach to the teaching and learning of the subject particularly improve in the use of charts and other instructional resources in the teaching of the subject and expose their students to more practicals particularly group/individual student based practicals as a way of motivating the learners.

References

Adesokan, C. O (2002). Students' attitude and gender as determinants of performance in JSS Integrated Science. Unpublished B.Ed Project Chemistry of Nigeria.

Akinmade, C. T. (1992). The swing away from science. The Nigerian Chapter. Journal of the Science Teachers' Association of Nigeria, 24 (122), 126-129.

Anderson, L.W., Ryan, D.W. & Shapiro, B.J. (1989). The IEA classroom environment study. Oxford: Pergamon Press.

Bassey, W.S, Umoren, G. & Udida, L.A. (2010). Cognitive styles, secondary school students' attitude and academic performance in Chemistry in Akwa Ibom state- Nigeria. http://academicdirect.org

Best, J. & Kahn, J. (1992). Research in education. New York: Prentice Hall.

Burstein, L. (1992). The analysis of multilevel data in educational research and evaluation. Review of Research in Education; 8, 158-223. Federal Republic of Nigeria 2004: National Policy on Education (Revised), NERC.

Edomwonyi-otu, L. & Avaa, A. (2011). The challenge of effective teaching of Chemistry. A case study. http://lejpt.academicdirect.org/A18/001-008.htm

Flanders, N. A. (1970). Analyzing teacher behaviour. Reading: Addison.

Gay, R.L. (1992). Educational research: Competencies for analysis and application. (4th Ed.). New York: Macmillan.

George, R & Kaplan, M. D. (1998). A structural model of parent and teacher influences on students' attitudes of eight grades. Evidence from NELS: 88 Science 82(1) 93-109.

Gibbons, S. Kimmel, H and O'Shea, M. (1997). Changing teacher behaviour through development: Implementing the teaching and content standards in science. School Science and Mathematics; 97(6), 302-310.

Halladyna, T. and Shaughnessy, J. (1982). Attitudes towards science: A qualitative synthesis. Journal of Research in Science Teaching, 66 4: 547-563.

Hussain, S. Ali, R. Khan, M. Ramzan, M. & Qadeer, Z. (2011). Attitude of secondary school teachers towards teaching profession. International Journal of Academic Research

Hough, L.W. & Peter, M.K. (1982). The relationship between attitudes towards science and science achievement. Journal of Research in Science Teaching, 19(1): 33-38.

Kan, A. & Akbas, A. (2006). Affective factors that influence Chemistry achievement (Attitude and self efficacy) and the power of these factors to predict Chemistry achievement- I. Journal of Turkish Science Education volume 3 issue 1 http://www.tused.org

Kempa, R.F. & Dude, K. (1974). Science interest and attitude traits in students subsequent to the study of Chemistry at the O'Level of the general Certificate of Education. Journal of Research in Science Teaching. 11(4) 361-370.

Kwale SMASSE panel (2004). Gender issues in Mathematics and Science education. A paper presented in cycle 1 of Kwale district INSET- 2004.

Long, J.C. (1981). The effects of a diagnostic-prescriptive teaching strategy on student achievement and attitude in biology. Journal of Research in Science Teaching, 18(6): 515-523.

Obadara, O. E. (2008). Influence of teacher factors on academic performance of secondary school students in Ogun state, Nigeria. African Journal for the Study of Educational Issues (AJEDUI): 4.

Ojo, M. O. (1989). The differential effectiveness cooperative competitive and individual's goal structures on students' performance in Chemistry. Unpublished PhD thesis, University of Ibadan, Ibadan.

Olatunde, Y.P. (2009). Students' attitude towards Mathematics and academic achievement in some selected secondary schools in Southwestern Nigeria. European Journal of Scientific Research, 36: 336-341.

Oloruntegbe, K. O & Oluwatelure, T.A. (2010). Effects of parental involvement on students' attitude and performance in science. African Journal of Microbiology Research, 4, 1-9. http//www.academicjournals.org/ajmr.

Papanastasiou, E. C., (2001) Willingness to follow Math related careers among seniors in Math classes: The case of Cyprus. Manuscript submitted for publication. Science Education International 13(2) 20-21.

Serin, O. & Mohammadzadeh, B. (2008). The relationship between primary school students' attitude towards science achievement and their science achievement. World education-centre.org/index.

Twoli, N. Maundu, J. Muindi, D. Kiio, M & Kithinji, C. (2007). Instructional methods in education: A course book for general teaching methods. Nairobi: Kenya Institute of Education

Woolfolf, A. (2007). Educational psychology. Boston: Pearson.

TABLES

Table 1. Scores of Kwale County students' attitude towards Chemistry.

STATEMENT	N	SD (%)	D (%)	NS (%)	A (%)	SA (%)
Chemistry is useful in my future life.	482	1.9	3.1	9.3	32.2	53.5
I do not like Chemistry.	482	42.1	28.4	15.4	10.2	3.9
I enjoy Chemistry theory lessons.	480	6.0	9.4	12.1	41.5	31.0
I enjoy Chemistry practical lessons.	482	3.3	3.9	6.0	40.0	46.7
Chemistry is a difficult subject.	482	23.2	24.7	16.6	19.7	15.8
I like my Chemistry teacher.	481	3.7	6.4	7.1	32.4	50.3
I often study Chemistry on my own.	482	10.4	14.5	13.3	35.3	26.6
My friends influenced me to choose Chemistry.	481	42.0	27.7	12.3	9.6	8.5
My Chemistry teacher influenced me to choose Chemistry.	481	36.8	23.7	13.1	11.6	14.8
I enjoy doing other science subjects (Biology and Physics) more than Chemistry.	482	15.4	16.4	13.7	25.5	29.0
I like studying Chemistry most of my free time.	481	15.8	23.1	16.6	29.1	15.4

Table 2 Scores for attitude – Descriptive

Students scores	N	Mean	Std. Deviation	Std. Error	95% confidence interval for mean		Minimum	Maximum
					Lower bound	Upper bound		
<30	173	36.97	5.278	0.401	36.18	37.76	19.00	52.00
30-44	127	37.53	4.452	0.395	36.75	38.31	28.00	53.00
45-59	81	38.67	4.658	0.517	37.64	39.70	25.00	52.00
60-75	66	38.59	4.989	0.614	37.36	39.82	26.00	51.00
>75	28	40.50	4.694	0.887	38.68	42.32	31.00	49.00
Total	475	37.84	4.962	0.227	37.39	38.29	19.00	53.00

Table 3. Scores for attitude – ANOVA

	Sum of squares	df	Mean square	F	p
Between groups	433.694	4	108.424	4.535	0.001
Within groups	11237.464	470	23.909		
Totals	11671.158	474			

Table 4. Teachers' perception of their students' ability in Chemistry

Statement	SD (%)	D (%)	NS (%)	A (%)	S (%)
My students like coming to me with Chemistry problems for assistance.	0	33	22	22	22
Most students choose Chemistry in my school because they have no alternative.	11	11	0	22	56
Majority of my Students spend very little time studying Chemistry.	0	0	11	33	56
Most of my students consider Chemistry to be a difficult subject.	22	22	0	56	0
The Students' English language competence affects their performance in Chemistry negatively.	0	0	0	56	44
The Students' Mathematical competence affects their performance in Chemistry negatively.	11	22	0	44	22

Table 5. Effect of teachers' attitude towards students' ability on trend in performance in Chemistry – Descriptive

Trend of performance in the last 3 test	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower bound	Upper bound		
Declined Significantly	45	23.600	6.99805	1.04321	21.4976	25.7024	7.00	35.00
Declined Slightly	96	25.791	5.80366	.59233	24.6157	26.9676	8.00	35.00
Remained	130	24.738	6.03035	.52890	23.6920	25.7849	8.00	35.00
Improved Slightly	167	26.700	5.53903	.42862	25.8543	27.5469	11.00	35.00
Improved Significantly	42	27.404	5.38317	.83064	25.7272	29.0823	16.00	35.00
Total	480	25.758	5.94582	.27139	25.2251	26.2916	7.00	35.00

Table 6 Effect of teachers attitude towards students ability on trend in performance in Chemistry – ANOVA

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	607.077	4	151.769	4.415	.002
Within Groups	16326.890	475	34.372		
Total	16933.967	479			

WALKING THE TALK AND BUILDING BRIDGES IN THE CLASSROOM THROUGH ICT: THE WAY FORWARD FOR PRE-SERVICE TRAINING IN KENYAN UNIVERSITIES

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Abstract

The world is moving so fast that changes in time demand that learners in the classroom must be prepared to get to the moon by first landing in the sun for the ultimate goal of education is to take them there. The classroom is a theatre for teachers and learners to prepare themselves for educational challenges of the 21st century. It is apparently clear that both the teachers and the learners must embrace technology to realize their career goals and learning objectives. As part of the teaching and training of pre-service teachers for the future, Kenyan Universities must adapt to the technological changes for the 21st century. Initiated efforts and several strategies aimed at assisting pre-service teachers' integration of ICTs in their classroom practice must be anchored in the goals of education in Kenya and that of realizing the Vision 2030. Essentially, these will include modeling of ICT pedagogical integration, assessment of ICT pedagogical integration, relocating pre-service teacher classes to a working school, and implementing a collaborative inquiry model to bring university lecturers and pre-service teachers together in a critical exploration of their curricula, technology and identity of self to the changing needs of society. This will ultimately require utilizing a most significant change of methodology in training to ensure teachers and pre-service teachers' become knowledgeable about pedagogical integration of technology needed in classroom teaching. The greatest challenge this paper wishes to address therefore is whether institutions of higher learning and the pre-service teachers are "walking their talk." The study will look at the perceptions of the lecturers and the pre-service teachers in one public university in Kenya to establish the level of integration of ICT in teacher education.

Key words: ICT Pedagogical skills; Integration of ICT; Pre-service teachers.

Background to the study

According to Gill, & Dalgarno, (2010) the development of knowledge and skills in the use of ICTs is increasingly deemed to be an important aspect of preparation for participation in the world of technology, as is the use of ICTs to enhance the quality of teaching and learning and in the classrooms. Today and in the world-over, nations, governments, businesses and institutions of teaching and learning have accepted Information and Communications Technology (ICT) as away of life deeply entrenched and appreciated in their culture of daily operations (Cuban, 2001; Steketee, 2005, Elliott and 2004). Needless to argue that the use of ICT has became evident within teacher training programs around the world though its usage is being approached in a number of ways with varying degrees of success. Evidently, there is a myriad of challenges facing the users of ICT in the classroom ranging from but not limited to: ICT pedagogy approach, ICT skills development approach, Subject-specific approach and Practice driven approach as acknowledged in the field of teacher training institutions.

Institutions of learning and more particularly the pre-service learners in teacher training facilities have for long struggled with the use of ICT to enhance effective teaching and learning by adopting to different approaches but yet are to accept realities with changes in time and the best ways to adapt to the use of ICT in teaching and learning (Cuban, Kirkpatrick and Peck, 2001; Somekh, 2004). This failure to consistently use ICT can be attributed to what terms as lack of teacher preparedness to use ICTs which is a barrier to widespread and effective adoption as well as a situation of one in which policy makers have “unrealistic visions for information and communication technologies.” Essentially, the question of how best to prepare pre-service teachers in institutions of higher learning for the effective and efficient use of technologies in their classrooms and for learners to effectively learn is of pressing concern for teacher educators. Hence, this study is greatly interested in how pre-service teacher training institutions have integrated ICT in pedagogical training that fits in the ICT pedagogical approach. Essentially, universities training pre-service teachers have an obligation to teach and give the pre-service teachers knowledge and skills that will be necessary during their service delivery in schools and other institutions of learning. There is need to up-skill both teachers and students skills in the integration of ICT in education so as to encourage and build confidence in both the teachers and students efforts in integrating ICT in their daily operations (Wang, 2002; Zhiting & Hanbing, 2002).

Whereas the push for integration of ICT in education is good, educators also need to understand the importance of technology in the classroom. Many reasons have been cited for encouraging ICT integration among which include the need to equip both teachers and students with the skills to participate effectively and efficiently in the teaching and learning process and the thrive in an information society aimed at accelerating socio-economic, political and the need to create highly skilled and flexible workforces (Kenya Vision 2030; Baskin & Williams, 2006; Ottesen, 2006). According to McNair & Galanouli (2002), the potential for enhancement of the "quality of the learning experience" and the transformation of pedagogy are other factors driving ICT integration in classrooms for better teaching and learning. Nevertheless, what is needed is a shift in thinking so teachers will come to view technology as an effective tool to use throughout the course of planning, delivering and assessing instruction, but not something that must be used to meet a government-mandated technology standard.

Apparently, institutions of learning that are in a rush to catch up with the rest of the world are training and pushing teachers in a hurry to integrate ICT in their teaching as a normalcy to appear technologically advanced. This creates a situation where both teachers and students are taking packages in computers to develop technology skills. Willis & Sujo de Montes, (2002) are of the view that pre-service teachers and students be effectively subjected to a rigorous training in order to develop an understandings associated with effective implementation strategies of using technology in modern forms of education, as well as their self-efficacy as to their ICT competencies. The skills oriented model will essentially supplement the traditional expository patterns of classroom activity and radiantly cultivate the use of ICT as higher order thinking and learning tools.

Problem Statement

In order for the training of pre-service teachers to effectively and efficiently take place in the teacher training institutions, there ought to be resilience among the parties and the stakeholders involved in the entire process of training. Pre-service teachers deserve to be well equipped with the much needed knowledge and skills so as to be able to effectively integrate ICT in their classroom operations. The most critical part in the process of training the pre-service teachers is the issue of teacher preparedness to use ICTs for teaching and learning, the amount of knowledge in using computers, teacher attitude towards the integration of technology and their readiness to undertake challenges in learning the skills. According to Granger, Morbey, Owston & Wideman (2002), there needs to be a "relationship between teachers" ICT skills and successful implementation which is complex."

In essence, there is no witnessed goodwill among stakeholders and in some cases appreciated efforts that are well combined in addressing a range of contributing issues to failure by teachers and learners in our said institutions of learning to integrate ICT in teaching and learning. Apparently, both the teachers' and students' attitudes, philosophies behind the integration of ICT, communication, and access to skills training, coupled with having the necessary equipment and support have influenced the pace of ICT integration in the training of pre-service teachers and its use in the classroom. Besides, the pre-service teachers readiness to nurture the ICT culture and grow the critical mass of being able to sustain the use of ICTs effectively in their teaching and learning has proved to be a challenge in all aspects of implementation of the policy as ascribed by the ministry of education and training institutions. Therefore, the purpose of this study was to investigate how prepared Kenyatta University was in preparing pre-service teachers for their career in the classroom.

Methodology used in this Study

The researchers used descriptive survey approach to gather data from the respondents. The study was interested in gathering the views of the post-graduate students' understanding of the integration of ICT in teaching and learning in their institutions of learning. Both quantitative and qualitative techniques were used in collecting and analyzing. The study targeted 54 Masters students registered for April training and who are practicing teachers in schools across the republic of Kenya; 7 lecturers who taught during the session and head of the department, all totaling to 62 respondents.

Discussion of the Findings and Conclusion

This framework presents a useful starting point for the identification of a rigorous ICT implementation plan. While the approaches identified in this review all have their respective merits, each is potentially useless without a sound and practical understanding of how computers can be implemented as learning tools. Based on contemporary learning theory, the DLE operationalizes the conceptual changes that Wang (2002) argues must occur in the classroom if the computer is to transform teaching and learning.

However, given the socio-cultural nature of this framework, it is imperative that its implementation be seen as a gradual, progressive one. Lim et al. (2004) describe their implementation of an online learning environment as an evolution within which the stakeholders gradually adopt an alternative perspective of teaching and learning.

We need to recognize that in any introduction of new approaches and technologies, the most difficult obstacle to overcome for both students and tutors is a paradigm shift. The existing paradigm may serve as a filter, preventing the institution from experimenting with approaches that are contrary to prevailing wisdom. Hence, there is a need to gradually create a scaffolding structure where the changes are incrementally felt and the existing ways of doing things are addressed (Lim et al. 2004).

It has been proposed that this 'gradual' approach be adopted by UNDA where the DLE will facilitate the implementation of various features from all four approaches. By virtue of its principle position within the framework (see Figure 1), it can be inferred that teaching context characteristics are paramount within a DLE. The fundamental nature of the variables that prevail within this component, will directly and indirectly impact upon the course of events within the other components. For this reason, a rigorous PD program for staff, as well as general ICT skills development must support any implementation of a DLE.

In conclusion, pre-service teachers have a significant role to play in the sustained and authentic application of ICT in schools. It is imperative, therefore, that due consideration be given to the nature of programs they are exposed to in their teacher-training courses. This review has highlighted a number of existing approaches that have been successful to some degree. In principle, each approach is providing a necessary building block in the development of competent and confident teachers in a technology-rich world. What is lacking, however, is a practical understanding of learning environments that are most conducive to the implementation of ICT as powerful learning tools. The DLE offers this practical guide and paves the way for the transformations in teaching and learning that learning technologies have been promising for many years.

References

Baskin, C. & Williams, M. (2006). ICT integration in schools: Where are we now and what comes next? Australasian Journal of Educational Technology, 22(4), 455-473.

Elliott, A. (2004). Cultural change needed to exploit ICT in schools. Information Age. Retrieved April, 2004, from http://www.infoage.idg.com.au/index.php/id;63435706;fp;4;fpid;404956636

Cuban, L., Kirkpatrick, H. & Peck, C. (2001). High access and low use of technologies in high School classrooms: Explaining the apparent paradox. America Educational Research Journal, 28(4), 813-834

Gill, L. & Dalgarno, B. (2010). How does pre-service teacher preparedness to use ICTs for learning and teaching develop during the first two years of teacher training? In C.H. Steel, M.J. Keppell, P. Gerbic & S. Housego (Eds.). Curriculum, technology & transformation for an unknown future. Proceedings ascilite Sydney 2010 (pp.371-381). http://ascilite.org.au/conferences/sydney10/procs/Gill-full.pdf

Granger, C., Morbey, H., Owston, R. & Wideman, H. (2002). Factors contributing to teachers‟ successful implementation of IT. Journal of Computer Assisted Learning. 18, 480- 488.

Lim, C.P., Hung, D., Wong, P. & Hu, C. (2004). The pedagogical design of ICT integration in online learning: A case study. International Journal of Instructional Media, 31(1), p. 37.

McNair, V. & Galanouli, D. (2002). Information and communications technology in teacher education: Can a reflective portfolio enhance reflective practice? Journal of Information Technology for Teacher Education, 11(2).

Steketee, C. (2005). Integrating ICT as an integral teaching and learning tool into pre-service teacher training courses. Issues in Educational Research, 15(1), 101-113. http://www.iier.org.au/iier15/steketee.html

Wang, Y. (2002). When technology meets beliefs: Pre-service teachers' perception of the teachers' role in the classroom with computers. Journal of Research on Technology in Education, 35(1), 150-162.

Willis, E.M. & Sujo de Montes, L. (2002). Does requiring a technology course in pre-service teacher education affect student teachers' technology use in the classroom? Journal of Computing in Teacher Education, 18(3).

Zhiting, Z. & Hanbing, Y. (2002). ICT and pre-service teacher education: Towards an integrated approach. Report of the 7th UNESCO-ACEID International Conference on Education, 11- 14 December, Bangkok. Retrieved July 2004 from http://www2.unescobkk.org/ips/ebooks/documents/aceidconf7/ICTPreservice.pdf

USING CASE STUDIES TO PROMOTE TEACHER LEARNING

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Abstract

Case studies have been used in law and business schools for many years to engage students in thinking about issues related to these cases. In the last few decades, teacher preparation programs have begun using case studies to have prospective teachers learn from classroom-based situations. Multimedia case studies can provide video and other media (e.g., photos, facilitator questions, text) to offer a context for prospective teachers to experience, learn from and reflect on instructional approaches, teacher decisions, teacher-student interaction, teacher questioning, assessment, etc. prior to their teaching practice experience. In this paper, we present a rationale for and demonstration of some multimedia case studies that were created through the Kenyatta University-Syracuse University Partnership. The cases include a variety of (a) secondary subjects (e.g., language, science and mathematics), (b) contexts (e.g., laboratory and technology use), and (c) instructional approaches (e.g., interactive lecture, student skits, student demonstrations and small group work).

Introduction

A case study is a record of practice in some context (e.g., law, business, engineering, medicine and education). Cases can be in written, video or multimedia form. A multimedia case is one that involves more than one type of media (e.g., video, text, photos).

Case studies have a long history of being used in preparing professionals in engineering, medicine, business and law. In the last 20 years, there has been interest in using case studies in the preparation of teachers. Teacher educators face a number of practical problems in preparing teachers, such as (a) difficulties with prospective teachers having field placements prior to teaching practice, (b) insufficient number of high-quality classrooms available for prospective teacher placement, (c) prospective teachers lack experience necessary to observe the complex and rapid interactions that occur in classrooms, and (d) prospective teachers lack a common context to reflect on in methods courses.

Rationale

Multimedia case studies can become sites for investigation, reflection and study by prospective teachers in ways that are not easily accomplished through other means. They can provide artifacts that can be examined by prospective teachers and support their reflection on both the case study teacher's practice and their own emerging practice.

According to Schön (1995), the knowing of competent professionals is tacit and implicit in their actions as they make judgments and perform tasks in everyday settings that are characterized by uncertainty, complexity, uniqueness, and conflict. Schön also observes that effective practitioners are often at a loss to produce adequate descriptions of what it is that they know. This tacit and implicit knowledge of the effective practitioner is especially problematic for the prospective teacher, who lacks the experience of the professional in action. The practice of the competent teacher may appear smooth, easy and unproblematic to the prospective teacher. Case studies can help make this practice problematic.

Case studies can (a) promote the epistemological development of teachers, (b) support the development of teachers as reflective practitioners, (c) provide a means of understanding theoretical principles, while bridging the gap between theory and practice, (d) enable teachers to analyze and reason effectively about the complex particulars of practice, (e) support the development of teachers as decision makers, (f) provide paradigmatic exemplars of practice, and (g) overcome the limitations of field experiences.

How might Multimedia Case Studies be Used?

Multimedia case studies could be used to have prospective teachers reflect on a variety of teaching practices, such as: (a) exemplary practice, (b) ways of teaching a particular topic, (c) decisions that teachers make during teaching, (d) teacher questioning, (e) how an instructional approach might support student learning, (f) teacher use of motivation, (g) ways of engaging students in learning, or (h) other acts of teaching practice.

Kim et al. (2006), in their meta-analysis of 100 case studies, reviewed research literature across disciplines and found that effective cases are relevant, realistic, engaging, challenging and instructional. Relevant cases "should target an appropriate level of learners, match the content with instructional goals and objectives, and make explicit the setting of the narrative" (p. 869). Realistic cases are ones that have "authentic materials, distractors or non-pertinent features, and gradual disclosure of content" (p. 870). Engaging cases have "rich and sufficient content that allows multiple levels of analysis and interpretation, multiple voices and perspectives, and opportunities for learners to determine the course and outcome of the case" (p. 870). Cases can be made challenging by "increasing the degree of content difficulty, including cases that are rare or unusual, altering the structure of cases by presenting data in a non-sequential way, or including multiple cases in a series" (p. 870). Cases can be made instructional by "building up students' prior knowledge, assessing students' knowledge and skills, providing specific feedback to students, and embedding various teaching aids to support student learning" (p. 872). Kim and colleagues found these to be core attributes of cases from their review of the literature across disciplines.

Kenyan Multimedia Case Studies

Kenyatta University and Syracuse University have had an institutional linkage since 2000 and have had a variety of collaborative activities, including co-sponsoring the International Conferences on Education in 2009, 2011 and 2013. Beginning in October 2009 (with a planning grant) and April 2011 (with a funded grant), the Kenyatta University-Syracuse University partnership has had funding from the United States Agency for International Development (USAID) to work on building capacity in teacher education.

One of the activities that we have carried out through this grant project is the development of some multimedia case studies.

Thus far, we have developed 19 multimedia case studies. These 19 cases consist of video with the transcription of what is being said included as text on the video, still photos taken during the lesson, and facilitator questions. The lessons were all filmed in Kenyan secondary schools and include lessons in biology, chemistry, English, German, mathematics and physics. The cases include a variety of contexts, such as a laboratory and use of technology. The cases also include a variety of instructional approaches-interactive lecture, student skit, student demonstration and small group work.

Preparing to Use Multimedia Case Studies

The multimedia case studies that we have prepared are available for use at http://kenyammcs.syr.edu [password: KUcases$]. However, some preparation is needed in order to use the cases effectively. Our suggestions are to read some of the literature on facilitating case studies and choose a framing that fits with the goals for using a case. One such framing is the Learning to Notice Framework laid out by van Es and Sherin (2008) who propose that teacher educators support prospective teachers in (a) "identifying what is important in the teaching situation, (b) using what one knows about the context to reason about a situation, and (c) making connections between specific events and broader principles of teaching and learning" (p. 245).

We have worked with mathematics and science teacher educators at Kenyatta University through professional development workshops to think about and plan how to use some of these multimedia case studies in preparing teachers. Some suggested steps for thinking about implementation are to (a) view the individual video lessons, (b) take notes, and (c) plan for how to use specific video clips by (i) determining the goal for using a video clip, (ii) selecting the clip, and (iii) planning for questions to facilitate prospective teachers interactions with the case. We believe that multimedia case studies can be useful sites for exploration and reflection on teaching practices and that they can support novice teachers in their growth as teachers.

References

Kim, S., Phillips, W. R., Pinsky, L., Brock, D., Phillips, K., & Keary, J. (2006). A conceptual framework for developing teaching cases: A review and synthesis of the literature across disciplines. Medical Education, 40, 867-876.

Schön, D. A. (1995). The new scholarship requires a new epistemology. Change, 27, 26-34. van Es, E. A., & Sherin, M. G. (2008). Mathematics teachers 'learning to notice' in the context of a video club. Teaching and Teacher Education, 24, 244-276.

AN EVALUATION OF SELECTED ICT MATERIALS USED IN CHEMISTRY EDUCATION IN KENYAN SECONDARY SCHOOLS

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Abstract

Many developing countries are making every effort to produce and use ICT materials as teaching-learning resources in schools. This effort is more directed to the science and mathematics, an emphasis based on the belief that these subjects are difficult and yet most valuable for National Development. Kenya is one such a developing country that is making efforts to develop and use ICT materials at secondary school level. The institution, which is charged with the responsibility to develop the material is the National Curriculum Centre; Kenya Institute of Education (KIE). Apart from developing other resources, emphasis has gone to the production of DVDs (Digital Video Discs) for simulations. This paper evaluates one of the DVDs - simulation materials for form 3 (year III) chemistry. The first author who is a teacher of chemistry and has used the material for some time did the evaluation. The evaluation brings out some useful features. First the material is curriculum based, hence fully covers the form three chemistry syllabus. The content is most relevant and correct with an exception of minimal errors especially in writing formulae and chemical equations. Other positive features include use of some feedback mechanism in the form of quizzes or short questions at the end of every topic. All these make the learners excited and engaged in a lesson. For improvement, the producers may think of paying attention to the simulation flow, which is either slow or too basic to reflect the true phenomenon. The activities should also include more challenging inquiry based type of questions. Being the first edition, these materials can be viewed as a useful start on which viable development can be made. Teachers of science can contribute to the quality of ICT materials they commonly use if they can have an evaluative mind to generate ideas and share them. Such commutative effort by the teachers can accelerate reviews that can bring improvement.

Introduction

Information and Communications Technology (ICT) can make science teaching and learning more versatile and goal oriented. It can also motivate and activate students, promote cooperation, study authentic contexts and creativity in learning. However, there are some scholars who argue that the use of ICT in teaching science is disappointing (Kibble 2008). This is because use of ICT in most countries concentrates on routine tasks like sporadic retrieval of information from the Internet. The use of ICT as an aid to teaching and learning has been adopted largely as an act of faith (Stevenson, 1997). If further development of ICT in education is to be justified, hard evidence of its benefits is required (McFarlane, 2000).

A wide range of materials is available for use in ICT integration in learning. Teachers are therefore required to select appropriate materials for use in teaching. In an attempt to improve on ICT integration in subject content learning in Kenya, the Kenya Institute of Curriculum Development (KICD) formerly Kenya Institute of Education (KIE), developed some materials for learning of subject matter in chemistry in 2011. The ICT materials prepared by KICD to be used in chemistry learning are computer based tutorial materials.

This paper discusses the ability of Chemistry ICT materials prepared by KIE to contribute in quality of teaching, learning and evaluation through improvements in cognition, pedagogies, convergence, culture, and data. ICT in education is not all about the technology, but about the teaching and learning process. Teachers' involvement with ICT is undoubtedly influenced by the working contexts in which teachers find themselves. Teachers' have an active role in (1) creating conditions for ICT use; (2) selecting and evaluating appropriate ICT tools and (3) designing teaching and learning activities.

ICTs provide many opportunities to more easily use a variety of pedagogies. As a tool, ICTs can support didactic or facilitative approaches, collaboration and interaction across time and distance, enquiry or interrogation, open or closed research approaches easier. Table 1 shows a comparison of traditional learning environments to technology learning environments that brings out the benefits of science learning environments that include technology.

Traditional Learning Environments	Technology Learning Environments
Teacher-centred instruction	Student-centred learning
Single-sense stimulation	Multi-sensory stimulation
Single-media	Multimedia
Isolated work	Collaborative work
Passive learning	Active, exploratory, inquiry based learning
Factual knowledge based learning	Critical thinking and informed decision making
Isolated artificial context	Authentic real world context
Reactive response	Proactive/planned action

Table 1: Benefits of science learning environments that include technology

The capacity of ICT to deliver information or to communicate with a mass of students in quite individual ways opens up the possibility of tailoring pedagogy to the needs of a student in time and place without the limitations imposed by peer groups.

Instructors who seek to integrate educational software into the learning environment should be able to assess the value of these tools for communicating and reinforcing learning (Beacon, 2013). Barker and King (1993) have developed a method for evaluating interactive multimedia courseware. They provide four factors, which their research suggests are of key importance to successful products. These factors are: appropriateness of multimedia mix, mode and style of interaction, quality of interaction, user learning styles, monitoring and assessment techniques, built-in intelligence, adequacy of ancillary learning support tools and suitability for single user/group/distributed use. A starting point for such an analysis is provided by the Perspectives Interaction Paradigm of Squires & McDougall (1994). When Software is used as an instructor to develop knowledge and skills, it is hierarchically structured in terms of content and skill complexity (Quynh and Thao, 2007). Each lesson focuses on a specific content or skill and all the lessons are arranged from introductory to advanced levels. Drill-and-practice is a common feature of instructional software as it reflects strongly the Initial-Response-Evaluation (IRE) model.

This study is however limited to characterising the form 3 chemistry ICT materials provided by the KICD for use by the teachers and students in secondary schools in Kenya. The evaluation was guided by the following questions:

1. Are the chemistry ICT materials provided by KICD goal-directed actions in relation to tasks which have been designed to bring about learning for a specific group of students?

2. Is the software content appropriately structured in terms of complexity for the form three learners?

3. Does the software provide item exercises for practice and items for testing?

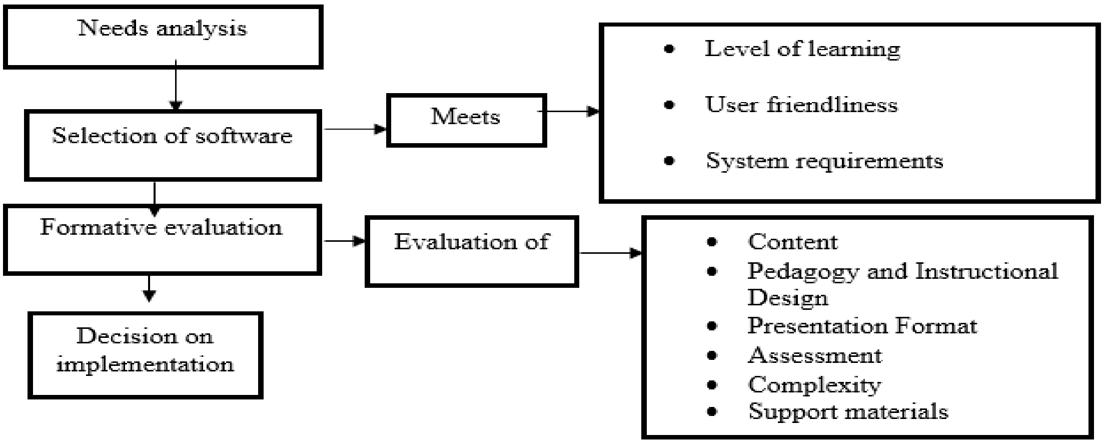
Method of Evaluation

A qualitative case study research method was chosen because it would provide thick and rich descriptions of how the materials can be used or modified to improve school chemistry learning process. The software material for use with the form three students was analysed with a view of describing its current situation and offering suggestions for development.

Software Evaluation Process

There are different ways in which software is evaluated by teachers on the basis of their perception of the roles of software in teaching and learning, the main stages of software evaluation process of educational software evaluation is presented in figure 1.

Software Evaluation Process



Adapted from Quynh and Thao (2007)

Figure 1: The process of educational software evaluation

System Requirements

Both the software and the medium through which it is delivered should be evaluated. Often, the educational institution makes the decision about the hardware prior to departmental or individual decisions about media so that constraints on possible software choices already pertain (Geissinger 1997). Some software products provide only minimal information about the program: a one-line description of system requirements. Others also provide useful information that will help you further along in the process, such as instructional objectives, integration suggestions, related online resources, and supplemental print materials (Glencoe/McGraw-Hill 2005). The ICT learning material by KICD is contained in VCDs, which are used in a computer CD drive and easily displayed by windows explorer. The VCDs contains information on how to start off, a brief description of content, and the intended grade level. For example the VCD intended for use for form three chemistry is indicated 'Secondary Chemistry Form 3 Version 1'. Other information given on the CD include; Physical address of the producer, phone number, fax, email address and website. This is useful as it can facilitate quick consultations with the producer. No details on computer operation/use instructions are given.

It could be very useful for the material to have a brief description on how to navigate through the material at the beginning for the sake of those learners and teachers who are not very conversant with use of ICT. There are no specially written students' directions. For example the learner could easily miss out on the voice prompt if the volume button is set on the low. However, the voice only reads what is displayed on the screen and therefore might not be of great significance if missed out by learners with no visual impairment. The learner might however miss out on the objectives, as they do not come on direct display when a topic is opened.

Educational Software Evaluation

Evaluation of educational software is a fundamental step for teachers and trainers who are in the process of adopting it as a learning resource. Very often teachers, trainers, educators, school administrators and, generally speaking, all users of educational multimedia are not fully aware of the characteristics, potentialities, forms and limits of these resources. As a result, they are often unable to critically appraise them (Giovanna, 2000). It should also be considered that educational multimedia has an intrinsic complexity, because it is at the same time software running on a computer and an educational resource. There are many aspects to consider in the evaluation.

The features of multimedia educational software can be identified as:

- Content that is to be taught;
- Delivery media used to provide information;

- User interface, that is, the way the educational software presents itself to the user,
- Interaction: devices through which the user interacts with the computer; making choices, answering questions or performing activities and is provided with feedback to each response and
- Instructional strategy adopted.

The following criteria by Glencoe/McGraw-Hill (2005), Georgiadou et al (2001), Barker and King (1993), Beacon and Geissinger (1997) may help determine whether the software will meet the needs of the teacher and the students.

Content

Beacon (2013) argues that with educational software, "content is king." No act of multimedia glitz can overcome a lack of core content. Information must be communicated clearly, in age-appropriate language. Ideas must be divided into small, logical modules for easy comprehension and long-term retention. The content should be appropriate for the particular level of learners. In the evaluation of content we strive to answer the following questions:

- Are the objectives of the program clearly defined?
- Is the tool developmentally appropriate?
- Does the product encourage performance-based learning?
- Does the program adequately cover the concepts and skills required?
- Does the software increase student understanding of the topic?
- Does the package show any bias (social, religious, ethnic, or gender), which might taint its presentation?

- Are there any assessment tools? Can they be modified?
- Can the scope or sequence of the content be modified?

The ICT software provided by KICD for use in secondary school chemistry syllabus has carried the learning objectives as outlined by the ministry of education in the chemistry syllabus. However these objectives are not clearly stated at the beginning of the learning material hence the learner may not be able to identify the aim of going through the material at the very beginning. There are objectives for the subtopics but it requires extra navigation to access them. Though the navigations are easy, some learners can miss out these objectives. The objectives are clearly stated in observable terms. The material can be termed as developmentally appropriate because it covers work for form 3 level and appropriate vocabulary is used. It can therefore be assumed to support academic expectations of learners.

The program fairly covers the concepts and skills required for each topic and learners are involved in the development of learning. However some topics such as the mole have very shallow coverage that on their own, learners may not acquire sufficient learning by use of the material. Activities are well structured since figures and formulas of compounds thought to be difficult to type by the learner are given as options that learners only need to select. Where models of atoms are used in chemistry, certain colours are used to represent elements as agreed upon worldwide. This is referred to as international colour codes for atomic models (Twoli 2006). The illustrations of atomic models used in the ICT material are a good representation of atoms. Both ball and spoke and space filling models are appropriately used. However, colour coding has not been followed. An example is where carbon is given blue colour instead of black while hydrogen is given yellow colour instead of white.

The photographs used in various areas were relevant to the subject and reflective of the societal set-up. The simulations are good. Steps can be followed easily. However in some cases, when one clicks on step 2 before the voice reading step 1 is through, there is voice overlap which can lead to confusion. Voice prompts should be counter checked against written material. At one point a voice reads carbon (IV) oxide as carbon (VI) oxide, which is a non-existent compound.

The animations and video clips are of good quality. They contain appropriate content. However at one point a video clip on the fountain experiment was interchanged with a simple animation on preparation of ammonia solution which can be very confusing to the learner. Some clips such as the test of metal ions with ammonia solution are likely to give learners the wrong ideas on skills used in such tests. It is not advisable for the learners to close the mouth of test tube containing reacting mixture with their unprotected fingers. In the reaction of zinc ions with ammonia a less concentrated zinc ion solution should have been used in order to achieve the results without having to fill the test tube with the solution.

Concept mapping such as the one given in the Haber process is well used. Concept mapping helps learners to link concepts and ideas. However the learner should have been given a chance to develop these maps on their own with some guidance from the materials. More concept maps can be used especially in organic chemistry section. Examples given are properly sequenced. They are worked in steps as prompted by the learner. However, occasional errors of formulas of compounds were also noted such as Potassium hydrogen carbonate written as KHCO instead of KHCO3. The quizzes are however not well positioned since they are grouped with objectives and background. The learner may therefore tend to access the quiz before learning the content which makes it difficult for him/her to work them out. When the learner proceeds into the content, they may forget to go back to the quiz. It could be more appropriate for the quizzes to be positioned at the end of the subtopic under study.

Only two trials are given to the student for each question. This is limiting since some areas in chemistry are mathematical and an error such as giving the answer in less decimal places than programmed is 567onceptual as a miss on the answer. Once the two trials are exhausted, the learner is given a chance to check the answers and proceed to the next quiz. The learner may therefore proceed on with the material without proper 567onceptualization of underlying concepts.

Of great concern is that a few questions were found to reject the correct answer and on checking it was discovered that it was fed with the wrong answer. Since the material was prepared for use by learners, accuracy should be improved. Some questions such as a table in an activity in organic chemistry (alkynes) section have the structural formula that does not match the names offered as the correct options. Also, there is an activity presented as a table in the topic of the mole where a student is expected to fill out correct answers yet there are no clear instructions on how to arrive at those answers. The table contains blank spaces that do not guide on figures to use in the calculation. The learner therefore, can only work on assumptions and guesswork. There is an activity case where the learner is directed to click on the right answer yet the answer options are not displayed. An example is the second quiz on Nitrogen and its compounds.

Another important note on quizzes and activity questions is that once the learner misses a single step in a mathematical exercise, he/she is forced to redo the exercises from the beginning. This consumes unnecessary time and some learners are likely to opt for the answer in order to move on to the next activity. It would be user-friendlier if the learner was allowed to repeat only those steps he/she went wrong.

There are a number of typological errors that are capable of misleading learners who have not learnt the concept before or who may not have textbooks to supplement the ICT materials. Some examples are use of units like cm3 and °c where some parts of these units are either typed wrongly or are completely missing (e.g. in several areas, cm3 is represented as cm3 or cm while °c is represented as just ° or c and 6.023×1023 written as 6.023×1023 this gives different meaning to the units and the figures. Generally there are numerous errors in the use of superscript and subscript, which constantly distorts the meaning of equations, figures and statements. A number of chemical equations and chemical formulas are completely distorted by either improper or complete lack of appropriate subscripting and superscripting. Many chemical equations are completely incomprehensible because the arrow that should separate reactants from products is replaced by a letter such as W. This is particularly so in the topics on nitrogen, chlorine and sulphur and their compounds. Some organic compounds such as 3-bromo, 5-ethyl, 2-methylheptane are wrongly named. The content of the material, the activities and the quizzes cannot be modified therefore the teacher cannot correct these errors.

Pedagogy and Instructional Design

The two core elements that are important in all educational settings are motivation and structure, which largely define the instructional nature of an information environment (Georgiadou et al, 2001). A learner can be motivated by being informed on what s/he will achieve at the end of the instruction by stating the aims and objectives. Structure refers to how instructional information is organised. The amount of content covered, the way it is presented and assessed both visually and sequentially, the way it is accessed - all of these elements go towards an instructional design picture that either permits or inhibits learning Glencoe/McGraw-Hill (2005). When evaluating instructional design, the following questions come to mind:

- Can you adjust the level of difficulty in the instruction?
- How is the material reinforced? Are drill and practice exercises appropriate?
- What kinds of learning aids are provided? : A glossary of terms, links to advanced and/or related concepts, or printable materials?
- How does the program accommodate multiple modes of learning including visual and sound elements?
- Will it engage students? Is it dynamic enough to capture and hold students' interests?
- Will it produce a report or certificate of mastery? How do you track performance?
- Does the software appeal to various learning styles and adapt to various learning abilities?
- Does the application successfully integrate technology and instruction?

Another aspect of materials is presented by Barker and King (1993) as interactivity. This defines users' involvement in participatory tasks which helps make the product meaningful and invoke thought. There are a number of activities in these materials though they mainly involve learners in just clicking a button and sitting back to watch or listen. Another category identified by Barker and King (1993) is engagement. They argue that appropriate use of audio and moving video segments can contribute greatly to users' motivation to work with the medium. Going by this definition, the ICT materials in this study were found to contain a large amount of engagement opportunities. The simulations used can maintain the learners' interest and a number of activities keep them engaged. Responses from activities done by learners are also encouraging and learner friendly. These materials however do not allow users to configure them and change them to meet particular individual needs contribute well to the quality of the educational experience.

The instruction in these ICT materials has a level of difficulty appropriate for the learner of indicated grade. There are appropriate practice exercises for each section though they are few and thus diverse dimensions of each concept have not been adequately covered. There are also no learning aids such as a glossary of terms, links to advanced and/or related concepts, or printable materials provided in these materials.

There is adequate use of varying illustrations, animations, photographs and video clips. The simulations are good and learners really like looking at them. This is one area that these resources score highly. Learners get curious and motivated. With motivation, a lot of learning can go on. According to some theories, curiosity and interest (motivation) can trigger engagement of learners using the DVD - simulations resulting in improved conceptualisation (Marilyn et al 2011). This relationship has been represented in figure 1.

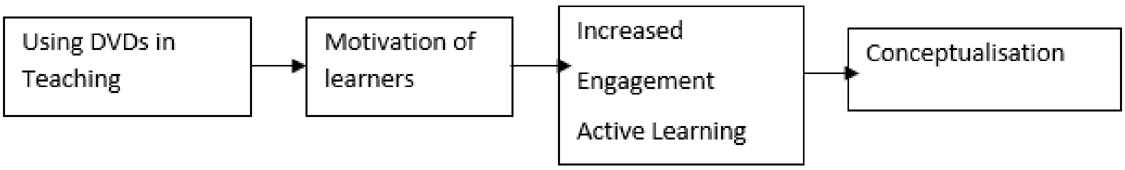
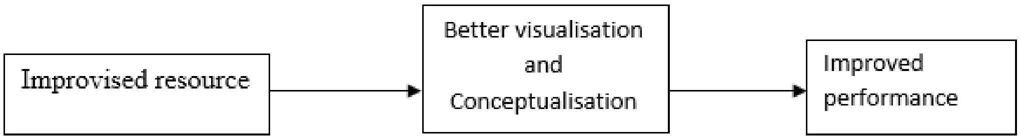


Figure 1: Effect of using DVDs in science learning

Video clips are appropriate especially for learners who have no access to laboratories. The learners can easily identify with the learning situation in the clips because they are taken in a local setup. In the video clips the precautions required for each experiment are stated.

Improvisation was found to be a useful feature. Considering that many developing countries are struggling with lack of convectional resources, this is a useful feature that teachers should emulate. In a number of situations, local materials are be used in one case for example sticks are used for stirring and used plastic bottles as containers. There is no doubt that many teachers can borrow this technique and spread out the spirit of improvisation with the idea of teaching science in a meaningful way.



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EFFECTS OF MATHEMATICAL VOCABULARY INSTRUCTION ON STUDENTS' ACHIEVEMENT IN MATHEMATICS IN SECONDARY SCHOOLS OF MURANG'A COUNTY, KENYA

Benson Njoroge Wanjiru

Abstract

The purpose of the current study will be to explore the influence of mathematical vocabulary instruction on students' Mathematics achievement. The central thesis of the study will be that success in Mathematics requires knowledge in mathematical vocabulary; a specific, which enables the teachers to communicate mathematical concepts and the learners to learn, understand and communicate Mathematics. The study will be guided by the following (three) objectives: (1) To determine the extent to which mathematical vocabulary influences Mathematics achievement (2) To establish the factors that contribute to mastery of mathematical vocabulary (3) To develop a prototype for a lesson plan for Mathematics vocabulary based instruction. The study will be a quasi-experimental pre-test and post-test design. It will be conducted in two county secondary schools in Murang'a County, Kenya: one Girls' school and the other a Boys' school. The schools will be chosen purposively since they are the best performing county schools in the District. The study will target 1450 secondary school students in Kahuro District of Murang'a County. The study sample will involve two hundred and eight (208) form two students in the two county schools and six mathematics teachers. Both the experimental group and the control group will consist of fifty-two (52) students. The experimental group will be exposed to a combined direct and indirect approach of vocabulary instruction for four weeks. In addition, the experimental group will be exposed to the Mathematics Vocabulary Dictionary found at the website www. Maths dictionary for Kids by Jenny Eather. The study will employ four (4) instruments namely: Students' Vocabulary Test (SVT), Students' Vocabulary Dictionary (SVD), Students Mathematics Achievement Test (SMAT) and Mathematics Teachers Questionnaire (MTQ) to collect both qualitative and quantitative data. Paired t-test will be used to determine if there is any significant mean difference in students' performance, Students' Vocabulary Test and Mathematics achievement scores between the control and experimental groups. The statistical significance of the results will then be examined at $\alpha=0.05$ statistical confidence level. The study contends that precise

mathematical vocabulary instruction is a prerequisite for improved mathematical achievement.

Background to the Study

Mathematics is a compulsory subject in the secondary school curriculum in Kenya. The importance of school mathematics cannot be overemphasized. Mathematics is crucial not only for success in school, but in being an informed citizen, being productive in one's chosen career, and in personal fulfilment. In today's technology driven society, greater demands have been placed on individuals to interpret and use mathematics to make sense of information and complex situations. Mathematics is as an essential tool in many fields, including natural science, engineering, medicine, and the social sciences. It is also used in day-to-day activities at home, in the market places and in offices. Mathematics is a compulsory subject in the secondary school curriculum in Kenya. Despite the importance to which the society values mathematics, the performance of the students in KCSE has been dismal.

A key component in understanding mathematics is learning vocabulary. Vocabulary is the knowledge of a word and its meaning (Staley, 2005). However, it also encompasses comprehending how words are used in oral and written formats. According to Miller (1993: 12), students are likely to be handicapped in their effort to learn mathematics if they do not understand the vocabulary that is used in mathematics classrooms, textbooks and assessment tests. Mathematical vocabulary refers to words that label mathematical concepts for example quotient, volume, vertex, dividend, and hexagon (Sanders, 2007). One of the obstacles that make mathematical vocabulary difficult to learn is lack of opportunity (Paul & Sinha, 2010). This is because much of the vocabulary used in mathematics classroom is rarely encountered in everyday life. In addition, mathematics teachers often neglect meaningful vocabulary instruction. Also, many terms have meanings in the realm of mathematics that differ from their meanings in everyday usage (Njoroge, 2003). Without appropriate vocabulary instruction, students are likely to experience difficulties and interference in the learning of concepts for which they have background knowledge that appears unrelated to mathematics. According to Solano-Flores and Trumbull (2003), the abstract nature of mathematical vocabulary is another factor contributing to difficulty in learning mathematical vocabulary. This is because many mathematical words represent concepts and not objects. Words such as quotient, fraction, and factor describe concepts but have no unique unambiguous representations in the real world. An integral part of learning mathematics is using vocabulary to communicate mathematics ideas; to explain, conjure and defend one's ideas orally and writing about mathematics (NCTM, 1989). Students need to know the meaning of mathematics vocabulary words-whether written or spoken-in order to understand and communicate mathematics ideas. According to Sanders (2007), terms, phrases, and symbols are essential in communicating mathematical ideas; and becoming fluent with them is vital for children's mathematical learning. Research reveals that the knowledge of mathematics vocabulary directly affects achievement in arithmetic, particularly problem-solving (Staley, 2005). Riordain and D'onoghue, J. (2009) indicated that vocabulary knowledge is strongly related to overall academic achievement in school. Although students may excel in computation, their ability to apply their mathematics skills will be hindered if they do not understand the vocabulary required to master content and able to apply in future situations. Thus teaching vocabulary in the mathematics content area is a critical element of effective instruction.

Research Hypotheses

The study will be guided by four (4) null hypotheses:

HO1: There is no significant difference between scores on vocabulary assessments for form two students taught Mathematical vocabulary and those not taught Mathematical vocabulary.

HO2: There is no significant difference between students' gender and performance in Mathematical Vocabulary Test.

HO3: There is no significant difference between mathematics performance for form two students taught mathematics vocabulary and those not taught mathematical vocabulary.

HO4: There is no significant difference between students' gender and scores in mathematics

Methodology

The study design will be quasi-experimental design. The notational paradigm of the design can be summarized as shown below:

Experimental Group	**R**	**01**	**X**	**02**
Control group	**R**	**01**		**02**

(R: Random Assignment, X: Treatment, O: Observation)

The study will be carried out in two County Schools in Kahuro District of Murang'a County: One Boys and One Girls School. It will target all 1450 students of the two County Schools. A sample of 208 Form two (2) students will be selected for the study. Out of the three (3) Form Two (2) classes, simple random technique will be used to choose two of the classes. Six mathematics teachers handling the Form Two Classes will also be included in the study.

The study will employ four (4) instruments namely: Students' Vocabulary Test (SVT), Students' Vocabulary Dictionary (SVD), Students Mathematics Achievement Test (SMAT) and Mathematics Teachers Questionnaire (MTQ) to collect both qualitative and quantitative data.

Since the Students' vocabulary Test (SMVT) and Students' Mathematics Achievement Test (SMAT) items will have dichotomous scores with varied levels of difficulty, their reliability coefficient will be determined using Kuder-Richardson (KR-Formula 20) estimates. The reliability of the non-dichotomous score tool, MTQ will be determined using the Cronbach coefficient formula adapted from Sattler (1988:27). The drafted instruments will be piloted in in the two schools. They will be piloted in one of the three Form Two (2) classes. This class will not be used in the main study. The twenty (20) students from the class will be randomly selected and SMVT & SMAT will be administered to them.

Actual administration of the experiment will take the following steps:

Step 1: Pre-test of the 104 Form Two (II) students in each school on understanding Mathematics vocabulary words derived from form one syllabus. This will involve administration of SMVT.

Step 2: Teaching mathematics vocabulary using various strategies to the experimental group for a period of four (4) weeks. Lesson plan for teaching mathematical vocabulary will be developed by the teacher with collaboration with the researchers and experts in mathematical education from Kenyatta University.

Step 3: It will involve Post-testing students on knowledge of form two (2) mathematics vocabulary words. This will involve the administration of SMVT

Step 4: It will involve administration of the Students' Mathematics Achievement Test (SMAT) to both control and experimental groups.

Quantitative data will be analysed student t-test. Paired t-test will be used to determine if there is any significant mean difference in students' performance in Students' Vocabulary Test and Mathematics achievement scores between (i) the control and experimental groups (ii) pre-test and post-test (iii) between genders. The statistical significance of the results will then be examined at α=0.05 statistical confidence level. Qualitative analysis will consider the inferences that will be made from the opinions of the respondents. This analysis will be narratively presented and where possible presented in tabular form. The lesson plan will be analysed and a prototype for teaching mathematical vocabulary will be developed.

References

Miller, D. L. (1993). Making the connection with language. Arithmetic Teacher, 40(6) 311-16. Monroe, E. E., & Pendergrass, M. R. (2002). Effects of mathematical vocabulary instruction on fourth grade students. Reading Improvement, 32, 120–132.

National Council of Teachers of Mathematics. (1989). Curriculum and Evaluation Standards for School Mathematics. Reston: NCTM.

Njoroge, B. (2003). The Relationship between Mathematical Language and Students' Performance in Mathematics in Nairobi Province, Kenya, Unpublished M.Ed Thesis, Kenyatta University, Nairobi.

Paul, M. & Sinha, A. (2010). Effect of proficiency in English on the performance of B. Tech students' in-group discussion. In African Journal of Business Management vol. 4(8)

Riordain, M. N., & O'Donoghue, J. (2009). The relationship between performance on mathematical word problems and language proficiency for students learning through the medium of Irish. Education Stud. Math. 71; 43-64

Sanders, S. P. (2007). Embedded strategies in mathematics vocabulary instruction: A quasi-experimental study. Published PhD dissertation. Clemson University.

Sattler, J.M. (1988). Assessment of Children, 3th ed. San Diego: Jerome M Sattler Publisher.

Solano-Flores, G, & Trumbull, E. (2003). Examining language in context: The need for new research and practice paradigms in the testing of English-language learners Educational Researcher, 32(2), 3-13.

Staley, L.E (2005). The effects of English language proficiency on students' performance on standardized test of mathematics achievement. Published PhD dissertation. Los Angeles: University of California

Internet Sources

Http://www.amathsdictionaryforkids.com

ORIENTING THE TEACHING OF PHYSICS IN LINE WITH THE ACHIEVEMENT OF VISION TWENTY THIRTY: A CASE STUDY OF KENYAN SITUATION

Maina, P.G. and Muthwii, S.M.

Abstract

The teaching and learning of science has been a challenge to students as well as to teachers alike. By twenty thirty Kenya is supposed to be a middle level income nation. In the fifties Kenya was at the same developmental level with some of the technologically advanced Asian tigers countries such as South Korea and Malaysia. The question is where have things gone wrong? With no doubt science subjects such as physics must play a vital role in the technological development agenda of any country. For Kenya to be a middle level income country by twenty thirty, the teaching of physics and other sciences alike must be put into emphasis. Vision twenty thirty is only 17 years away; can Kenya get there within this short period. There is a need therefore to revolutionalize the teaching of sciences and in our case physics. With this dream in mind a research centering on the teaching of physics in a heuristically practical approach using videos was carried out in Kiambu County. This paper presents exciting findings from the study, a demonstration that integrating instructional videos can bring about an improvement in the teaching and learning process of physics at secondary school level and therefore strongly recommended for schools that offer the subject. It is also an important resource that practicing teachers and learning institutions can use to record science related information rather than mainly relying on textbooks.

Introduction

Instruction in Science subjects in most developing countries has focused on the convectional methods, which include lectures, demonstrations and experiments in laboratories. The emergence of videos and other e-learning materials is beginning to simulate new impetus in school science instruction. Using computers for example is beginning to appeal to teachers even in rural areas for various reasons. The first reason is because of the distribution of power in rural schools and secondly because of the government's initiative to assist and promote use of electronic media in schools. The cost of electronic gadgets has also drastically been going down. The result of all these factors is that a number of schools in rural Kenya have started experimenting and integrating electronic media with the conventional methods. So far there is no much research that has been done to determine effects of this integration in instructions. This is what prompted this study, which was done in Kenya to determine the instructional and motivational effects integrating videos in physics.

In Kenya, secondary school students are required to sit for two or three science subject exams in their national examinations but the enrolment for the last seven years shows that physics is the least appealing subject to students. The average enrolment for the past few years is 30%, 91% and 94% for physics, biology and chemistry respectively. But looking at the national performance it appears that physics has the same performance as the other two science subjects ranging between 40 to 49%. Why then is physics not as popular as other subjects? This prompted the study to focus on form two-level (10th year in school) the time before the students select their science subjects for the national examinations two years later. The choice of using videos was arrived at after considering several factors. Teachers are quite innovative in their demonstrations but these creative ideas are not documented or recorded and secondly physics is basically a subject that requires the learner to participate in quite a number of topics for better understanding. The other factor that was considered is the availability of computers and Internet services that have made sharing of videos affordable and available in most parts of the country.

Background

For a long time videos have been known to be an essential teaching aid but its effect when integrated in teaching physics had not been studied. At the Kenya Institute of

Curriculum development, (the body that deals with preparation of secondary schools audio visual aids), only one physics videotape was available containing just a few topics. The main drawbacks to use of videos in instructions were mainly three. The first one was the higher price of hardware required to show videos such as TVs and video players. The second was lack of power in most rural parts of the country and the third was and still is the unavailability of physics instructional videos. These problems have systematically been solved, some locally, others by the technological advancements in the developed countries. TV's and computer monitors are now available and found in many schools. Various organizations have donated computers in schools when new advanced versions are developed. The government has given Rural Electrification a priority to create rapid industrialization and more schools are now connected to the main electricity lines than ever before. Internet Service Providers are competing to reach the furthest parts of the country. Modems and all the essential items required to download information from the Internet are now available and affordable even to individual teachers. These initiatives by the government and private entrepreneurs solve the problems outlined earlier that were limiting the use of videos.

The study focused on the following two questions:

1. What is the effect of integrating physics instructional videos on students' performance?

2. What is the motivational effect on the learners when videos are integrated in the teaching of physics?

Conceptual Framework

A classical experiment by Albert Bandura (1968) illustrates how observational learning can occur by watching a model without using reinforcement. The experiment illustrated a major distinction between learning and performance. Observational learning or modeling has been defined as a learning process in which a person observes and imitates an activity. Bandura used children who were found to imitate adults' behavior in the famous doll study even without reinforcement. In this experiment an adult was repeatedly hitting and kicking a doll and when the children observed this through a video, they repeated the same behavior by hitting each other more frequently than those who had not watched the video. The experiment has been repeated with adolescents and with different activities but yielded the same results. In 1986, Bandura focused this experiment on specific learning processes among them attention and motivation. In view of his findings the learners at secondary school level can change their motivational orientation by watching video and attempt to reproduce what they have seen as long as it is interesting to them. It explains why youngsters dress and imitate the heroes they watch in videos that are locally available to them. Similarly if interesting physics instructional videos would be made available to learners, they can transfer this behavior and find the subject more appealing and hence improve their performance.

Method

The study used a quasi-experimental design with pre and post-tests administered to a control and experimental group. Both groups were taught two topics but the experimental group followed up with an instructional video on the second topics. The results were analyzed and then compared to determine which specific areas of physics were improved by including physics videos in the experimental group's lesson. An observation schedule was used to monitor the motivational effects as the students watched the video. Both groups watched a video but the experimental group watched an instructional physics video while the control group watched an ordinary entertainment video. However, so as not to disadvantage the control group, the instructional videos were provided to the control group after the research. It was realized that for the last three year, the two schools chosen for research had a national exams performance index of 4.95 for the control group and 5.02 for the experimental group in a maximum index of 12.0. This affirmed closeness of the learners' ability in the two groups. After the pilot study in a separate school, the physics teachers taught the form two class in both schools a topic on moment (turning effects of forces) using the conventional methods. This topic took about two weeks to cover after which an achievement test was given to both the control and experimental group. Their results were taken as pre-test raw data. After revision of the test the teachers taught the next topic on Hooke's law a closely related topic to that of moments and have the same level of difficulty. But in this case the experimental group watched a video on Hooke's law. A post-test on Hooke's law was administered to both groups and during the lessons, an observation schedule was filled in by the physics teachers to be used in determining how motivated the learners were while watching the videos.

Results

Both pre-test and post-test achievement test items were set to cover the three aspects of secondary school physics examinations, namely the mathematics skills, theoretical concept formation and process skills development. The pre and post-tests followed the same format as that used in the national examinations.

Summary of Average Percentage Results

Group	Test	Overall	M.S	T.C.F	P.S.
Control	Pre-test	57	54	59	58
	Post-test	56	59	56	55
Experimental	Pre-test	61	57	62	61
	Post-test	63	63	65	61

M-S – Mathematical, Skills T.C – Theoretical Concepts formation, P.S – Process Skills development

On mathematical skills, both groups registered close improvement and this therefore ruled out the effect of treatment. The possible explanation was that after revision of the pre-test, learners acquired the necessary mathematical skills tested, mainly drawing of linear graphs and their interpretation and use of simple algebraic expressions. The t-test on pre and post-test achievement tests showed that the improvement was significant at the 0.05 level but occurred to both groups. The other possible reason for the improvement could be that the students were also having further practice in their mathematics lessons or practicing their own. For theoretical concepts formation the control group had a drop and the experimental group had an improvement. Further the experimental group had a t-ratio of pre-test to post-test that was significant at 0.05 levels. The control group had a t-ratio that could only be significant at 0.01. The process skills that were mainly included in the achievement test items focused on observing, communicating, measuring, inferring, predicting and classifying. There was a decline in performance for the control group but the experimental group remained the same. If there was no intervention then, that is, use of videos, there could also have been a decline. In evaluating specific test items, the t-ratio was significant at 0.05 level for the experimental group but below the established mark for the control group. This could only be as a result of treatment in the experimental group.

Overall performance of the control group showed a slight decline when the pre-test results were compared to the post-test results but this agrees with past findings in that the topics that are generally viewed as difficult are taught later in the syllabus. In the secondary schools syllabus, the topic turning effect is taught before the topic on Hooke's law as students perceived the later to be more difficult. Waititu, (2004) had researched on difficult topics in physics and found that the two have a difficulty index that was close hence their choice for the study. The experimental group had an overall improvement on performance in the post-test that could be attributed to the instructional video that was shown to the learners after teaching the second topic.

The t-test carried out on the overall test confirmed that the treatment, which is integrating an instructional video, did actually create a significant improvement at 0.05 level for the experimental group. As regards the control group, a drop in processing skill and theoretical concepts questions nullified the improvement in mathematical questions, thus the net effect was an overall drop. The product moment correlations carried out showed that students in control group had a performance that remained consistent in that those who had performed well in the pre-test also performed well in post-test. The overall correlation between pre and post-test for control group was 0.724, which is considered quite substantial in physical and educational tests (Garret, 1977). The experimental group's correlations between the students performance in the two tests varied considerably and this could only be attributed to the instructional videos shown to the experimental group. Learners in the experimental group were highly motivated during the lesson in which they were watching the physics video on Hooke's law. These lessons were characterized by more frequent questions than in the other lessons, requests to pause the video to jot down the key points, being more attentive and remaining glued to their sheets even when the video ended requesting for another episode. The students were found to extend their active learning time after the lesson being more curious than in the earlier topic's lesson.

Conclusion

The contents of the secondary school physics is abstract to learners if taught without practical work and where this is not possible, a video can demystify the contents because most of the topic require the student to visualize the effects of changing parameters. For example, all the topics that include some kind of motion are better understood when taught with some video rather than drawing diagrams, which do not show the effects of displacement. Stretching springs, seesaw, covering distances, hydraulic lifts, motors and dynamos are all examples of topics that can be more exciting when recorded on a video and then used as a teaching aid. Nevertheless, teachers have to bear in mind that an aid is not a substitute to practical work or relia where possible.

The findings of this study can be of use to the other science subjects as well in improving performance. It was evident that the improvement was out of the motivation by the instructional video and therefore, any other science subject can be tried upon as the basic process skills are the same in all science subjects. The learners were found to develop a greater understanding of the subject because the recording of the video related well with their environment, the technology brought what they see outside the classroom.

Recommendations

Wiske (1998) suggested that teachers must be allowed to experiment with technology in low-risk environment and receive constructive feedback. Innovators and researchers must start reform efforts from grassroots' level not top-down or quick fix programs, as technology is here to stay. In this regard, there has to be extensive preparation and continual learning in the part of teachers. The results from this study demonstrate that Wiske's (1998) suggestion can yield worthwhile findings if the educators are ready to experiment new innovative ideas but with ethical considerations in mind. For this study, the groups chosen comprised of learners who may or may not opt for physics in their final examinations minimizing the risk of experimenting with students. The study has shown that high technology which is already at our disposal can allow teachers to extend their students' learning experiences well beyond the classroom walls and now with the optic fibre connections in some parts of the towns in the country, there will be faster, cheaper and relevant content to be shared by both teachers and students alike. Affordable digital video cameras or mobile phones can innovatively be used to make learning more exciting. As a key recommendation therefore, a physics videos website with local innovations in teaching of the subject would be very useful in sharing what may not be put in textbooks if the content requires motion to be fully comprehended. Fully exploiting ICT resources that are readily available right to the rural areas such as video technology will bring about rapid innovation of physics education and cause drastic changes in the way of science education. This will hopefully give rich prospects for physics practices in the classroom edging us closer towards vision 2030 within the short period of the remaining time.

References

Bandura, A. (1986). Social foundation of thoughts and action, Englewood Cliffs, NJ: Pentice-Hall.

Dexter, S.L., Aderson, R.E., & Becker, H. L. (1999). Teachers' view of computers as catalysts for changes in their teaching practice. Journal of Research on Computing in Education.

Fick, L. & Bell, R. (2001). Preparing tomorrow's science teachers to use technology: Guidelines for science educators. Contemporary issues in technology and teacher education.

Fullan, M. (1991). The new meaning of educational change. New York: Teachers College Press.

Garret, H. E. (1977). Statistics in Psychology and Education. Bombay: Allied Pacific Private ltd.

Kuachak, D.P & Eggen, P. D. (1993). Learning and Teaching. Boston: Allyn and Bacon.

Newton, L. (2001). Teaching Science with ICT. London: Continuum books.

Slavin, R. (1990). Cooperative Learning: Theory, research and practice Englewood cliffs, New Jersey: Prentice Hall.

Stantrock, W. J. (2004). Educational Psychology. New York: Mc Graw-Hill.

Waititu, M. M. (2004). Exploring teachers' and student's perception of difficult topics of Kenya. secondary school physics. Med Thesis. Nairobi: Kenyatta University (unpublished).

Weld, J. (2004). The game of science education. New York: Allyn and Bacon.

Wiske, M. (1998). Teaching foe Understanding: Linking researching with practice. San Francisco: Jossey-Bass publishers.

Woolnough, E. (1985). Practical Science. Role and reality of practical work in school. Philadelphia: Open University Press. Milton Keynes.

THE ATTITUDES OF SCIENCE TEACHERS AND STUDENTS TOWARDS COMPUTERS IN SENIOR HIGH SCHOOLS WITHIN THE ACCRA METROPOLIS

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Abstract

This study investigated the attitudes of science teachers and students towards computers in senior high schools within the Accra Metropolis. The study looked at the computer facilities (hardware and software) available in the schools, attitudes of teachers and students towards computers and challenges encountered in the use of computers. Ten schools within the Accra Metropolis were randomly selected. Data was analyzed using SPSS-version 12. Results indicated that computer facilities were available in the schools and that; science teachers and students had a positive outlook towards computers. The study recommended that efforts must be made by the teachers to allay the fear and apprehensiveness of students in using computers, heads of senior high schools should allow teachers and students to have access to the Internet if present in schools, and Ghana Education Service (GES) with the support of Ghana Education Trust Fund (GETFUND) should collaborate with school authorities to expand the existing computer and internet facilities in the schools.

Keywords: Computer, hardware, software, attitude

Introduction

It has been observed that teaching of science in Senior High Schools face numerous problems. These include teachers with inadequate specialized knowledge in teaching science, the inability of teachers to use activity oriented strategies during teaching and inadequate supply of material resources and laboratories (Anamuah – Mensah, 1997). The obvious results of these unfortunate situations are that students are unable to explore and develop interest in science. Therefore, computers could be used in order to create a format for students to increase their interest in science as well as make it easy for them to grasp basic concepts. Liaw (2002) stressed that the success of computer use in the science classroom heavily depends on positive user attitudes towards it. A person's attitude toward a computer is influenced by computer liking, computer confidence and computer anxiety or comfort (Delcourt & Kinzie, 1993).

Computer attitude has been defined as a person's general evaluation or feeling of favour or antipathy toward computer technologies and specific computer related activities (Smith et al, 2000). Balli et al., (1997) investigated pre-service teachers' attitude towards technology available in schools and its use by students. They found that many of the teachers were surprised by the sophisticated nature of what was available in schools and the students' abilities in using them. This led many of them to reassess their attitudes and it also helped increase their confidence levels in using these technologies. Some studies have noted how teachers' attitude has changed as they move from a position of anxiety to increasing comfort (CELT report, 1995). Computer attitude evaluation usually encompasses statements that examine users' interaction with computer hardware, computer software, other persons related to computers, and activities that involve computer use (Smith et al. 2000). If the resources are available, if the teachers are trained and favorably disposed, then one does not envisage much trouble in getting the students to use computers in learning.

Ajzen, (1988) observed that those with positive attitudes towards the use of computers in education behave differently from colleagues with less positive attitude. O'Hara (1998) studied the attitudes of students using the Internet and found increased motivation and focuses on the learning task. Griffin (1998) found that teacher attitude towards computer is an important factor related to the teacher's role towards the effective use of computers in education. Therefore, it is evident that familiarity with computers and the ability to use them effectively will be important to science education within educational institutions in senior high schools in Ghana. This certainly will encourage the use of computer – aided teaching strategies in science classrooms in Ghana.

Research Objectives

The following research objectives guided the study:

1. To determine the computer facilities (hardware and software) available in the schools?

2. To investigate attitudes of teachers and students towards computers?

Hypothesis

The following hypothesis was tested:

There is no statistically significant difference between teachers and students' attitudes towards use of computers in schools.

Methodology

The research design adopted for this study was a descriptive survey. This design was selected because the researcher needed to solicit people's opinions, attitudes and behavior in the use of computer technology in the science class.

Sample Size

The respondents consisted of 47 teachers and 300 students in the area of science. The Accra Metropolis was chosen for the study because it is relatively large, fairly populated and also had a good number of schools. Ten schools were randomly selected. In the selection of the ten senior high schools, the researcher used the lottery method, which is a type of random sampling. The technique used in selecting the teacher sample size was snowball sampling. Convenience sampling was used in selecting students for the study.

Research Instrument

There were two sets of questionnaires, one for the science teachers and the other for science students. The researcher designed the questionnaires, by looking at the literature review and gathering appropriate questions that needed to be asked.

Piloting Procedure

There was a pilot study, which preceded the main study. A small sample, which consisted of 7 teachers and 15 students, were selected and the respondents requested to respond to the questionnaire.

Data Analysis

The data collected from the closed ended items was analyzed using the Statistical Package for Social Sciences (SPSS) - version 12. Independent sample t-test was used to compare the mean scores for the data provided by the teachers and students.

Results and Discussion

Background Characteristics of Respondents

The background characteristics for teachers were examined in terms of science course taught, teaching experience, qualification and computer training, if any. The students were examined in terms of gender, age and who taught them how to use the computers.

Objective 1: What computer facilities (hardware and software) are available in the schools?

The significance of this question was to find out the accessibility of computer facilities. The information gathered in respect of the number of computers in the schools' laboratory is shown below.

Table 1: Number of computers

	Teachers		Students	
Number of computers	**Frequency**	**Percent (%)**	**Frequency**	**Percent (%)**
11 – 20	5	10.6	30	10.0
21 – 30	27	57.4	180	60.0
Above 40	15	31.9	90	30.0
Total	47	100	300	100

As observed in Table 1, most schools had 21 to 30 computers. None of the schools had less than 10 computers.

Information concerning the frequency of computer use is presented

Table 2: Frequency of Computer Use

	Teachers		Students	
Duration	Frequency	Percent (%)	Frequency	Percent (%)
Once a month	9	19.1	48	16.0
Once a week	6	12.8	163	54.3
Several times a week	7	14.9	10	3.3
Everyday	7	14.9	11	3.7
Never	18	38.3	68	22.7
Total	47	100	300	100

It is shown in Table 2 that 18 (38.3%) teachers never used the computer at school, but 7 (14.9%) teachers used the computer several times a week or everyday. And 163 (54.3%) students used the computer at least once a week and only 10 (3.3%) of them used the computer several times a week. Sixty-eight (22.7%) students never used the computer in school.

The duration of Internet usage is presented in Table 3.

Table 3: Duration of Internet Usage

	Teachers		Students	
Duration of usage	**Frequency**	**Percent (%)**	**Frequency**	**Percent (%)**
Once a month	2	4.3	30	10.0
Once a week	6	12.8	30	10.0
Several times a week	2	4.3	0	0.0
Never	37	78.7	240	80.0
Total	47	100	300	100

Table 3 reveals that 37 (78.7%) teachers did not use the Internet at all but 2 (4.3%) of them used the Internet either once a month or several times a week. Majority of the students, 240 (80.0%) did not use the Internet at all, but 30 (10.0%) students used the Internet either once a month or once a week. No student was able to use the Internet several times a week.

Information concerning the software used on the computer is shown in

Table 4.

Table 4: Software on computer

	Teachers		Students	
Software	Frequency	Percent (%)	Frequency	Percent (%)
Encarta 2007	4	8.5	30	10.0
Microsoft Office	42	89.4	240	80.0
Dictionary	0	0.0	0	0.0
Science software	0	0.0	0	0.0
Others	1	2.1	30	10.0
Total	47	100	300	100

The analysis in Table 4 shows that 42 (89.4%) teachers mostly had the Microsoft office software. Only 1 (2.1%) teacher was aware of other software on their computer, which was Mavis Beacon. Two hundred and forty (80.0%) students mostly had the software Microsoft Office. However, 30 (10.0%) students had other software on their computers, such as Mavis Beacon, educational games, Hangaroo, Kaspersky Anti-Virus 7.0, VLC media player, Media Player Classic, Real Player, WinRAR, Zip, SPSS, Mozilla Fox, Supercopier2 and

Adobe Reader. None of the respondents had dictionary or science software on their computer.

The data in respect of the first research question suggest that both hardware and software were available in all the schools that participated in the study. Most teachers had access to the computers but in most cases they were not often used, unlike students who used them quite frequently. Teachers and students did use the Internet often. The most common available software on the computer of the schools was Microsoft office.

Objective 2: What are the attitudes of teachers and students towards computer technology?

This question dealt with the attitudes towards computers. Table 5 shows the attitudes of teachers towards the computer.

Table 5: Attitudes of respondents towards computers

	Teachers		Students	
Attitude	Frequency	Percent (%)	Frequency	Percent (%)
Strongly dislike	0	0.0	2	7.0
Moderately dislike	1	2.1	9	3.0
Neutral	2	4.3	38	12.7
Moderately like	20	42.6	111	37.0

Strongly like	24	51.1	140	46.7
Total	47	100	300	100

It is shown from table 5 that 24 (51.1%) teachers strongly liked computers and 20 (42.6%) teachers moderately liked computers. Meanwhile only 1 (2.1%) teacher moderately disliked computers. Two (4.3%) of them were neutral about computers. Also, 140 (46.7%) students strongly liked computers meanwhile only 2 (7.0%) of them strongly disliked computers. One hundred and eleven (37.0%) students moderately liked computers while nine (3.0%) of them moderately disliked computers. Thirty eight (12.7%) students were neutral about computers.

The data in respect of the computers' effect on teaching is shown in

Table 6.

Table 6: Computers' effect on teaching and learning

	Teachers		Students	
Computer	Frequency	Percent (%)	Frequency	Percent (%) effect
Less effective	2	4.3	7	2.3
Somewhat less Effective	2	4.3	9	3.0
Not affected	22	46.8	160	53.3
Somewhat more effective	14	29.8	40	13.3
Much more effective	7	14.9	84	28.0
Total	47	100	300	100

Table 6 indicates that 22 (46.8%) teachers were not affected by the use of computers. Two (4.3%) of them were less affected and somewhat less affected by the use of computers. However, 14 (29.8%) teachers were somewhat more affected by the use of computers while 7 (14.9%) of them were much more affected by the use of computers. One hundred and sixty (53.3%) students did not change the way they felt about school. Computers made 7 (2.3%) students liked school much less while 9 (3.0%) of them liked school a little less. Eighty-four (28.0%) students liked school much more because of computers and 40 (13.3%) students liked school a little more.

Information concerning computer usage in teaching is analyzed in Table 7.

Table 7: Computer usage in teaching and learning

	Teachers		Students	
Computer use	Frequency	Percent (%)	Frequency	Percent (%)
Definitely will not use	2	4.3	6	2.0
Probably will not use	1	2.1	3	1.0
Not sure	4	8.5	23	7.7
Probably will use	11	23.4	74	24.7
Definitely will use	29	61.7	194	64.7
Total	47	100	300	100

Table 7 reveals that 29 (61.7%) teachers definitely would use computers in teaching, but only 1 (2.1%) of them probably would not use computers. Eleven (23.4%) teachers probably would use computers while 2 (4.3%) of them definitely could not use computers. Four (8.5%) teachers were not sure whether or not they would use computers in teaching. Also, 194 (64.7%) respondents definitely could use computers in learning, but 3 (1.0%) students probably could not use computers. Seventy-four (24.7%) students probably could use computers in learning and six (2.0%) of them definitely could not use computers.

Twenty-three (7.7%) students were not sure whether or not they would use computers in learning.

Data concerning the impact of computers in school is analyzed in Table 8.

Table 8: Impact of computers on school

	Teachers		Students	
Impact	Frequency	Percent (%)	Frequency	Percent (%)
Extremely negative	0	0.0	34	11.3
Somewhat negative	1	2.1	19	6.3
Neutral	10	21.3	100	33.3
Somewhat positive	32	68.1	87	29.0
Extremely positive	4	8.5	60	20.0
Total	47	100	300	100

Table 8 outlines that 32 (68.1%) teachers reported that the overall impact of computers in school had been somewhat positive. Only 1 (2.1%) teacher thought computers had somewhat a negative impact. Four (8.5%) teachers felt that computers had an extremely positive impact and 10 (21.3%) of them believed that computers have neither a positive nor negative impact on schools. No teacher viewed computers as having an extreme negative impact on school. However, 100 (33.3%) students felt the overall impact of computers on school has been mostly neutral. Nineteen (6.3%) students thought computers had somewhat a negative impact while 34 (11.3%) of them were extremely negative about the impact of computers in school. However, 87 (29.0%) students found that computers had somewhat a positive impact in school and 60 (20.0%) of them found computers to have an extremely positive impact.

The results suggest that most teachers and students generally had a positive attitude towards computers. Computers did not have any effect on their teaching and learning. However, teachers and students thought that computers had a positive impact on school. Most teachers and students would definitely use computers in teaching and learning respectively.

Testing of Hypothesis

Hypothesis 1

Ho: There is no statistically significant difference between teachers and students attitudes toward computers in schools. This hypothesis sought to explore whether or not there is a difference between teachers and students in their attitudes toward computers. Testing for the differences between the two groups, teachers and students was done using the t-test.

The means and standard deviations for the attitudes of teachers and students are tabulated in Table 9.

Table 9: Attitudinal ratings of teachers versus students and their results

Scale	Teachers Mean ±SD	Students Mean ±SD	Mean Difference	t	p
Attitude	4.26 ± 0.84	4.43 ± 0.68	-0.17	-1.49	0.140
Effect	3.47 ± 0.95	3.62 ± 1.00	0.15	0.99	0.327
Usage	4.36 ± 1.03	4.49 ± 0.84	0.13	0.81	0.420
Impact	3.83 ± 0.60	3.40 ± 1.21	-0.43	-3.84	0.000*

Table 9 reflects the means and standard deviations of the attitudes of teachers and students toward the computer. The mean differences between the two groups are very small.

For the study, the impact of computers on teachers was found to be significantly ($p < 0.05$) different from the impact of computers on students. Statistically, there was no significant ($p > 0.05$) difference in attitude, effect and usage, therefore, there is no statistically significant difference between the groups, so the null hypothesis is accepted.

Discussion

In all the schools that took part in the study, there was availability of computer facilities, but unfortunately in most cases there was no accessibility, especially with the Internet. According to Fobih (2007), then Minister of Education, Science and Sports as part of the Ministry's "computers in school" policy, ICT based tools; systems, educational technologies, software and courseware would be deployed within the educational system to improve the quality of science.

It was found that both teachers and students generally had a positive attitude towards the computer. This is quite encouraging in the sense that it gives hope for the future use of computers in the classroom. If the resources are available, if the teachers are trained and favorably disposed, then one does not envisage much trouble in getting the students to use computers in learning. Teachers may welcome or resist the introduction of information technology into schools or may avoid it altogether. A comparison of attitudes of teachers and students showed that only 58% of teachers viewed the Internet as a useful teaching and learning tool as opposed to 92% of students (Richards, 1996).

The successful use of computers in the classroom is dependent on the teachers' attitude towards the computer (Lawton & Gerschner, 1982). Positive teacher attitudes towards computers are widely recognized as a necessary condition for effective use of information technology in the classroom (Woodrow, 1990). In that study, about 22% of teachers and 20% of students actually used the Internet, which is contrary to the findings of the current study.

Summary, Conclusions and Recommendations

Summary of Study

The research aimed at finding out the influence of computer technology on the teaching and learning of science in senior high schools in the Accra Metropolis. Forty-seven teachers and 300 students filled the questionnaires. The results of the data analysis provided a number of findings with respect to the attitudes of science teachers and students towards computers in senior high schools. These are:

1. Computer facilities were available in all the ten Senior High schools surveyed.

2. Both teachers and students had a positive attitude towards computers.

Conclusions

The findings revealed that computer facilities were available and that both teachers and students had positive attitudes about the use of computers to facilitate the teaching and learning of science. Therefore, it is possible to obtain positive outcomes if computer use is integrated into the teaching and learning of science.

Recommendations

On the basis of the study's findings, the following recommendations are made. Efforts should be made by the teachers to dispel the panic and uneasiness of students when using computer technologies. They should encourage students to be optimistic and feel at ease in the use of computers.

It is also recommended that the Ghana education service (GES) with the support of Ghana Education Trust Fund (GETFUND) collaborate with school authorities to expand the existing computer and Internet facilities in the school, so that the student-computer ratio of 1:1 can be achieved.

References

Ajzen, I. (1988). Attitudes, Personality and Behaviour. UK. Open University Press.

Anamuah, M. J. (1997). “A” Level Chemistry Practical Knowledge: Are there two-culture theory and practical. Journal of Ghana Association of Science Teachers (GAST), 1 (1) 25. Ghana.

Balli, S. J., Wright, M. D. & Foster, P. N. (1997). Preservice teachers' field experiences with technology. Educational Technology, 37(5): 40-46. In Lal,

Vijendra. (2002). The impact of computer-based technologies in Schools – a preliminary literature review. Australia. http://www.effectsproject.uts.edu.au/project_papers/4_vijendra_lal.pdf

Centre for Educational Leadership and Technology (CELT). (1995). America's 21st century school: linking education reform and technology. Marlborough, MA. In Lal,

Vijendra. (2002). The impact of computer-based technologies in Schools – a preliminary literature review. Australia.

Delcourt, M. B. & Kinzie, M. B. (1993). Computer technologies in teacher education: The measurement of attitudes and self- efficacy. Journal of Research and Development in Education. 27 (1), 35-41

Fobih, D. (2007). Minister of Education, Science and Sports (MOESS). A speech at the computers in school policy makers’ workshop. Ghana

Griffin, J. (1998). CAL innovation as viewed by purchasers of computer software in Secondary Schools. Journal of Computer Assisted Learning, 4(1), pp 34 – 43.

Lawton, J. & Gerschner, V. T. (1982). A review of the literature on attitudes towards computers and computerized instruction. Journal of Research and Development in Education. 16 (1). p. 50-55.

Liaw, S. S. (2002). An Internet survey for perceptions of computers and the worldwide web: relationship, prediction, and difference. Computer in Human Behavior, 18(1), 17-35

O'Hara, S. P. (1998). A case study of attitudinal effects of Internet use in a middle school integrated science curriculum. Paper presented at the Annual Meeting of the National Association for Research in Science Teaching. San Diego, CA. In Lal, Vijendra. (2002). The impact of computer-based technologies in Schools – a preliminary literature review. Australia. http://www.effectsproject.uts.edu. au/project_papers/4_vijendra_lal.pdf

Richards, F. C. (1996). The impact of the Internet on teaching and learning as perceived by teachers, library media specialists and students. Unpublished Masters Thesis. Salem-Teikyo University. In Lal, Vijendra. (2002). The impact of computer-based Technologies in Schools – a preliminary literature review. Australia. http://www.effectsproject.uts.edu.au/project_papers /4_vijendra_lal.pdf

Smith, B., Caputi, P. & Rawstorne, P. (2000). Differentiating Computer Experience and Attitudes toward Computers: An Empirical Investigation. Computers in Human Behavior, 16, 59-81

THE BUILDING BLOCKS FOR A STRONGER AFRICAN UNIVERSITY

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Abstract

There seems to be consensus that university education is declining in Sub-Saharan Africa and hence the rampant institutional crisis. Huge criticisms have been leveled against the African University to the extent of being branded an ivory tower, irrelevant and out of touch with reality. Often the graduates from the African university have become a laughing stalk and taunted to be a mere 'Paper Tiger.' This makes us question the landmark achievement of establishing over 200 universities in the continent of Africa in the 21st Century. Nevertheless, the role played by the university in any country is critical. It is the only institution with the relevant and needed skills for fast socio-economic development; the university has able equipment, capacity and capability to generate knowledge through research, and other effective ways of disseminating the needed knowledge. Thus, the position of the university as the key actor in any country's progress and development cannot be overemphasized. The other relevant institutions should therefore urgently cooperate in revitalizing the dream for African university's better deliveries. In this regard, the countries' government, the university itself and other stakeholders must cooperate to rid the problems, which are responsible for the university's poor performance, dwindling image and poor public perception. Ugly problems like ethnicity and nepotism in staff recruitment, poor and feeble governing policies, and internal management boards that are weak, visionless, and flippancy in their leadership must be urgently replaced. If all these problems are effectively looked into introspectively, and objectively by the relevant institutions; then the African university can be revitalized to serve the citizens to improve their livelihoods and enhance more socio – economic development. Secondly the African university will produce graduates who are able to tackle the many problems weighing down this continent. This paper therefore seeks to address ways of revitalizing the African university in order to enhance its performance and sustainability.

Introduction

The university has recently become a vital organ critical for the creation and consumption of knowledge in any country. As a creator of knowledge, the university indeed makes a significant contribution in the creation of the so-called 'intangible assets' namely knowledge, skills and innovation: these invisible assets have become the touchstones, and bedrocks for any continental, or national transformation.

The need for a functional, dynamic, quality, relevant and vibrant university has recently emerged as one of the top most agenda globally (Shattock 2007). Here in Africa, the need cannot be overemphasized as the continent continues to wade through a hurricane of change in all dimensions: technological changes, socio-political and socio-economical. The African university therefore is called upon to reexamine its mission and goals in order to interrogate its relevance visa vise its mission statement (World Bank 2009). Overtime mission statements have been reduced to a mere identity slogan or advertisement gimmicks whereby sacrifice and hard work in fulfilling the essence, and values of the mission are compromised. In real management world, each institution must be seen working hard to fulfill its objectives, to this Shattock (2007) argues,

> *Management…the art and science of formulating, implementing and evaluating across functional decisions that enable an organization to fulfill its objectives*

In the wake of the internal and external challenges that face African university in the new millennium; the African university must respond and find its rightful place in order for it to play its rightful role in African development (Tettey 2006). Indeed, with its mega expansion in the recent decades; the African university is faced with a huge challenge of balancing such growth and expansion with its phenomenal goals of excellence, relevance, and access (Michigan University 2007, 2). Thus, the African university is greatly challenged by the myriads of problems, which seemingly compromise its performance.

Bourgeoning literature continue to lament the nose-diving of higher education in Africa to the extent where the African university cannot bail the continent out, Tettey (2006, 6) thus comments,

> *An evaluation of higher education in Africa over the last two decades suggests that institutions are beleaguered by a myriad of problems which affect their ability to function as the centers of intellectual excellence that they were conceived to be, and in fact were for quite some time…..*

Creating a relevant Vision for the African university

A vision describes as powerful motivators that result from the visualized end product or destination. Thus a vision is then a picture where we want to go. It is expressed in a statement which according to D' souza (2001, 93) has the capacity to:-

- Give the journey a direction
- Call the group to rally to the mission ahead
- Light a flame to inspire and excite people to action
- Provide visible evidence of the organization's commitment and priorities
- Stand as a visible reminder to focus people's minds and efforts
- Declares the standards which the organization would like to be judged

Organizations have no otherwise but to work together to create a vision that after being launched to the public domain, they can be judged from the vision as to whether they are relevant. As such, visions must be built on desired realties, and possibilities; visions cannot be mere abstractions: indeed they present some framework or a mental picture of what we want to do in order to create a meaningful future. D'sounza (2001, 94) likens a vision to a compass that serves as a guide.

The African university must come up with a vision statement that reflects the realities of the continent, concerns and needs. Because as mentioned earlier the vision statement is futuristic, it should therefore express the reality the African university wants to create. Having stated that, we can count the troubling realities in the continent of Africa which in certainly should be addressed by the African university with a great urgency through teaching and research:-

- Tropical diseases
- Famine
- Poor governance
- Corruption
- Negative ethnicity and regionalism
- Gender disparity
- Illiteracy
- Social inequality
- Refugee influx
- Internal wars and conflicts
- Deforestation and desertification
- Soil degradation
- Mismanagement of natural resources

In raising the above issues, it is does not at any rate suggest that the African university is solely responsible for shouldering all the social problems solo. Far from it; but the African university can forge a close regional partnership to work with the regional populations and develop the region; as Shattock (2007, 113 - 114) puts it

> *…but all universities are being drawn in to contributing to regional agendas …universities were expected to have a regional role because…they can help grow thesea assets by offering innovative capabilities, production capabilities, quality skill, learning networking and collaboration.*

Lundvall and Jonson (1994) underscore the importance of interactive learning whereby the university offers the base for innovation and change through teaching and applied research; the capacity for the university in facilitating such concepts cannot be overemphasized. Therefore, for the African university to be seen as a world class, it should refine its vision and mission statement carefully to thus become a hub for African economic development through industrial transformation by championing a new learning base and network regionally (see Shattock 2007, 116). To become relevant then, the mission statement somehow must midwife a lifelong education that accurately communicates the core of the regional agenda, and allows the regional players to participate as partners. For that reason, working together with the regional partners, it will not be difficult for the African university to promote interactive research, teaching and training portfolio relevant for all stakeholders' activities.

Nason (2009, 8) argues that unless the university minds the agenda of the local communities, such university is rendered irrelevant. Karani (1991, 76) agrees with the same concept when he says,

> *…however, a few decades ago, the rural population has often tended to view the university as an "Ivory Tower" thus dubbing universities as irrelevant, out touch*

> *with the people's needs and out of step with the reality beyond the universities' walls.*

One way of transforming the society is for the African university to be in step with the peoples' needs. Again Nason (2009, 9) strongly comments,

> *…therefore the local communities will continue to see the university as a distant place; a place of empty rhetoric by some proud and hot-headed intellectuals who have nothing to offer in the practical world. Thus, until very recently, the pursuit of higher education was seen as unimportant as the highly educated became abstract, transcended from the society and unconnected with the real people. To change this picture, the university will need to get closer to the rural people and increase their sensitivity to the communal and societal needs*

There is an increase in literature that constantly is calling for a strong partnernship between the university and the communities. Here in Kenya, the chairman of the Commission for Higher Education CHE (CHE 2008) scored high on this when he said,

> *...to be effected, among the things that need to be done is for universities and stakeholders to forge a partnership in order to develop a knowledge-based orientation that is suited to the situational realities of Kenya.*

Therefore, the regions surrounding the African university must feel the university is articulating their needs, and they are seen as stakeholders who can work together for the sustainable development of the region. This boils down to the fact that there must be some measure of ownership of the African university by the local regions who continuously see the university as a relevant and serious partner in solving their problems for a fast, relevant and sustainable development.

Over the decades the African university has existed, most of the above problems have coexisted with the African university. There should then be a thorough audit of the relevance of the African university vision. We should interrogate the African university's vision to establish whether its mission correctly and relevantly addresses the realities of the

African continent. In the same vein, the African university must be seen to be out to pursue its vision into completion. Thus, for example, we should hear what the African university is willing and planning to do with the perennial famine in Africa, which is responsible for many deaths and depilation of most of the population in Africa. By the virtue of the existence of these many vices, it means the African university's vision has not effectively addressed the realities of Africa.

A workable Mission statement for the African university

D'Souza (2001, 108 – 110) describes the mission statement as a statement that seeks to answer the single question, "Why does your organization exist?" According to D'souza (2001), the answer which otherwise is supposedly to express the mission statement, it should also in a nutshell express the organization's purpose of existence, the tasks done to fulfill the organization's purpose and the organizational culture; that is the core values that show how things are to be done in the organization in pursuance of its mission. D'souza (2001) continues to give the criteria for crafting a good mission statement,

- Enable every person to focus on the existence of the organization
- The mission statement invigorates the stakeholders to work towards adding value and making a difference
- The mission statement is fundamentally the foundation on which all organizational policies, methods, procedures and decisions are based
- The mission statement becomes the starting point for both strategic planning, related operational planning and a roadmap for all implementation
- Finally, the mission statement is critical when evaluating all the institutional objectives

Thus, crafting a relevant mission statement for the African university cannot be done in a haphazard way. It is hard work. In Nason (2011, 3) and Muindi (2011), both decry institutional plagiarism while crafting their mission statements. While condemning the practice of cutting and pasting other institutions' mission statement, D'souza (2001, 108) states that each institution's mission statement must be unique because it is what differentiates the given institution from other similar institutions. Indeed, when mission statements are just cut and pasted, such mission statement become ambiguous, irrelevant and a source of conflicts for the stakeholders. Within such environment, Nason (2011, 4) points out that a mission statement which is ambiguity ridden curtails the strategic planning, decisions and consequently their implementations.

In reexamining its mission and goals, the African university must include the following concerns in order to promote effectiveness in the continent of Africa:-

- The urgency to seek and articulate those relevant values and missions that befit the African university today
- Putting in place strategies that are mission driven to address the challenges in Africa in the 21st Century
- Crafting and applying goals and objectives that enhance the African university responses to the challenges in today's world, which is a rapid changing world.

The mission statement correctly embodies the stated objectives of any organization or institution. However, there is a worrying trend nowadays whereby the stated mission by any institution cannot be used effectively to evaluate the institution's success against its performance. This is because mission statements have merely been reduced to rhetoric statements. Shattock (2007, 4) explains more on the issue of mission statements,

> *One could seek to evaluate university success simply by measuring performance against each institution's stated objectives but experience suggests that mission statements, at least in …universities, have become marketing tools rather than realistic statements of strategic purpose: the once popular slogan 'fitness for purpose' has degenerated under market pressure into rhetoric and exaggeration and is liable to manipulation.*

The African university therefore must come up with a solid mission statement that goes beyond apoplectic rhetoric to mission statements, which are a true embodiment of relevant and measurable objectives that seek to transform the continent. University of Illinois (2002, 28) outlined some objectives that can be used to summarize the mission statement in the African university,

- Enhancement of teaching and research training systems in African university to ensure quality assurance and competitive products who can fit anywhere in the world.
- Adoption and application of the changing technological environment in the African university for faster development.
- Improvement on the governance structures in the African university
- Developing effective strategies that can be employed to mobilize and maximize institutional, local, national, regional, and international resources for higher education in the African university
- Adoption of innovative approaches in African university to enhance sustainable change and development in the in Africa

- Initiation of relevant reforms in higher education in the African university to enhance the promotion of sustainable human development to effectively address the inadequacy of professionals in Africa and meet the changing economic needs
- Develop relevant partnerships among world institutions of higher learning to create educational models that meet the realities of the 21st century in Africa
- Respond effectively to the growing challenges of globalization in Africa
- Recognition and effective use of the rich and wealth of the African intellectual diaspora that more than often builds other parts of the world leaving Africa to wade in underdevelopment and poverty

Very precisely, the African university must have a mission statement that correctly addresses the realities of the continent in order to develop effective objectives that can turnaround the troubling realities in Africa. Through quality teaching and research the African university is capable of developing the needed knowledge and skills that can be applied to the troubling realities of Africa. World Bank (2009:44) is of the same opinion when it correctly asserts,

> *Knowledge has become a key driver of growth and development countries with higher skill level are better equipped to face new challenges and master technological discoveries.*

The 21st Century economy is knowledge driven. In his message during the 6th Exhibition by Kenyan Universities, the current chairman of CHE Prof. Thairu underscored the same thought when he said (CHE, 2008),

> *Universities must view themselves as laboratories for innovation and renovation of the educational system and subsequently the society. In a world where*

> *socioeconomic development is becoming more knowledge intensive, the role of universities imparting higher education is crucial.*

If the African university seeks to be relevantly innovative as part of its mission statement, then some of the sorry realities in Africa would be soon gone cases.

The African university presently struggles with issues of identity; in reality the African university appears to have been built on the foundations and structures transplanted from the West which were the norms during the colonial rule. Thus, the African university has a challenge to shed its colonial-oriented outfit and wear the indigenous outfit, which in essence reflects the African cultural and historical experience (Ekong 2009). Reflecting on the realities of Africa that can correctly by summarized as: corruption, poor governance, poverty, unemployment, ignorance and the severity of preventable tropical diseases; it is then not an exaggeration to claim the critical role to be played by the African university is purely developmental.

The unfriendly realities engulfing the African university

The African university finds itself in overwhelmingly unfriendly socio-economic and socio-political realities (Shattock 2007). With a lot of enthusiasm, the African university was expected to reverse the unfriendly social realities; however at least with research and production of professional, however, the results have remained marginal. Thus this has resulted into a general disenchantment with the anticipated breakthrough of research in the African university (Nason 2009, Ekong 2009). Therefore, the deliveries for the African university have been greatly compromised Tettey (2006) has this to say,

> *An evaluation of higher education in Africa over the last two decades suggests that institutions are beleaguered by a myriad of problems which affect their ability to function as the centers of intellectual excellence that they were conceived to be, and in fact were for quite some time.*

The ability of the African university to effectively function in today's dynamic world as a center for intellectual excellence is indeed found wanting (UNESCO 1998, World Bank 2006). A closer look shows that even the retention of qualified and experienced staff that can positively influence a better output of professionals from the African university is a big problem. To this Tettey (2006, 9) comments,

> *Unfortunately, much of the expertise base of African universities has been eroded to the extent that there is not enough capacity to provide quality training for new generations of citizens. This is due to a variety of factors, including inadequate and non-competitive salaries vis-à-vis local and international organizations, and lack of job satisfaction due to non-monetary reasons… particular fields of expertise. …these are health sciences, engineering, business, economics, and computer/ information science. Previous research suggests that these are the areas most affected by, and vulnerable to, the brain drain and high turnover in African institutions.*

Without a careful analysis of the correct situation of the African university and consequently a holistic transformation that addresses the anomalies facing the African university; very little hope exists in guaranteeing the capacities of the African university (World Bank 2009).

Adequate funding has/is a big issue that explains lack of expansion to solve the problem of inadequate facilities, decaying facilities that need urgent renovation, and the cause for de-motivated staff.

The Strong African University Must Work with the Society

At any rate, the university cannot be successful if it becomes a standalone or an island (Ekong 2009, World Bank 2009, Nason 2009). Today's university must be integrated to the society, and keep the society's needs in focus. Build a strong research foundation by collaborating with the society. For example, the university has facilities, and it can access information with which it can respond to local problems adequately. Through research the university can fulfill its social responsibility to the society and thus remain relevant. True too, the university has specialists who can advice, and participate in research work which will help to turnaround our communities in poverty reduction and development (World Bank 2009, World Bank 2006). Therefore, by working with the community, the university can continue enjoying an effective and mutually useful environment for research for the improvement of the local people's quality of life. Gone are the days when the university existed just like an ivory tower detached from the society; today's university must be integrated to the society, partner with the society and then the university will be able to justify its presence through social services activities (Karani 1991).

Strong African University must appropriate modern technology

According to David (2005) and Obeg (2002), modern technology like the Information and Communications Technology (ICT) has suddenly become responsible for the university's development, overall implementation and support of all the technology-based services that act as the core functions of the modern university (Haddad 2002). Therefore, usage of the modern technology has gone a long way in making the university's communication, administration, learning and teaching very easy. ICT resources accessible to the university include and not limited to: email, telephones, mobile phones, voice mail, SMS, facsimile machines, email, MyUni, Uniplus, eStaff, the internet, e-Services, computers, printers, scanners etc.

Put together, Haddad (2002) and Pelgrum (2001) show that ICT has continued to play a critical role in both learning and teaching; the following is a summary of what ICT can be used to improve education in a university,

- ICT helps to facilitate active learning

- Enhancement of collaborative learning with other universities in the world
- Facilitation of integrative learning which brings together different disciplines
- Evaluative learning that exposes the learner to many different learning pathways in solving problems.

The African university therefore stands to gain a lot if it invests in IT.

Conclusion

The Vision and Mission statement of the African university must be a true reflection of the current and core needs of the African continent. Indeed, the African university must move beyond being rhetorical or merely abstract in their vision mission statement and make their vision and mission statements to be the roadmap for transforming the continent of Africa through their teaching and interactive research. A strong regional partnership and collaboration is fundamental in pushing for the relevance of the African university in transforming Africa. By increasing her capacity to address the local and regional realities effectively through teaching and research; the African university will be on its way to becoming a 'World Class' university. A sure way of maintaining the 'World Class' status, the African university will embark on three essential practices,

- Retention of its experienced, skilled and competent staff
- Continuous development of its staff
- Maintenance of fair and competent admission criterion

These strategies will not only arrest the downward spiral of the African university but they will also propel it to success.

Recommendations

1. The dream of building a strong African University is attainable if only all stakeholders come on board; all actors must aim at integration
2. The architects of the African University should aim high to enhance accountability and equity.
3. Each individual university should have a specialization to avoid duplication
4. There is need for annual appraisal to keep people on their toes.
5. Appropriation of modern technology in learning and teaching should be mandatory for the African University.

References

Blurton, C. (1999). New Diversion in Education: UNESCO's World Communication 1992-2000. Paris: UNESCO, 41-61

David, M. (2005). Three Aspects of ICT in Education. Retrieved January 15, 2007, from http://otec.illeregen.Edu/ICTuo.html.

Haddad, A. and Draxier, C. (2002). Technologies for Education: Potentials, Parameters and Prospects. United Nations,

Ekong, D. (2009) The Future of Universities: From An African Perspective. Scholar-in-Residence, The Ford Foundation Office for South Africa, Johannesburg

Hildreth, P. (2006) Roles and Economic Potential of English Medium-Sized Cities: A

Discussion Paper: SURF: Manchester, p.28-9

Illinois State University (2007) African Universities in the 21st Century. 28th Annual Spring Symposium of the Center for African Studies, University of Illinois. Center for African Studies, University of Illinois, Urbana-Champaign, USA College of Education at the University of Illinois, Urbana-Champaign, USA CODESRIA. http://www.afrst.uiuc.edu

Karani, F.A. (1991). The Role of the University in Rural; Development in Kenya In Chitere O,. Mutiso, R., (Eds) (1991) Working With Rural Communities. A Participatory Action Research in Kenya, Nairobi University Press

Lundvall, B.A., & Johnson, B (1994). The Learning economy. Journal of Industry Studies, 2:23 – 42.

Muindi, B. (2011) Alarm raised over cheating in varsities. The Daily Nation Friday 25th, 2011, p72.

Nason, V. (2009) Strategies to Enhance Access and Equity in Higher Education among the Rural Folks. The 1st KIM Conference on Management. Transforming Higher Education, Opportunities and Challenges

Nason, V. (2011) Enhancing performance in the educational institutions through partnership with the local communities. Keynote Address at a local school in Machakos district, 3rd February, 2011.

Obeng, T.K. (2004). The Practical Application of ICT to Enhance University

Education in Ghana, Hulea University of Technology.

Pelgrum, W. J. (2001). Obstacles to the integration of ICT in education: Results from a worldwide educational assessment. Computer & Education, 37, 163-178.

Shattock, M. (2007). Managing Successful Universities. Open University Press, England.

Tettey, W. J. (2006). Staff Retention in African Universities: Elements of a sustainable Strategy Faculty of Communication and Culture, University of Calgary, Alberta. Sponsored by World Bank, Canada

UNESCO (1998). Higher education in the Twenty first century: Vision and Action. Paris: UNESCO.

World Bank (2006) Tertiary Education (Higher Education), Washing ton DC

World Bank (2009) Sub-Saharan African Education: Tertiary Education in Africa, Washington.

THE INFLUENCE OF COMPUTER TECHNOLOGY ON THE TEACHING AND LEARNING OF SCIENCE IN SENIOR HIGH SCHOOLS WITHIN THE ACCRA METROPOLIS

Rosemary Twum and Paul Dela Ahiatrogah

Abstract

The study was designed to investigate the influence of computer technology on the teaching and learning of science in senior high schools within the Accra Metropolis. The study looked at the skills teachers and students have in computer technology and also how computer technology was used in the teaching and learning of science. The target population for the study was science teachers and students in senior high schools within the Accra Metropolis. Ten schools were selected using random sampling technique. The research design employed was a descriptive survey. The data was collected through the means of a questionnaire, analyzed by the use of frequency tables as well as percentages. Further analysis was done using the t-test. The main findings of the study were that teachers and students did not use computers in teaching and learning. There were also challenges encountered when using computers. The study recommended that professional training should be provided for teachers to equip them with the required IT skills. Curriculum planners and developers should revise the science curriculum to reflect the integration of computers in the classroom.

Keywords: Computer technology, hardware, software, computer literacy, technology integration

Introduction

The purpose of the study was to find out the extent to which teachers and students were influenced by computer technology in the teaching and learning of science. Due to the misunderstanding of the methods of science, many pupils experience difficulty in science. Various approaches have been used to introduce students to the processes by which scientists find answers to questions about the natural world (Carpi & Egger, 2008).

According to Roschelle, Pea, Hoadley, Gordin, & Means (2000), the use of computer technology in science classes is one promising application of computers as learning and teaching tools. Science seeks to develop skills of investigation, reflection and analysis, to generate or refine knowledge, to find solutions and to pose problems. Increasing the understanding of science studied and the development of higher level reasoning skills such as these are central to reform directions in science education (Bybee & DeBoer, 1994). It offers students a very important resource for learning the concepts and processes of science through simulations, graphics, sound, data manipulation, and model building. These capabilities can improve scientific learning and facilitate communication of ideas and concepts (NSTA, 1999).

The National Commission of Excellence in Education (1983) states that only a few students come out of high school with an understanding of, or capability to use science. The committee reported that majority of students develop fear or dislike for science and therefore are unlikely to further their study in science. The West African Examination Council (WAEC) Chief Examiner's Report on science 2004 revealed that students performed badly because they lacked understanding of the requirement of questions, which also showed that they did not even grasp the basic concepts. Modern science concepts have the particulate nature of matter at their core. Scientists explain most phenomena in terms of atomic and molecular models.

Computers would create a format for students to increase their interest in science as well as make it much easier for them to grasp basic concepts. In the light of the above, Yushau (2006) submits that computers have been used in education for more than four decades, and they have been "unconditionally" accepted as an integral part of educational system. Science is important for the growth and development of every society and it should be fun to learn. However it appears students have difficulty in learning science. Dashielle

(1983) reports that about half of all students do not like science by the end of third grade. If students are asked at the secondary level to tell you about science, their usual reply is that science is boring and so difficult to grasp.

One question that science educators would naturally ask is whether the integration of ICT has had any significant impact in the science classroom. Therefore, the study seeks to investigate the influence of computer technology on the teaching and learning of science in senior high schools in Accra Metropolis.

Research Questions

The following research questions guided the study:

1. What skills do teachers and students have in computer technology?
2. How are computers used in the teaching and learning of science?
3. What are the challenges encountered in the use of computers for the teaching and learning of science?

Hypothesis

The following hypotheses were tested:

1. There is no statistically significant difference between teachers and students' skills in computer technology.
2. There is no statistically significant difference between teachers and students in the usage of computers in science.

Methodology

The research design adopted for this study was a descriptive survey. It had the merits of producing more information about the present needs which were characteristics of the research problem. The study described conditions that may exist by recording, analyzing and interpreting data according to research questions generated in the study.

Population and Sampling

The target population for the study was all science teachers and students in the senior high schools in the Accra Metropolis of Ghana. For the purpose of the study, ten schools in the Accra Metropolis were randomly selected. These were Teshie Presbyterian Senior High School, Accra Senior High School, Christian Methodist Senior High School, Holy Trinity Senior High School, O'Reilly Senior High School, Ebenezer Senior High School, Accra Girls Senior High School, Labone Senior High School, Nungua Senior High School and La Presbyterian Senior High School.

Research Instrument

There were two sets of questionnaires, one for the science teachers and the other for science students. The researcher designed the questionnaires by looking at the literature review and gathering appropriate questions that needed to be asked.

Piloting Procedure

There was a pilot study, which preceded the main study. Out of the 20 senior high schools, 10 were randomly selected as the sample size, whilst the 21st senior high school was used for the pilot study. A small sample, which consisted of 7 teachers and 15 students, were selected and the respondents requested to respond to the questionnaire. The Cronbach alpha coefficient for the pilot study was determined to be 0.71 and 0.75 for teachers and students respectively.

Data Analysis

Descriptive statistics were adopted for presenting and analysing the data in this thesis; the researcher summarized patterns in the responses from the sample by the use of frequency tables and percentages. The data collected from the closed ended items was analyzed using the Statistical Package for Social Sciences (SPSS) version 12. The independent samples t-test was used to compare the mean scores for the data provided by the teachers and students. This was done to test the two (2) hypotheses formulated to guide the study

Results and Discussion

Research Question 1: What skills do teachers and students have in computer technology?

This question deals with the skills teachers and students have in computer technology. The result of the analysis is presented in Tables 1, 2, 3 and 4.

The information gathered in respect of skills in the usage of computers is shown in table 1

Table 1: Skills in usage of computers

	Teachers		Students	
Skills in computers	Frequency	Percent (%)	Frequency	Percent (%)
Yes	34	72.3	247	82.3
No	13	27.7	53	17.7
Total	47	100	300	100

Table 1 shows that 34 (72.3%) teachers had skills in using a computer and 13 (27.7%) did not, while 247 (82.3%) students claimed they had skills in using a computer and 53 (17.7%) did not. This shows that most teachers and students have skills in computer usage.

Skills that respondents have are presented in Table 2.

Table 2: Skills used most

	Teachers		Students	
Activity	Frequency	Percent (%)	Frequency	Percent (%)
Programming	1	2.9	21	8.5
Create and maintain my own website	0	0.0	21	8.5
Internet use	1	2.9	64	25.9
Keyboard typing	18	52.9	85	34.4
Graphic design	0	0.0	23	9.3
Word processing	0	0.0	15	6.1
Spreadsheet software	14	41.2	18	7.3
Total	34	100	247	100

Table 2 provides information on 18 (52.9%) teachers reported keyboard typing as the skill used most and only 1 (2.9%) teacher viewed programming and the Internet was used least. But 14 (41.2%) teachers used spreadsheet software. It also shows that 85 (34.4%) students felt keyboard typing was the skill used most while surprisingly 15 (6.1%) believed that Word processing was used least. Sixty-four (25.9%) students used Internet and 23 (9.3%) students used graphic design. Twenty-one (8.5%) students used programming and creating or maintaining their own website.

Research Question 2: How are computers used in the teaching and learning of science?

This question deals with how computers are used in school.

The information gathered in respect of the computer usage in teaching and learning is presented in Table 3.

Table 3: Computer usage in teaching and learning

	Teachers in teaching		Students in learning	
Computer use	Frequency	Percent (%)	Frequency	Percent (%)
Yes	9	26.5	204	82.3
No	25	73.5	43	17.7
Total	34	100	247	100

It is clearly seen from table 3 that 25 (73.5%) teachers did not use computers in teaching while 9 (26.5%) did and 204 (82.3%) students used computers in learning while 43 (17.7%) of them did not. The way in which the computer is used is presented in table 4.

Table 4: Improvement in teaching and learning through computer use

	Teachers		Students	
Ways	Frequency	Percent (%)	Frequency	Percent (%)
Research	3	33.3	134	63.8
Attitude and motivation	6	66.7	21	10.0
Become independent	0	0.0	18	8.6
Creativity	0	0.0	35	16.7
Total	9	100	210	100

The data analyzed in table 4 depicts that 6 (66.7%) teachers found attitude and motivation improved learning through using the computer. Only 3 (33.3%) of the teachers found computers had helped to improve their ability to research. Computers did not help improve becoming independent and creativity. One hundred and thirty-four (63.8%) students felt that computers had helped to improve their ability to research. Thirty-five (16.7%) students believed that creativity improved learning through the computer and 21 (10.0%) students found attitude and motivation as improving learning through computers use. Information concerning computer usage in teaching science is shown in Table 5.

Table 5: Computer usage in teaching science

Computer use	Frequency	Percent (%)
Finding and comparing info	2	22.2
Scoring and testing students	1	11.1
Presenting of course content	3	33.3
Use drawings, graphs and images	3	33.3
Total	9	100

As indicated in Table 5, 3 (33.3%) teachers used computers to present course content as well as for drawings, graphs and images. Only 1 (11.l %) teacher used computers to score and test students. The data in respect of computer usage in learning science is reflected in Table 6.

Table 6: Computer usage in learning science

Computer use	Frequency	Percent (%)
Analyze data	15	7.1
Create graphs	8	3.8
Simulations	6	2.9
Internet search	47	22.4
Do not use computers	134	63.8
Total	210	100

It is clearly seen from Table 6 that 134 (63.8%) students did not use computers in science. Six (2.9%) students felt that they used simulations in science. Forty-seven (22.4%) students used the Internet in science and 15 (7.1%) of them analyzed data through computers to use in science. However, 6 (2.9%) students used simulations in science.

The results of this question suggest that about twenty-seven percent of teachers used computers in teaching while about eighty-two percent of students used computers in learning. The technology used most in teaching and learning was the Internet.

Research Question 3: What are the challenges encountered in the use of computers for the teaching and learning of science?

This question deals with the challenges in using the computer. The information gathered in respect of the challenges in computer usage is analyzed in Table 7.

Table 7: Challenges in computer usage

	Teachers		Students	
Challenges	Frequency	Percent (%)	Frequency	Percent (%)
Lack of confidence	2	22.2	29	13.8
Lack of comfort	0	0.0	46	21.9
Using keyboard and mouse	2	22.2	13	6.2
Takes time away from other activities	5	55.6	86	41.0
Technical problems	0	0.0	5	2.4
Others	0	0.0	31	14.8
Total	9	100	210	100

The information presented in Table 7 shows that 5 (55.6%) of the teachers indicated that a challenge in computer usage was that it took away time from other activities. Two (22.2%) of them felt lack of confidence in using keyboard and mouse as a challenge. Eighty-six (41.0%) of the students indicated that a challenge in computer usage was that it took away time from other activities while 5 (2.4%) of them felt technical problems was a challenge. Forty-six (21.9%) of the students found lack of comfort as a challenge and also 29 (13.8%) felt lack of confidence as a challenge in computer usage. Thirty-one (14.8%) students felt they did not have enough time to use the computer, not knowing how to use computers properly, not having enough computers, power failure, lack of funds for software and hardware, theft, computer viruses, lack of funds for training, access to legal software, cost of repairs and maintenance, identity security, funding of computer equipment and fear of technology among teachers.

Testing of Hypotheses

In order to test hypotheses 1 and 2, the sample size, mean and standard deviation as well as the mean difference and t-value were computed to compare the means between the two groups; teachers and students.

Hypothesis 1

Ho: There is no statistically significant difference between teachers and students' skills in computer technology.

This hypothesis sought to explore whether or not there is a difference between teachers and students in their skills in computer technology. The independent samples t-test was used in order to find out whether there is a statistical difference between the teachers and students in their skills in computer technology. Table 8 gives an account of the t-value of the two groups.

Table 8: The T –Test Value for the Independent Groups

Category	N	Mean	SD	Mean Difference	t	p
Teachers	34	1.26	0.45	0 .13	1.64	0.267
Students	247	1.13	0.34			

Table 8 shows whether the respondent has skills or not in the usage of computers. It is observed that there was a mean difference of 0.13 with values of t 1.64, $p > 0.05$, therefore, there is no statistically significant difference between the groups, so the null hypothesis is accepted.

The category-type related difference in skills was explored using the t-test to test whether there is a significant difference between the means of the two categories. Table 9 reports the categories of differences.

Table 9: Means of teachers versus students in the skills of respondents

	Teacher		Student				
Scale	Mean	SD	Mean	SD	Mean Difference	t	p
Skills	7.71	1.09	7.53	0.91	0.18	0.90	0.374

Table 9 provides means and standard deviations of teachers and students in their skills obtained. The mean differences between the two groups are very small.

It was found that there was a mean difference of 0.18 with values of t 0.90, $p > 0.05$, therefore, there is no statistically significant difference between the groups, so the null hypothesis is accepted.

Hypothesis 2

Ho: There is no statistically significant difference between teachers and students in the usage of computers in science. This hypothesis sought to explore whether or not there is a difference between teachers and students in their usage of computers in science. Table 10 depicts the t-value of the two groups.

Table 10: The T –Test Value for the Independent Groups

Category	N	Mean	SD	Mean Difference	t	p
Teacher	9	1.56	0.66	0.37	2.10	0.310
Student	204	1.18	0.69			

It is observed in Table 10 that there was a mean difference of 0.37 between the two groups.

It is observed that there was a mean difference of 0.37 with values of t 2.10, $p > 0.05$, therefore, there is no statistically significant difference between the groups, so the null hypothesis is accepted. The category-type related difference in perception was explored using the t-test to check whether there is significant difference between the means of the two categories. Table 11 reports the categorical means in the use of computer technology in science education.

Table 11: Means in computer use in science education

Scale	Teachers Mean ± SD	Students Mean ± SD	Mean Difference	t	p
Ways in computer use	2.00 ± 1.23	3.39 ± 2.38	1.39	3.15	0.009*
Computers in science	3.89 ± 1.17	4.10 ±1.34	0.21	0.52	0.614

Table 11 provides means and standard deviations of the use of computer technology in science education of teachers and students. The mean differences between the two groups are very small.

From the study, the way teachers used computers is significantly ($p < 0.05$) different from the way students use computers. Statistically, there is no difference ($p > 0.05$) in computer usage in science for both teachers and students.

Discussion

The results of this study suggest that most teachers and students had varying skills in the use of the computer. Professional development is necessary to help teachers learn not only how to use new technology but also how to provide meaningful instruction and activities using technology in the classroom (Ringstaff & Kelley, 2002). Teachers need in-depth, sustained assistance not only in the use of the technology but also in their efforts to integrate technology into the curriculum. Teachers also need embedded opportunities for professional learning and collaborating with colleagues in order to overcome the barrier of time and teachers' daily schedules (Kanaya & Light, 2005). Professional development not only motivates but it also helps teachers to keep up to date with new and effective practices in teaching and learning. However, substantial and effective professional development is rare, and many teachers naturally gravitate towards the more familiar methods they remember from their own experience as students (Sparks, 1998).

Students must acquire some form of mastery in being able to use a word processor, manipulate a spreadsheet, know what a database does, be able to use e-mail, and know how to browse the World Wide Web (WWW) in order to be computer literate (Stoll, 1999). Basics should also include performing computer operations such as using the keyboard and mouse, turning the computer on and off, opening computer applications, minimizing and closing windows as well as managing files and folders. Once these skills are mastered then students should be able to use the computer to conduct library and Internet research, to create and edit reports and presentations as well as communicating with others.

Computers used as laboratory tools may offer a fundamentally new way of aiding students' construction of science concepts (Mokros and Tinker, 1987). Computers present many new and exciting functions in science teaching that help students actively construct their science understanding from data they collect in laboratory settings. But it is important to note that computers by themselves will not develop an environment that will allow students to explore concepts. Teachers should use computer systems to access, generate and manipulate data and to publish results. Teachers apply computers and related technologies to support instruction in their grade level and subject areas. Students use telecommunications to collaborate, publish, and interact with peers, experts, and other audiences. Students should use technology to locate, evaluate, and collect information from a variety of sources. And also, students employed technology in the development of strategies for solving problems in the real world (ISTE, 1992).

The results also show that the teachers and students faced challenges and problems in the use of computers for the teaching and learning of science. These include unreliable Internet access in schools that had connectivity because the server was often down or due to power failures. Other problems were large class size, lack of adequate funding, lack of technical experts in schools who can deal with maintenance issues and resolve problems such as viruses and other technical problems as well as lack of professional training in ICT-integrated teaching. In Nigeria, similar problems in the use of ICT for teaching and learning were identified (Aladejana, 2007).

Summary, Conclusion and Recommendations

Summary of the Study

The research aimed at finding out the influence of computer technology on the teaching and learning of science in senior high schools in the Accra Metropolis. Forty-seven teachers and 300 students filled the questionnaires. The results of the data analysis provided a number of findings with respect to the influence of computer technology on the teaching and learning of science at the senior high school level. These are:

1. Teachers and students had basic skills in using computers.

2. Most teachers did not use computers in teaching, but those who did used them to supplement textbooks, develop lesson plans and to make learning fun. Most students did not use computers in learning, but those who did, used them to analyze data, create graphs, for simulations and to search the Internet.

Conclusion

The study showed that most teachers and students were not using computers in science and there were some challenges encountered in the use of computers.

Recommendations

The following recommendations were made.

The government should bring out policies to take care of issues involving class size, funding, provision of computer technologies in schools and the addition of more computers. The Minister of Education should contribute by organizing more workshops and seminars in order for teachers to be trained in using ICT to be equipped with the required skills in order to teach science in senior high schools. ICT-integrated activities should be integrated into the science course.

References

Aladejana, F. (2007). Complex Systems. The Implications of ICT and NKS for Science Teaching. Nigeria. Complex Systems Publications, Inc.

Bybee, R. W. & DeBoer, G. E. (1994). Research on goals for the science curriculum.

In Gable, D. L. Handbook of research on science teaching and Learning. New York. Macmillan.

Carpi. A & Egger, A. E., (2008). The Practice of Science: An Intro-duction to Research Methods, Vision learning. Vol. POS-2 (1). http://www.visionlearning.com/library/module_viewer.php?mid =148

Dashielle, D. (1983). Math/Science Education: Starting the Long Road Back. Education Special Issue, 150. USA.

International Society of Technology Education (ISTE) Accreditation Committee (1992). Curriculum Guidelines for Accreditation of Educational Computing and Technology Programs. Eugene, Oregon. ISTE.

Kanaya, T. & Light, D. (2005). Duration and relevance of a professional development program: Using Intel Teach to the Future to illuminate successful programmatic features. Presented at Society for Information Technology and Teacher Education International Conference 2005. Norfolk, A. AACE.

Monkros, J.R. & Tinker, R.F. (1987). The impact of microcomputer based-laboratories on the children’s ability to interpret graphs, Journal of Research in Science Teaching, 24(4), pp 369-383.

National Commission on Excellence in Education. (1983). A Nation at Risk: The Imperative for Educational Reform. Washington, DC.

National Science Teachers Association (NSTA). (1999). The use of computers in Science Education. United States.

Ringstaff, C., & Kelley, L. (2002). The Learning Return on Our Educational Technology Investment. San Francisco. West Ed.

Rochelle, J. M., Pea, R. D., Hoadley, C. M., Gordin, D. N., & Means, B. M. (2000).

Changing how and what children learn in school with computer-based technologies. The Future of Children, Children and Computer Technology, 10(2), 76-101

Sparks, D. (1998). Using technology to improve teaching and staff development: An interview with Kathleen Fulton. Journal of Staff Development, 19(1), pp 18-21.

Stoll, C. (1999). High-Tech Heretic: Why Computers Don’t Belong in the Classroom and other reflections by a Computer Contrarian. New York. Doubleday.

The West African Examinations Council. (2004). WAEC Chief Examiner’s Report.

Yushau, B. (2006). Computer attitude, use, experience, software familiarity and perceived pedagogical usefulness: The case of mathematics professors. Eurasia Journal of Mathematics, Science and Technology Education, 2(3), pp 1 – 7.

FACTORS THAT INFLUENCE UNDERGRADUATE STUDENT MOBILE LEARNING ACCEPTANCE A SYNTHESIS OF THE RESEARCH

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Abstract

With the rapid development of mobile technology, more people are getting access to increasingly sophisticated forms of technology and are becoming more comfortable with these technologies. While access to mobile technology is improving, research on mobile learning is still emerging. In higher education, students' acceptance and use of mobile tools for learning varies widely. Some students still prefer traditional ways of learning (i.e. classroom settings, paper and pen). Others adopt mobile learning, or more generally, technology integrated in learning actively. Given these differences, this paper explores whether mobile devices increase the frequency for learners to learn. And the additional question is what factors influence mobile acceptance. In the context of higher education, this research is significant for those designing and delivering mobile learning since it helps us better understand target audience. This presentation builds on and contributes to work in mobile learning, and mobile learning in higher education. The Unified Theory of Acceptance and Use of Technology (UTAUT) Model and the Technology Acceptance Model (TAM) as theoretical lenses, will be introduced to conduct a critical synthesis of the literature on mobile learning in higher education.

Introduction

Researchers have investigate determinants of acceptance, intention to use, as well as actual use of technology in higher education for several decades. The initial adoption theory in higher education is the Technology Acceptance Model (TAM). With the development of the theories, Unified Theory of Acceptance and Use of Technology (UTAUT) are now more used in research on mobile learning acceptance (Tibenderana and Ogao, 2008;

Williams, 2009). This literature review discusses both TAM and UTAUT, which are going to be used to answer research questions.

The following literature review begins with the introduction to mobile learning. Definition, development of mobile learning, and mobile learning in higher education will be stated. Then, I will carefully introduce Technology Acceptance Model (TAM), TAM2, and Unified Theory of Acceptance and Use of Technology Model (UTAUT), which provide theoretical support of students' acceptance to mobile learning.

Mobile Learning

Introduction to Mobile Learning

Mobile learning is a method of using mobile technologies and devices to deliver and assist curriculum-related products. Kukulska-Hulme and Traxler (2007) elaborated three fundamental characteristics, which are important in understanding Mobile Learning. They considered M-Learning as ubiquitous, pervasive, and ambient. This method utilizes ubiquitous tools and technologies, such as blog and streaming media, and is particularly popular in educational settings. Mobile Learning is pervasive due to the way people have adapted to the technologies in every aspect of daily life. Mobile learning is ambient because it "surrounds us completely, perhaps as natural as the air we breathe" (Kukulska-Hulme & Traxler, 2007, p. 33).

It's hard to find a universal definition for Mobile Learning since different scholars or learners hold different thoughts from various perspectives. However, the key principle to Mobile Learning is Anytime, Anyplace learning (Alexander, 2004; Lee & Chan, 2007; Liu, 2006; Liu & McCombs, 2009).

The problem of lacking a universal definition for Mobile Learning is also discussed by Lee and Chan (2007). They then developed a set of seven major attributes, which can be used to describe mobile learning. They concluded that Mobile learning must be spontaneous; the learning process through mobile learning must be portable; it should allow self-directed learning; it is ubiquitous; it is informal; it is pervasive; and it is a contextual learning. These seven key attributes although not the standard definition of Mobile Learning, they have covered a lot of other scholars' ideas of what mobile learning is all about (Lee and Chan, 2007; Ha and Jie, 2009).

Although what has been stated above almost provided clear elements in defining mobile learning, some other definitions describe M-learning as an extension of E-Learning. In some way, Mobile Learning can be another branch of E-Learning, but it at the same time doesn't depend on E-Learning. It stands on its own since it requires particular technological and pedagogical paradigms.

Technology is one of the most important factors in Mobile Learning. Network connection, device functionality and interface, educational or instructional product design features are all the factors influencing mobile learning experience. Moreover, composed of content, curriculum design, and student learning styles, pedagogy plays a vital part in M-Learning as well. Those components in pedagogy buckle together and influence each other when one changes. Content and curriculum should be designed in the consideration of students' learning styles in order to achieve better delivery of educational experience (Muir, 2001).

Development of Mobile Technology

With a basic idea of mobile learning in mind, there are two main factors that make mobile learning possible and popular. The first one is the rapid development and advances in mobile digital technology and wireless networks. The second one is that technology makes mobile devices more affordable to average person (Caudill, 2007).

Information technology, which is used in education, business and leisure, has become more "personalized, user-centered, mobile, networked, ubiquitous, and durable"

(Motiwalla, 2005, p. 585) through development in wireless and mobile handheld technology. Individuals are now able to access the Internet using their smart phones and other handheld devices using WiFi. WiFi refers to a local area network that uses radio signals to transmit and receive data over short distances to connect to the Internet. Many handheld mobile devices now have their own storage capabilities and wireless access to the Internet (Schwabe & Goth, 2005). This has reduced the need for portable storage like flash drives and CD's. Wireless mobile devices use a network interface card (NIC) to connect to a network and enable wireless data and voice communications (Avraamidou, 2008).

User preference for mobile devices is leading to increased services for mobile information, learning, and knowledge sharing opportunities in libraries and education (Hahn, 2008). Recent literature shows the interest in and the use of mobile learning as a main trend in education (Kukulska-Hulme, 2007; Naismith, Lonsdale, Vavoula, & Sharples, 2004). Research in mobile technology is diverse. Osaka Jogakuin College in Japan became the first educational institution to provide mobile learning devices (i.e. iPods) to their students to assist in English learning (McCarty, 2005). This success was soon followed by the Duke initiative to provide all first year students with iPods (Belanger, 2005). While providing students with these devices and learning content was successful for Duke, research has not determined whether college students will accept using mobile devices for communication between instructors and classmates. Students considered the lack of control over when and where communication occurred with instructors and classmates as a disadvantage. Students expressed a desire to control and maintain a boundary between academic and personal life by limiting cell phone communication to things like texting (Croop, 2009).

Mobile Learning in Higher Education

A broader idea of mobile learning discussed above provides us with a general picture of this area. Thus, in order to answer our research question, we need to talk about mobile learning in a certain context, higher education. Kim et al., (2006) state that it is the earliest stage that higher education in United States investigates the field of mobile learning. On the educational level of investigative focus, Franklin et al., (2007) finds most of the studies and surveys conducted to be within elementary and secondary students in United States.

Kukulska-Hulme (2005) suggests the first task that should be considered in the process of design teaching and learning in a new paradigm is the student audience. In mobile learning, Jones et al., (2007) indicates that it is also important to collect data on the learners' use of technology that would enable a mobile platform. In United Kingdom, Lubega, McCrindle, Williams, Armitage, and Clements (2004) conduct several brainstorming focus groups to acquire information about learners' attitude toward the use of mobile devices in educational settings. The findings are helpful to tailor mobile learning so that instructions will be successfully implemented. Kukulska-Hulme (2005) highly encourages that having a clear picture of users' preference is necessary in the field of mobile learning.

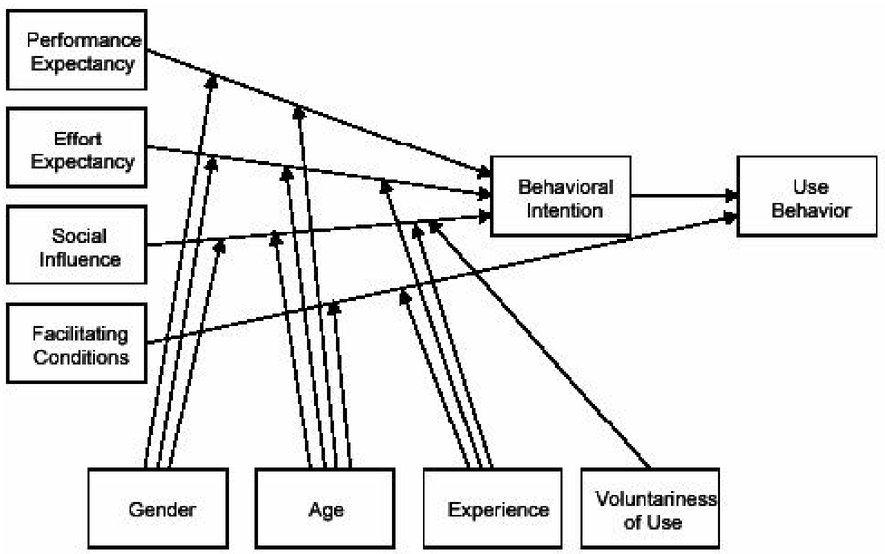
Models

Mobile technology studies have examined perceptions and attitudes toward mobile learning (Ally and Stauffer, 2008; Croop, 2009; Fozdar and Kumar, 2007) as a means to support language acquisition (McCarty, 2005), increase student engagement (Stead, 2005) and access for learning (Aderinoye, et al., 2007), as a tool to extend audio discussions (Wei, Chen, and Wang, 2007), and to support instructor-student and student communication (Cavus, Bicen, and Akeil, 2008). However, there is little research using technology acceptance theory as a basis to identify determinants for student use and usage of handheld mobile devices in academic settings.

Unified Theory of Acceptance and Use of Technology Model (UTAUT)

Definition

UTAUT model is developed to explain intentions to use an information system and subsequent usage behavior. This model consists of four key elements, Performance Expectancy, Effort Expectancy, Social Influence, and Facilitating Conditions, which will directly influence usage intention and behavior (Venkatesh et. al., 2003). They also suggested that Gender, Age, Experience, Voluntariness of Use would serve as control variables indirectly to impact usage intention and behavior aligns with the four key elements.



Key Constructs and Their Relationship with Mobile Learning

Performance Expectancy. Performance Expectancy is defined as how a person believes technology will benefit him/her from job performance. UTAUT suggests that Performance Expectancy is the strongest predictor, which indicates individuals' Behavioral Intention of using information technology. According to previous research, Performance

Expectancy and Behavioral Intention will be lead by Gender and Age, which means that Performance Expectancy has stronger moderate effect on male and younger people (Morris & Venkatesh, 2000).

Performance Expectancy and Mobile Learning. Research shows that Kuwaiti students' intention of using electronic government resources are affected by Performance Expectancy (Alawadhi and Morris, 2008). While Lin, et al., (2004) don't consider performance expectancy as a main factor of students' behavioral intention to use instant messaging on mobile devices. Croop (2009) carried out an experiment using mixed method design to investigate students' attitudes toward mobile learning. Data was collected using UTAUT instrument, focus groups, and interviews. The result shows that part of students in focus group confused of how they could benefit from access to content on a cell phone or PDA.

In another study, which inspects students' perception of mobile access to course content, most of the students report that they agree or strongly agree that using mobile devices to review course content is beneficial. The survey findings revealed that students more prefer using computers as their prime choice to access online course materials, and using mobile devices for supplemental access (Ally & Stauffer, 2008). Different results show that further research is needed to identify the significance of Performance Expectancy as a predictor to predict uses' Behavioral Intention for Mobile Learning.

Effort Expectancy. Effort Expectancy is the ease of how an individual uses an information technology. Previous research shows that constructs associated with Effort Expectancy will be strong determinants of individuals' behavioral intention for women (Venkatesh and Morris, 2000; Venkatesh, Morris and Ackerman, 2000) and older workers (Morris and Venkatesh, 2000).

Effort Expectancy and Mobile Learning. Effort Expectancy will influence individuals' behavior mostly at initial and early stages of mobile use of library or academic content. At the same time, Effort Expectancy is going to decrease when users gain more experience. Moreover, the moderating effect of Gender on Effort Expectancy will be stronger in women than in men. Carlsson, et al., (2006) found in a study on the adoption rates of mobile services that, users intended to use mobile services and devices under a direct and positive effect of effort. In another study, individuals' intension to use information kiosks is significantly affected by Effort Expectancy (Wang & Shih, 2008).

Social Influence. Social Influence is that users perceive whether there are other important factors to influence their belief to use a new information technology. Research reveals that Social Influence is a vital factor in user acceptance of information technology (Davis, 1989; Venkatesh, 2003). Other researches suggest that Social Influence is strongest during initial stages of technology use and decrease over time (Venkatesh, 2003). Besides, UTAUT indicates that Age is a factor, which determines the effect of Social Influence on behavior (Morris, 2000).

Social Influence and Mobile Learning. In the context of mobile learning, Social Influence (instructors, parents, peers, etc.) will strongly impact younger students' intention of adopting mobile devices for academic use. UTAUT also indicates that Social Influence on Behavioral Intention will be more important at initial and early stages of mobile learning. It will decrease over time when users have more experience. Furthermore, Social Influence will be controlled by Gender and Age. For example Social Influence can be strongest to affect women to use mobile devices than men.

There was a research conducted to examine acceptance of E-government services using UTAUT. Alawadhi and Morris (2008) found that peer influence is more important when users have limited experience with a piece of technology, such as mobile devices.

Facilitating Conditions. Facilitating is defined as the “degree in which an individual believes that an organizational and technical infrastructure exists to support use of the system” (Venkatesh, et al., 2003, p. 453).

When Performance and Effort Expectancy are not presented, Facilitating Condition will serve as a predictor of Behavioral Intention. But it will become minimal when Performance and Effort Expectancy are well presented. However, Facilitating Condition is a direct predictor of actual usage of technology instead of Intention Behavior (Venkatesh, et al., 2003). Researches also show that Age and Experience are control factors on Facilitating Conditions. Usage will increase with the experience and age of users (Morris, 2000).

Facilitating Conditions and Mobile Learning. In a study of using pocket PCs to deliver museum tours, 70% of the visitors self-reported spending longer in a tour exhibition, 45% thought the technology is hard to use, especially the older visitors (Proctor & Burton, 2003). This reminds me that without training and support for mobile learning, lack of technology skills can be a potential barrier. Naismith (2004) identifies that in order to increase effectiveness of mobile device use, students and staff training for mobile learning should be conducted as an important component. Concannon, Flynn, and Compbell (2005) also emphasize the importance of providing students with guidance and technical support to facilitate engagement with learning technologies.

Strengths

The main advantage of UTAUT is that it can explain up to 70% of variance of intention (Venkatesh, et al., 2003). Researches indicate that previous technology acceptance models can only successfully predict 30% to 40% of cases of the acceptance of a technology (Meister and Compeau, 2002; Taylor & Todd, 1995; Venkatesh and Davis, 2000). UTAUT emphasizes voluntariness of use and facilitating factors. In addition, UTAUT includes a distinction between mediating and determining factors.

Limitations

Above all, UTAUT is a rather new theoretical framework. Therefore, it requires more research to validate its robustness (Straub, 2009). It also failed to include individual factors such as self-motivation that may help to state technology acceptance and use of mobile devices.

Technology Acceptance Model (TAM)

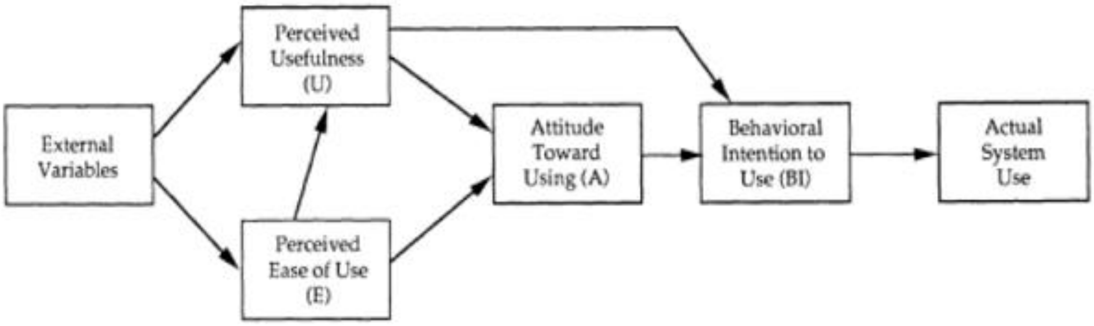
Technology Acceptance Model is developed by Davis (1989) which is an adaptation of the Theory of Reasoned Action (TRA). TAM, UTAUT, and other technology adoption theories or models are developed based on TRA. It helps explain human adoption behavior from a social psychological perspective. Theory of Reasoned Action, developed by Fishbein and Ajzen (1975), is widely used for human behavior research. The objective of this theory is to understand and predict individuals' behavior by evaluating the attitude, behavioral intention, and subject norm. Subject norm means an individual's decision of whether he/she should or should not perform a behavior according to his/her perception of others' beliefs (Davis, 1989; Fishbein and Ajzen, 1975; Sheppard, Hartwick, and Warshaw, 1988; Venkatesh, et al., 2003).

TAM is a more specific model than TRA to predict the acceptance of technology. It also provided feasible modifications in order to make the technology acceptable for users. TAM is one of the most robust technology acceptance theoretic models, as well as the most applied theoretical model (Lee, 2003).

Key Construct of TAM

In TAM, there are two major variables that determine individuals' Behavioral Intention to Use (BI), Perceived Usefulness (U) and Perceived Ease of Use (E). Davis defines Perceived Usefulness as, "the degree to which a person believes that using a particular system would enhance his or her job performance"(p. 320). He defines Perceived

Ease of Use as the "degree to which a person believes that using a particular system would be free of effort" (Davis, Bagozzi, and Warshaw, 1989, p. 320).

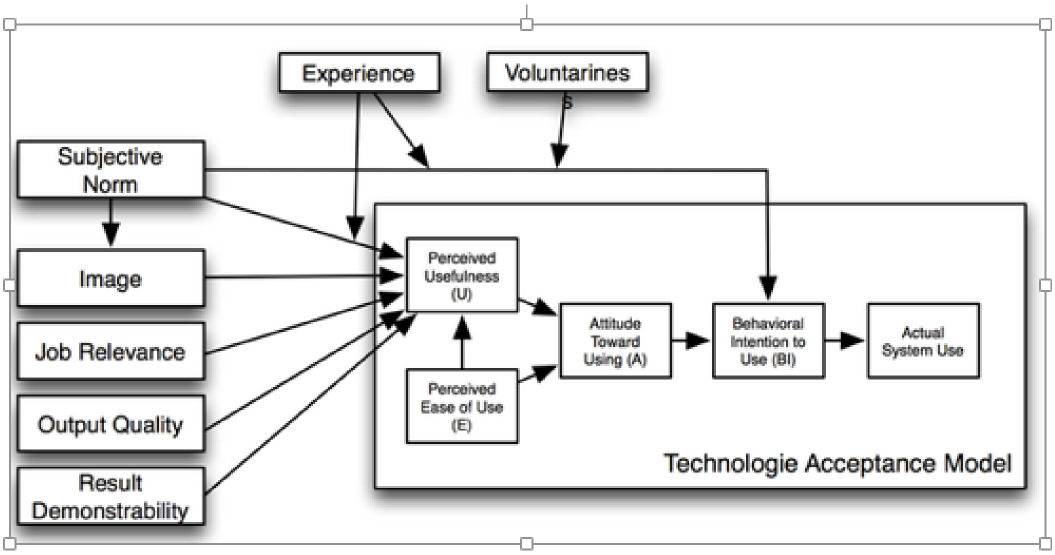


Moreover, TAM theorizes that individuals' Actual System Use is determined by Behavioral Intention to Use. And the relationship between Attitude Toward Using (A) and BI are suggested in TAM that "all else being equal, people form intentions to perform behaviors toward which they have positive affect" (Davis, et al., 1989, p. 986).

Users' beliefs are important since it is normally easier to be changed due to the implementation of interventions such as user training (Davis, 1993; Venkatesh and Speier, 1999). Davis et al., (1989) state that the main goal of TAM "is to provide an explanation of the determinants of computer acceptance that is general, capable of explaining user behavior across a broad range of end-user computing technologies and user populations…" (Davis, et al., 1989, p. 985). TAM suggests that the two primary variables, U and E, are determining factors that influence individuals' acceptance of an information technology.

TAM2

In order to enhance the robustness of TAM, Venkatesh and Davis (2000) modified TAM to consist social influence processes (Subject Norm, Voluntariness, and Image) and cognitive instrumental processes (Job Relevance, Output Quality, Results Demonstrability, and Perceived Ease of Use). Unlike TAM, TAM 2 and UTAUT are distinct from voluntary and mandatory usage. Hartwick and Barki (1994) indicate that usage intentions vary when a change is organizationally mandated. TAM2 also proposed that image will positively influence subjective norm. Individuals believe that use of a technology will increase their social status within a group. Job Relevance is a person's perception of whether a technology is applicable to his or her job (Venkatesh, 2000). TAM2 suggests that users understand themselves the best of what is needed to successfully complete their work. Therefore, this knowledge will offer them with a clear picture of how a technology is helpful to assist them finishing their jobs (Venkatesh, 2000; Moore, 1991).



Summary

Mobile learning is a new and developing teaching and learning platform. With the widely uses of mobile devices, there is only limited research study factors that influence acceptance and use of mobile learning using technology acceptance models. Besides, Hu, Clark, and Ma (2003) also state that although technology usage is increasing in academia, user resistance to technology is considerable.

I select UTAUT and TAM as the theoretical frame in my research. These models not only examine the variables, which affect students' intention behavior to use mobile devices, but also provide fundamental concept for further modification and use.

References

Alawadhi, S., & Morris, A. (2008). The Use of the UTAUT Model in the Adoption of Egovernment Services in Kuwait Paper presented at the Proceedings of the 41st Hawaii International Conference on System Sciences, Hawaii.

Ally, M., & Stauffer, K. (2008). Enhancing mobile learning delivery through exploration of the learner experience. Paper presented at the Fifth IEEE International Conference on Wireless, Mobile, and Ubiquitous Technology in Education.

Avraamidou, L. (2008). Prospects for the use of mobile technologies in science education. AACE Journal, 16(3), 347-365.

Belanger, Y. (2005). Duke University iPod first year experience final evaluation report Retrieved January 12, 2009, from [http://cit.duke.edu/pdf/ipod_initiative_04_05.pdf]

Chien, Y.T. (1997). Digital libraries, knowledge networks, and human-centered information systems. In: Proceedings of the International Symposium on Research, Development and Practice in Digital Libraries (ISDL'97), Tsukuba, Ibaraki, Japan. [http://www.dl.ulis.ac.jp/ISDL97/proceedings/ytchien/ytchien.html].

Concannon, F., Flynn, A., & Campbell, M. (2005). What campus-based students think about the quality and benefits of e-learning. British Journal of Educational Technology, 36 (3), 501-512.

Croop, F. J. (2009). Student perceptions related to mobile learning in higher education. Unpublished Dissertation, Northcentral University, Prescott Valley, Arizona.

Davis, F. D., Bagozzi, R. P., & Warshaw, P. R. (1989). User acceptance of computer technology: A comparison of two theoretical models. Management Science, 35(8), 982-1003.

Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. MIS Quarterly, 13(3), 319-340.

Fishbein, M., & Ajzen, I. (1975). Belief, attitude, intention, and behavior: An introduction to theory and research. Reading, MA: Addison-Wesley.

Franklin, T., Sexton, C., Lu, Y., & Ma, H. (2007). PDAs in teacher education: A case study examining mobile technology integration. Journal of Technology and Teacher Education, 15(1), 39-57.

Ha, L., & Jie Du, H. (2009). Literature trends for mobile learning: Word frequencies and concept maps. International Journal of Mobile Learning and Organization, 3 (3), 275-288.

Hahn, J. (2008). Mobile learning for the twenty-first century librarian. Reference Services Review, 36(3).

Hartwick, J., & Barki, H. (1994). Explaining the role of user participation in information system use. Management Science, 40(4), 440-465.

Jones, A., Issroff, K., Scanlon, E., McAndrew, P., & Clough, G. (2007). Affective factors in learning with mobile devices. Big Issues in Mobile Learning. Nottingham: Learning Science Research Institute at the University of Nottingham. Retrieved April 25, 2007.

Kim, S. H., Mims, C., & Holmes, K. P. (2006). An introduction to current trends and benefits of mobile wireless technology use in higher education. AACE Journal, 14(1), 77-100.

Kukulska-Hulme, A., & Traxler, J. (2007). Mobile learning: A handbook for educators and trainers. New York, NY: Routledge Publishing, Taylor & Francis Group.

Lee, M. J., & Chan, A. (2007). Pervasive, lifestyle-integrated mobile learning for distance learners: An analysis and unexpected results from a podcasting study. Open Learning. 22 (3), 201-210.

Lee, Y., Kozar, K. A., & Larsen, K. R. T. (2003). The Technology Acceptance Model: Past, present, and the future. Communications of the Association of Information Systems (12), 752-780.

Lin, J., Chan, H. C., & Jin, Y. (2004). Instant messaging acceptance and use among college students. Paper presented at the 8th Conference of the Pacific Asia Conference on Information Systems.

Liu, Y. (2006). Delivering education to students: Turning MPS players into learning tools. Texas Distance Learning Association, San Antonio, TX: 2006 TxDLA Conference Paper.

Liu, Y., & McCombos, S. (2009). Podcasting: A Flexible E-Learning Tool. In S. Yuen & H. Yang, (Eds.). Collective Intelligence and E-learning 2.0: Implications of Web-Based Communities and Networking. New York. IDG Publishing.

Lubega, J., McCrindle, R., Williams, S., Armitage, U., & Clements, I. (2004). Uses of mobile phones in higher education. Proceeding of Ed-Media, 2004.

McCarty, S. (2005). Spoken Internet to go: Popularization through podcasting. JALT CALL, 1(2), 67 – 74.

Meister, D. B., & Compeau, D. R. (2002). Infusion of innovation adoption: An individual perspective. Paper presented at the ASAC.

Morris, M. G., & Venkatesh, V. (2000). Age differences in technology adoption decisions: Implications for a changing workforce. Personnel Psychology, 53(2), 375–403.

Motiwalla, L. F. (2005). Mobile learning: A framework and evaluation. Computers & Education, 49(3).

Muir, D.J. (2001). Adapting online education to different learning styles. National Educational Computing Conference, "Building on the Future". Chicago, IL.

Naismith, L., Lonsdale, P., Vavoula, G., & Sharples, M. (2004). Literature review in mobile technologies and learning (No. 11).

Proctor, N., & Burton, J. (2003). Tate modern multimedia tour pilots 2002-2003. Paper presented at the MLEARN 2003: Learning with Mobile Devices, London, UK.

Schwabe, G., & Goth, C. (2005). Mobile learning with a mobile game: Design and motivational effects. Journal of Computer Assisted Learning, 21, 204-216.

Sheppard, B. H., Hartwick, J., & Warshaw, P. R. (1988). The Theory of Reasoned action: A meta-analysis of past research with recommendations for modifications and future research. The Journal of Consumer Research, 15(3), 325-343.

Straub, E. T. (2009). Understanding technology adoption: Theory and future directions for informal learning. Review of Educational Reserch, 79.

Taylor, S., & Todd, P. A. (1995). Understanding information technology usage: A test of competing models. Information Systems Research, 6(2), 144-176.

Tibenderana, P. K. G., & Ogao, P. J. (2008). Acceptance and use of electronic library services in Uganda universities. JCDL.

Venkatesh, V., Morris, M. G., & Ackerman, P. L. (2000). A longitudinal field investigation of gender differences in individual technology adoption decision making processes. Organizational Behavior and Human Decision Processes, 83(1), 33-60.

Venkatesh, V., & Davis, F. D. (2000). A theoretical extension of the Technology Acceptance Model: Four longitudinal field studies. Management Science, 46(2), 186-204.

Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User acceptance of information technology: Toward a unified view. MIS Quarterly, 27(3), 425-478

Wang, Y. S., & Shih, Y.W. (2008). Why do people use information kiosks? A validation of the Unified Theory of Acceptance and Use of Technology. Government Information Quarterly, 26(1), 158-165.

THE INFLUENCE OF MOBILE PHONE TECHNOLOGIES ON SATISFACTION AND PERFORMANCE OF SCIENCE UNIVERSITY STUDENTS IN GHANA

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Abstract

The study was designed to examine the uses of one of the widespread technologies, which is the mobile phone and involved finding out how this technology contributed to learning in a way that enhances self-satisfaction and academic performance of Ghanaian students in public universities. The research design employed was a descriptive survey. Both purposive and convenience sampling techniques was used in selecting the sample size. The target population for the study was students in three selected public universities in Ghana. Three universities out of six were selected because they are the largest public universities in Ghana and they also have relatively good wireless networking. Data was collected and analyzed using descriptive statistics. Eighteen departments out of 35 were selected, so that a larger sample of students filled the questionnaire. Five hundred and three students filled the main questionnaire. Most students were not satisfied in the use of mobile technologies in learning science. Satisfaction had a positive effect on performance. All the science students had access to a mobile phone, but not all of them were using it for academic purposes.
Keywords: Internet, M-learning, mobile phone, smartphone, satisfaction

Introduction

Science gives us a powerful tool for understanding how our world works and how we live and interact with our physical surroundings. The word science is derived from the Latin word scientia, meaning knowledge. Science is usually regarded as difficult because it involves critical thinking. Science seeks to develop skills of investigation, reflection and analysis, to generate or refine knowledge, to find solutions and to pose problems. Increasing the understanding of science studied and the development of higher level reasoning skills such as these are central to reform directions in science education (Bybee & DeBoer, 1994). Recent advances in Information and Communication Technology (ICT) have dramatically increased the potential of mobile devices as educational tools. Due to increases in processing power, memory and connectivity for mobile hand devices have made them more interactive and media-rich than ever before (Pea and Maldonado, 2006).

According to Ally (2009), M-learning can be described as the process of using a mobile device to access and study learning materials to communicate with fellow students, instructors or institutions. The most appropriate mobile device for learners in Africa is a mobile phone and possibilities and latest developments in mobile technologies must be tested against practicality, usability, and cost effectiveness (Brown, 2005). A mobile phone is regarded as a small device which stores contact information, makes task or to-do lists, keeps track of appointments, sets reminders, uses the built-in calculator for simple mathematics, sends or receives e-mail, gets information from the Internet, plays games, sends text messages, features like Bluetooth, camera, radio and integrated devices such as Personal Digital Assistants (PDAs), and MP3 players (www.howstuffworks.com).

Satisfaction deals with teaching method, classroom environment and student workload, discussion groups as well as facilities available on campus. Gulek and Demirtas' (2005) research suggested that when students used mobile devices they spent more time in collaborative work, participated in more project-based instruction, produced writing of higher quality and greater length, gained increased access to information, improved research skills and spend more time doing homework. It also showed that these students directed their own learning, report a greater reliance on active learning strategies, readily engaged in problem solving and critical thinking as well as consistently showing deeper and more flexible uses of mobile phone technologies.

Statement of the Problem

Science is considered to be a complex course as compared to other courses especially since it is mainly about abstract concepts, difficult theories, laws and models therefore making it not that easy to grasp. It is therefore, very necessary to look at technologies, that would make science more interactive and easier to understand. It has been observed that quite a number of university science students have access to mobile phones with internet connectivity, but they do not use it in science learning. Learning with mobile phone technologies has not yet fully grown; it is still in its infancy of implementation, especially in Africa.

Research has been done in North America, Europe, Asia and South Africa and East Africa on mobile learning, but devices such as laptops, Pocket Personal Computers (PC), iPADs, iPhones and PDAs were considered (Ally, 2009; Brown, 2003; Bustos & Nussbaum, 2007; Warschauer, 2011). As far as literature review is concerned there has not been much empirical study done in Sub-Saharan Africa, especially Ghana to identify the current status of the usage of mobile phones in learning.

Research Objectives

This study has the following objectives:

a) Assess to what extent students are satisfied in the use of mobile phones in science learning

b) Investigate whether satisfaction of mobile technologies has an effect on performance in science learning

Methodology

Research Design

The research design adopted for this study was a descriptive survey. It hoped to furnish answers to questions related to whom, what, when, why, and sometimes how (Cooper & Schindler, 2001).

Location of the study

The study was conducted in University of Ghana, University of Cape Coast and Kwame Nkrumah University of Science and Technology. This was because these universities had relatively good wireless network infrastructure, which would facilitate my research process.

Target Population

The population of interest in this study was all 4th year university science students. Fourth year students were used because it was expected that they would have reached some level of proficiency in the use of technologies and would also have gone through a large volume of work, which would warrant the use of a mobile phone.

Below is a tabular representation of the population.

Table 1: Population on universities, departments, lecturers and students

	Target Population	**Sample Size**	**Percentage (%)**
Universities	6	3	50
Departments	35	18	51
Students	1490	503	34

Source: Ministry of Education, 2011

From Table 1, it is observed that there are six public universities of which the researcher chose three as a sample size. There were 35 departments in the three public universities; only 18 departments were selected as a sample size. The targeted population for the three universities was 1,490 students.

Sampling Techniques

Purposive sampling was employed in selecting the three universities because they have good wireless network infrastructure, are highly populated and specialize in the area of Science. In the selection of the six departments, the researcher used the random sampling technique. The technique in choosing student-sample size was convenience sampling because only students that happened to be available at that time and willing to fill the questionnaire were selected in the sample.

Students' Questionnaire (SQ)

This questionnaire used closed ended items. Frequencies for all closed items were tallied and percentages of students' responses computed. Final year science students in each department completed this. This helped to gather information on how students use mobile phones in their learning.

Pilot Study

A group of students and lecturers was selected from University College of Education, Winneba (UEW) to fill the questionnaires for the pilot study. Some amendments were made on the format of questionnaire and the content in general. Their recommendations were incorporated in the final questionnaire so as to enable collection of data that will be valid for analysis.

Validity

Construct and concurrent validation was established through pre-testing study. The validation of the instruments was carried out to check appropriateness of the data collection instruments. The face validity and content validity of the questionnaire were assessed individually by three experts in the field of ICT from University of Education, University of Ghana and also University of Cape Coast. Research supervisors and colleagues were also relied upon to determine whether the questionnaire adequately reflected the concerns of the research (Fraenkel & Wallen, 2000). The responses enabled the researcher to eliminate those items that were not clear and this also ensured construct validity of the research tools. Content validation was carried out to establish the inclusiveness of the items with respect to the variables.

Reliability

Reliability measure demonstrates that the operations of the study such as data collection procedures could be repeated, with the same results (Mugenda & Mugenda, 2003). For the purpose of this study, reliability of the instrument was established through a pilot study, which was taken with students and lecturers from University College of Education, Winneba (UEW). This university was chosen because it has a relatively good wireless network infrastructure and specialize in areas of Science. To test the reliability of the questionnaire, Cronbach's alpha formula was used. A correlation coefficient of 0.7 should be considered high enough to judge the instrument as reliable for the study.

Data Analysis

The completed questionnaires were serially numbered, coded and tabulated with the aid of SPSS-version 17 computer programme. The first stage of analysis involved descriptive statistics, which was adopted for presenting and analysing the data in this paper. The second stage included inferential statistics, which in this case was correlation.

Results and Discussion

Background Characteristics of Respondents

The background characteristics for students were examined in terms of gender, age, name of science programme pursued in university, whether a mobile phone is owned, model and type of mobile phone acquired, the service provider used, the impact of mobile phones in science learning and their GPA's.

The features available on the mobile phone are shown in Table 2.

Table 2: Features available on mobile phone for science learning

	Frequency	Percent
Strongly Agree	18	3.6
Agree	23	4.6
Uncertain	52	10.3
Disagree	397	78.9
Strongly Disagree	13	2.6
Total	503	100.0

Table 2 shows that most 397 (78.9%) students are satisfied with the features available on their phone, although 13 (2.6%) strongly disagree with the features available.

The science application available on the phone is shown in table 3.

Table 3: Science applications available appropriate for my learning

	Frequency	Percent
Strongly Agree	24	4.8
Agree	33	6.6
Uncertain	55	10.9
Disagree	52	10.3
Strongly Disagree	339	67.4
Total	503	100.0

It was realized from Table 3 that 339 (67.4%) students were in disagreement with the science applications available on their phone while 24 (4.8%) of them agreed.

The use of phones to communicate with coursemates is tabulated in table 4.

Table 4: Satisfied with the use of phone to communicate with coursemates

	Frequency	Percent
Strongly Agree	173	34.4
Agree	258	51.3
Uncertain	13	2.6
Disagree	56	11.1
Strongly Disagree	3	0.6
Total	503	100.0

Table 4 reveals that 258 (51.3%) students had agreed that they use their phones to communicate with their course mates while 3 (0.6%) were not satisfied with the use of mobile phones to contact their coursemates.

How students are satisfied with mobile phones expanding their horizon is reflected in table 5.

Table 5: Satisfied with how phones expanded my horizon of knowledge

	Frequency	Percent
Strongly Agree	104	20.7
Agree	142	28.2
Uncertain	47	9.3
Disagree	198	39.4
Strongly Disagree	12	2.4
Total	503	100.0

As observed in Table 5, 198 (39.4%) students did not think mobile phones expand their horizon of knowledge whiles 47 (9.3%) of them were uncertain.

Information concerning how students are satisfied with communicating with lecturers via mobile phones, is shown in table 6.

Table 6: Satisfaction with how phones have increased communication with lecturers

	Frequency	Percent
Strongly Agree	18	3.6
Agree	35	7.0
Uncertain	16	3.2
Disagree	426	84.7
Strongly Disagree	8	1.6
Total	503	100.0

The information presented in Table 6 shows that 426 (84.7%) students did not contact their lecturers via mobile phones, but 35 (7.0%) students used their phones to contact their lecturers.

Obtaining information via mobile phones is presented in table 7.

Table 7: Satisfied with the use of mobile phone technologies in obtaining Information.

	Frequency	Percent
Strongly Agree	53	10.5
Agree	378	75.1
Uncertain	10	2.0
Disagree	46	9.1
Strongly Disagree	16	3.2
Total	503	100.0

The data analyzed in Table 7 depict that 378 (75.1%) respondents obtain information via mobile phones whiles only 16 (3.2%) of them strongly disagree with the statement.

Data concerning interactivity in science learning via mobile phones is analyzed in Table 8.

Table 8: Satisfied with how phones increase interactive science learning

	Frequency	Percent
Strongly Agree	25	5.0
Agree	32	6.4
Uncertain	36	7.2
Disagree	395	78.5
Strongly Disagree	15	3.0
Total	503	100.0

It is clearly seen from Table 8 that 395 (78.5%) students did not believe that mobile phones increase interactivity in science learning and 36 (7.2%) of them were not sure.

Using mobile phones for group discussions and presentations is analyzed in Table 9.

Table 9: **Satisfied with phones being used for student's group discussions and presentations.**

	Frequency	Percent
Strongly Agree	64	12.7
Agree	238	47.3
Uncertain	97	19.3
Disagree	81	16.1
Strongly Disagree	23	4.6
Total	503	100.0

The analysis in table 9 reveals that 238 (47.3%) respondents used their phones for group assignments, but a few of them never used mobile phones for that purpose.

Satisfaction of phones in learning science is presented in table 10.

Table 10: Satisfied with the use of phones in science learning

	Frequency	Percent
Strongly Agree	49	9.7
Agree	66	13.1
Uncertain	26	5.2
Disagree	342	68.0
Strongly Disagree	20	4.0
Total	503	100.0

Table 10 reveals that most 342 (68.0%) students are generally not satisfied with the use of mobile phones in learning. But, 49 (9.7%) agreed that they are satisfied with use of phones in learning science.

Wireless Internet bandwidth and reliability is analyzed in Table 11.

Table 11: Satisfied with bandwidth and reliability of wireless Internet on campus

	Frequency	Percent
Strongly Agree	76	15.1
Agree	184	36.6
Uncertain	66	13.1
Disagree	125	24.9
Strongly Disagree	52	10.3
Total	503	100.0

It is clearly seen in table 11 that majority of students 184 (36.6%) were satisfied with the bandwidth and reliability of the wireless networks on campus. But, a lot of students also believed that the wireless Internet was quite slow and not steady.

Satisfaction of science instructors sending information online is presented in table 12.

Table 12: Satisfied with instructors sending science information online

	Frequency	Percent
Agree	66	13.1
Disagree	437	86.9
Total	503	100.0

It was observed in table 12 that 437 (86.9%) students are not satisfied with lecturers not sending information online. Only a few of them 66 (13.1%) actually received information from their lecturers online.

The use of video podcasts to show science demonstrations is revealed in Table 13.

Table 13: Satisfied with use of science video podcasts to show demonstrations

	Frequency	Percent
Disagree	421	83.7
Strongly Disagree	82	16.3
Total	503	100.0

It was shown in table 13 that none of the students agreed that video podcasts were not used to show demonstrations in science. This might be because most students are not aware that such science videos exist.

Audio recordings used in capturing lecturers and discussions are presented in table 14.

Table 14: Satisfied with the use of audio recordings to capture science lecturers and discussions

	Frequency	Percent
Strongly Agree	64	12.7
Agree	181	36.0
Uncertain	142	28.2
Disagree	90	17.9
Strongly Disagree	26	5.2
Total	503	100.0

Table 14 shows 181 (36.0%) of students used this feature on their phone to capture speech from their science classes. Although, 142 (28.2%) of them were not aware of using this feature on their phone.

The data in respect of total satisfaction in the use of mobile phone technologies in learning is shown in Table 15.

Table 15: Overall Satisfaction

Satisfaction	Frequency	Percent (%)
Agree	8	1.6
Uncertain	159	31.6
Disagree	301	59.8
Strongly Disagree	35	7.0
Total	503	100

Table 15 testifies to the fact that 159 (31.6%) of students were uncertain as to whether they are satisfied with the use of mobile technologies in learning and 301 (59.8%) were dissatisfied with their use in learning. Only 8 (1.6%) were actually satisfied with the technologies being used in learning science.

The information gathered in respect of correlation of satisfaction against performance is reflected in Table 16.

Table 16: Correlation of satisfaction against performance

		Satisfaction	Performance
Satisfaction	Pearson Correlation	1	.497**
	Sig. (2-tailed)		.000
	N	503	503
Performance	Pearson Correlation	.497**	1
	Sig. (2-tailed)	.000	
	N	503	503

**. Correlation is significant at the 0.01 level (2-tailed).

As indicated in Table 16, the Pearson correlation was determined to be 0.497, therefore showing a moderate association between satisfaction and performance. As satisfaction increases, performance tends to also increase.

Discussion

One study revealed that the students can use mobile phones for exchanging useful information with their classmates about their studies, their academic performance has increased due to this technology, improved the level of the quality of education, shared important and useful information with classmates, used dictionary, thesaurus and calculator available in the mobile phone and felt more satisfaction due to mobile phone facilities available, teaching methods and collaborative teamwork with their peers (Muhammad et al, 2011).

Unfortunately, in this study, overall satisfaction for mobile phone technologies in learning was relatively low. This could be due to the fact that students are not aware of the benefits mobile phones can have on their learning and those who are aware are actually not ready to use mobile phones in their learning. Also satisfaction and performance were correlated and it was found out that as satisfaction increases, the performance also increases. This is not a surprise, because generally students who are satisfied in the mobile technologies are more likely to perform better.

Summary, Conclusions and Recommendations

Conclusion

The results of the data analysis provided a number of findings with respect to the influence of mobile phone technologies on satisfaction and performance of science university students in Ghana. It was found with some of the mobile technologies available, most students listened to audio clips as well as watched video clips in learning, conducting research, read science news, books and magazines and also used science dictionaries as well as calculators on their phones. But, most students did not use office applications on their phones. Most students were dissatisfied with mobile phone technologies used in science learning. Satisfaction also had a positive effect on performance.

Recommendations

On the basis of the study’s findings, the following recommendations were made:
A well-resourced mobile learning facility centre needs to be established within the School of Sciences within the universities and courses must be available to train science students on the appropriate use of mobile phones in learning.

Students should be aware that they could download mobile applications in science in order to enhance their learning. For example, free apps for exploring the periodic table or ‘The elements, which include chemical images and information.’

References

Ally, M. (2009). Ed. Mobile learning: Transforming the delivery of education and training. Athabasca University Press. Learning and Skills Improvement Service (LSIS). Quality Improvement Agency. Exmobileence Gateway at http://www.exmobileencegateway.org.uk/ferl.aclearn.page.id958.

Brown, T. H. (2003). The Role of M-Learning in the Future of E-Learning in Africa? Proceedings of 21st ICDE World Conference.

Brown, T. H. (2005). Towards a model for M-learning in Africa. International Journal on E-Learning. 4, 299-316.

Bustos, H. & Nussbaum, M. (2009). An Experimental Study of the Inclusion of Technology in Higher Education. Computer Applications in Engineering Education, 17(1), 100−107.

Bybee, R. W. & DeBoer, G. E. (1994). Research on goals for the science curriculum. In Gable, D. L. Handbook of research on science teaching and Learning. New York. Macmillan.

Cooper, D. R., & Schindler, P. S. (2001). Business Research Methods. (7th Ed) United States: McGraw-Hill.

Fraenkel, J. R., & Wallen, N. E. (2000). How to design and evaluate research in education. 4th ed. USA: McGraw-Hill Company Inc.

Gulek, J.C. & Demirtas, H. (2005). Learning with technology: The Impact of laptop use on student achievement. Journal of Technology, Learning and Assessment, 3(2) available from http://www.jtla.org.

Muhammad, J., Muhammad, A. M., & Aijaz A. G. (2011). Mobile Phone Culture and its Psychological Impacts on Students' Learning at the University Level. Language in India. Strength for Today and Bright Hope for Tomorrow. Vol 11.

Mugenda, O. & Mugenda, A.G. (2003). Research Methods: Quantitative & Qualitative Approaches. Nairobi, Kenya: Acts Press.

Pea, R. & Maldonado, H. (2006). WILD for learning: Interacting through new computing devices anytime anywhere. In Sawyer, K (Ed.), Cambridge handbook of the learning sciences. (pp. 427-442). New York: Cambridge University Press.

Warschauer, M. (2011). Tablet Computers in Education. Eventually Tablets will Facilitate more Personalized and Interactive Learning. Educational Technology Debate – Exploring Learning in Developing Countries.

IDENTIFYING ESSENTIAL LANGUAGE AND LITERACY SKILLS FOR SECONDARY SCHOOLS STUDENTS LEARNING THROUGH THE MEDIUM OF ENGLISH LANGUAGE

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As one of the dominant world languages, English is spoken in five countries as the native language and in numerous other countries—where it is a foreign language—as an official language and the language of instruction. In countries where English is the native language, it is taught to speakers of other languages as an additional language, dubbed English as a second language (ESL), to enable them to participate in all domains of life of the target country. In many countries where it is an official language and language of instruction students tend to use English in specific domains, particularly school, as most communication outside of school is in the local languages. These are two similar though different contexts for enhancing English language skills. In both settings there are concerns about students' difficulties in developing adequate English proficiency to successfully learn content through that medium.

Focusing on the United States and Kenya, this presentation will consider the similarities and differences in the content of English language instruction for secondary schools, in both environments. It will compare the English language teaching standards in the United States with the Kenyan secondary school English language syllabus to consider the similarities and differences in the content of secondary school English language teaching. This comparison will broaden the understanding of what it means to teach English language in the school setting with a view to providing a framework for creating and evaluating teaching and learning materials for speakers of other languages who are learning through the medium of English. A key component of this discussion is recognizing the importance of academic language.

English Language Learners in Kenya and the U.S.A

In the United States English, the term ‘English Language Learners’ is the current referent for students who enter schools speaking languages other than English. They have also been referred to as English as a Second Language (ESL) students and Limited English Proficient (LEP) students, both terms are viewed as unfavorable for many educators of English for speakers of other languages. ‘English language learners’ is the preferred term as it captures the process through which students are evolving. Since most students in Kenya are learning and using English as an additional language, there is not a specific label ascribed to them. However, they are virtually English language learners.

The primary difference between English language instruction in the U.S. and Kenya is that most pupils in Kenya, as English language learners, are collectively introduced to English, as a new language, in Standard One, their first year of schooling. Kenya has 44 indigenous languages, termed mother tongues, and Kiswahili is a lingua franca and one of the official languages. Students begin learning Kiswahili as a subject in Standard One, alongside English. They typically learn English as a subject, while using their mother tongue as the language of instruction during their first 3 years of school. Consequently, when they begin using English as a language of instruction in Standard Four, it is not a new language for them. By the time they reach secondary school, they have had at least 8 years of exposure to English language.

However, despite 5-8 years of instruction in and through English language, many secondary schools struggle with English. Sure and Ogechi (2009) have found that some students are unable to communicate effectively in English; they are largely passive recipients, exhibiting rote learning. Additionally, some teachers have difficulty explaining scientific and mathematical concepts simply and clearly due to their insufficient English lexical resources.

In the U.S. students may enter the school system as English language learners at any grade level, whether or not they have had prior exposure to English. Upon arrival in the U.S., students are typically placed in grades commensurate with their age. Consequently, a newly arrived 14 years old student would be placed in secondary school whether or not she had any prior exposure to English. The ELLs in the U.S. are, however, have very diverse backgrounds, unlike Kenyan students. In a given school they can represent more than 50 different languages and have varying backgrounds in English, ranging from none to several years as a subject, to use as a medium of instruction (e.g. those coming from Nepal).

Primary and secondary school students entering U.S. schools from non-English speaking countries are given an English language placement test when they enter the school system to determine what type of English support services they may need. This test places students at the beginner, intermediate or advanced levels of English proficiency, or determines that they are sufficiently proficient in English and do not need English support services. Teachers who have been certified to teach ELL students provide these support services. In some secondary schools, ELL students, particularly at the beginner and intermediate levels, are placed in sheltered content classrooms. These are classes such as sciences, mathematics, social studies, technology, and English language arts, where all of the students are English language learners. This enables the teachers some of whom may not be ESL trained teachers, to provide language scaffolding to enable the ELL students to understand the subject content. Other schools place students in content classes alongside native English speakers, where the teachers have not had any preparation in teaching ELL students. The ELL students are expected to keep pace with the native English speakers.

Students who have been designated as ELLs based on their performance on the placement test must test out of ELL services by passing an English proficiency test which is administered at the end of each academic year. On this test students can move up a level from beginner to intermediate or advanced, or test at the proficiency level, which means they are no longer eligible for ELL support services. Some students remain at the intermediate level after more than four years of schooling in the U.S. Recently I worked with a 10th grade student who entered school in the U.S. in grade 5 but was still at the intermediate level of English proficiency in 10th grade. She commented to me one day that as she sits in class, sometimes she just feels like crying due to her frustration in being unable to follow and participate in instruction in her content classes.

In both cases, students learn English language and content of other subjects simultaneously. However, unlike in Kenya, in the U.S. students receive English language support services alongside their other subjects. In elementary schools they are pulled out of their regular classrooms for these services, for specified minutes each day, while in secondary schools they have an ESL class for one or two class periods a day. Secondary school students in the U.S, who are learning English as an additional language, typically receive English language support services, beyond their academic subjects.

Once ELL students in the US are classified as beginners, intermediate or advanced in terms of English language proficiency based on their performance on a placement test, they then receive the requisite language instruction to develop the four skills (listening, speaking, reading and writing) along with phonology, vocabulary and syntax. However, the English language support these students receive from the ELL class cannot begin to bridge the gap between what they are expected to know to access knowledge in a secondary school classroom and their English proficiency level. Consequently many ELL students struggle with learning academic content. In the U.S. there are a category of students termed long term English learners. A Long Term English Learner (LTEL) is a student who has been enrolled in U.S. schools for more than six years but is no longer progressing towards English proficiency and is struggling academically (Calderon and Minaya-Rowe, 2011; Freeman and Freeman, 2009). They do not have the English skills needed for academic success. Many of these students have gone though the primary school system and appear fluent in English, but continue to struggle with academic language. Kenyan secondary students who struggle with English could be considered long term English learners.

What Does It Mean to Teach English?

In learning any language, students must be able to manipulate its phonological, syntactic and lexical aspects in order to communicate at a basic level. The specifics of what is taught within each of these categories depend on the purpose for which students are learning the language. In many countries where English is not the native language, students learn English as a foreign language, for enrichment. Most of these students may never use English outside of communicating with English-speaking visitors to their country or reading newspapers and other English texts. Some students may desire to study in English-speaking countries, and need to pass an English proficiency test, such as the Teaching of English as a Foreign Language (TOEFL) assessment, so they would need a more in-depth knowledge of and ability to use English. Within Africa and Asia there are a number of countries that use English as the language of instruction throughout formal schooling. Students in these countries need to access and produce knowledge at varied levels in English. Table 1 outlines the objectives for teaching English in secondary schools in Kenya; they are listed as competencies, which students should demonstrate.

Table 1: Objectives of Teaching English in Kenyan Secondary Schools

Competencies

Listen attentively for comprehension and respond appropriately
Use listening skills to infer and interpret meaning correctly from spoken discourse
Listen and process information from a variety of sources
Speak accurately, fluently, confidently and appropriately in a variety of contexts
Use non-verbal cues effectively in speaking
Read fluently and efficiently
Appreciate the importance of reading for a variety of purposes
Develop a life-long interest in reading a wide range of subjects
Read and comprehend literary and nonliterary materials
Read and analyze literary and non-literary works from Kenya, East Africa, Africa and the rest of the world, and relate to the experiences in these works
Appreciate and respect own as well as other people's culture
Make an efficient use of a range of sources of information, including libraries, dictionaries, encyclopedias and the internet
Use correct spelling, punctuation and paragraphs
Use a variety of sentence structures and vocabulary
Communicate appropriately in functional and creative writing
Write neatly, legibly and effectively

Use correct grammatical and idiomatic forms of English
Think creatively and critically
Appreciate the special way literary writers use language
Appreciate the universal human values contained in literary works

Kenya Institute of Education (KIE)

The list of competencies in Table 1 suggests that the purpose for teaching English at the secondary school in Kenya is to provide students with a general use of the language in all four modalities. Aside from addressing literary skills and language, e.g. “the special way literary writers use language” the objectives address general skills. There is some reference to reading non-literary works, and “a wide range of subjects,” but this does not specify how language is used for instructional purposes.

Cummins (1983, 1984, 2003) has drawn a distinction between what he terms Basic Interpersonal Communication Skills (BICS), language skills necessary for general interaction with their peers, and Cognitive Academic Language Proficiency (CALP), language skills necessary for academic success, those that enable students to access and produce knowledge. He contends that in the United States, English language learners typically develop BICS within 2 – 3 years, while it can take 7 or more years for them to develop CALP. Students in the U.S, even those who speak a language other than English at home with their families, typically develop BICS through interaction with their peers and being immersed in an English-speaking environment through the media and other settings outside of school. Many teachers in the U.S. confuse BICS, which ELL students manifest among their peers, with English proficiency and are therefore confused when these same students have difficulty in their classroom.

In countries outside of the U.S like Kenya, many students do not develop BICS by the time they are required to engage in English medium instruction (Gathumbi, 2008), as they tend to use English only in the classroom. Among their peers most students speak their mother tongue, Kiswahili or Sheng', a combination of the three languages which originated in the urban areas (Momanyi, 2009; Nzunga, 2002). However, many students have also not developed CALP, so they are impeded in accessing content knowledge in the various subjects they are required to study in secondary school (Bunyi, 2008).

While Kenyan language policy addresses the need for BICS, the reality is that Kenyan students have a greater need for CALP. Recognition of these dual needs is manifested in English language standards in the United States, where there is currently a great emphasis on literacy across the curriculum. In Kenya, there are no designated standards for secondary school English, but a secondary school English syllabus which outlines what students are expected to learn at the respective levels of secondary school, from Form 1 to 4. Kioko and Muthwii (2001) have attributed some of the wastage in the educational system in Kenya to the language situation in the country, contending that the language of instruction significantly impacts students' success in other subject areas. Focusing on how language is used in instruction of content subjects could be one means of overtly addressing this situation.

Focusing on Academic Language

Academic literacy is the foundation of school success as it involves a high level of sophisticated language, which becomes increasingly complex as students advance to higher grade levels. Although there is not a commonly agreed upon definition of this term, a common feature of all definitions focuses on how language is used in school to acquire new knowledge and foster success on academic tasks (Bailey, 2007; Gibbons, 2002; Schleppegrell, 2004; Short 2002). Gee (2008) contends that it is the content that gives meaning to the academic language. Students must understand disciplines in a specific language, and how words with multiple meanings are used differently in the respective subject areas. They must also understand the various text structures and the writing requirements of the different disciplines. English teachers, therefore, should help students develop this knowledge and the requisite skills through the integration of language and academic subject content in their teaching. Some of the specific features of academic language are:

- Latin and Greek vocabulary
- Morphologically complex words
- Nouns, adjectives, and prepositions
- Grammatical metaphor, including nominalizations (Nagy and Townsend, 2012, p 93)

Emphasis on teaching academic language to English second language learners in the United States is reflected in the national and state learning standards for teaching English to speakers of other languages. Four of the five English proficiency standards adopted by the Teachers of English to Speakers of Other Languages (TESOL) organization for instruction at the primary and secondary school level where English is the instructional language address academic language of the core areas (See Table 2).

Table 2: TESOL Standards

Standard 1	English language learners communicate for social, intercultural, and instructional purposes within the school setting.
Standard 2	English language learners communicate information, ideas, and concepts necessary for academic success in the area of language arts
Standard 4	English language learners communicate information, ideas, and concepts necessary for academic success in the area of mathematics
Standard 4	English language learners communicate information, ideas, and concepts necessary for academic success in the area of science
Standard 5	English language learners communicate information, ideas, and concepts necessary for academic success in the area of social studies.

Source: Teachers of English to Speakers of Other Languages (2006)

Many of the communication skills which students need are included in the competencies for secondary school students in Kenya, listed in Table 1, but the TESOL standards emphasize "information, ideas, and concepts necessary for academic success" in the respective subject content areas.

One research-based model used in the United States, as well as dozens of other countries (Echevarria, Vogt, and Short, 2013, xi), is the Sheltered Instruction Observation Protocol (SIOP). This model, developed by Echevarria, Vogt, and Short (2000), presents content drawn from multiple subject areas through thematic or interdisciplinary English language units. The SIOP model modifies grade level instruction "to make the information comprehensible to the students while promoting the students' academic English development" (Echevarria, Vogt, and Short, 2013, p. 15).

A key component of the SIOP model is the stating of content and language objectives. This is to enable teachers to focus on the specific linguistic skills students need in order to access the content. Table 3 provides examples of language and content objectives for the primary subject areas.

Table 3: Language and Content Objectives

Subject	Language objective	Content objective
Science	1. Students will orally describe three types of cells to a partner. 2. Students will orally identify similar and distinguishing characteristics of each type of cell	1. Students will produce a visual representation of each of the three types of cells. 2. Students will list similar and distinguishing characteristics of each type of cell in the appropriate columns on the graphic organizer
Social Studies	Students will summarize in writing how geographic features impacted colonial life.	Students will create a map to show how geographic features have affected colonial life
Language Arts	Students will use transitional phrases (e.g., as a result) in writing an expository essay.	Students will be able to draft a conclusion paragraph for their expository essay.
Mathematics	Students will read a word problem and identify the essential information they need to solve the problem	Students will construct the mathematical sentence from the word problem and work out the solution to the problem

These two sets of lesson objectives distinguish between the processing of content and the linguistic skills needed for this processing.

The SIOP model was developed to offer effective instruction for adolescent students learning through the medium of English as a second language. It is premised on the recognition that students whose proficiency in English is not very well developed struggle with learning content in the various subject areas. Teachers need to be cognizant of this and make accommodations in the learning environment while not compromising the integrity of the content being delivered (Williams, 2009). Interdependence between language and academic development becomes increasingly important at the secondary school level and beyond as mastery of advanced level academic skills and knowledge becomes increasingly dependent on advanced level academic language skills (Gibbons, 2003; Short and Fitzsimmons, 2007).

Using the WIDA (World-class Instructional Design and Assessment) standards, a set of English development standards used in many parts of the U.S as an example, table 4 provides an illustration of how language and content can be integrated in the teaching of social English and the four major content instructional areas while differentiating for English proficiency levels. It combines the ELD standard, for ELLS, with the content standards, for all students, and delineates performance indicators by proficiency levels, ranging from beginning (Entering) to advanced level (Bridging).

The entering and emerging levels are equivalent to beginner and early intermediate proficiency. At the developing level, students understand more complex speech but may have difficulty expressing all their thoughts due to a restricted vocabulary and a limited command of language structure. At the developing level, students use simple sentences frequently marked by grammatical errors. Proficiency in reading at this level may vary considerably. At the expanding level, students communicate in English in new or unfamiliar settings but have occasional difficulty with complex structures and abstract academic concepts. Although they may read with considerable fluency, they may have difficulty understanding texts with complex sentence structure or abstract vocabulary and words with multiple meanings. Although they can read independently they may have difficulty with comprehension when processing grade-level information. Students at the bridging level can express themselves fluently and spontaneously on a wide range of personal, general, academic, or social topics in a variety of contexts. They have a good command of technical and academic vocabulary as well as a variety of idiomatic expressions and colloquialisms. They can produce well-structured texts at differing degrees of linguistic complexity (WIDA, 2012). A sixth level-reaching-suggests that the student is sufficiently proficient to handle academic language without scaffolding. For each standard, it is expected that students at all proficiency levels will interact with the designated grade-level words and expressions. Whereas ELL students in the United States are at all five proficiency levels, Kenya educators would need to determine at which levels secondary school Kenyan students might be.

Table 4: Integration of Language and Content for Teaching English

<table>
<tr><td colspan="6">ELD STANDARD 1: Social & Instructional Language
Topic – Collaborative Discussion
Content Standard: Propel conversations by posing and responding to questions that relate the current discussion to broader themes or larger ideas; actively incorporate others into the discussion; and clarify, verify, or challenge ideas and conclusions.</td></tr>
<tr><td></td><td>Level 1: Entering</td><td>Level 2: Emerging</td><td>Level 3: Developing</td><td>Level 4: Expanding</td><td>Level 5: Bridging</td></tr>
<tr><td>Speaking</td><td>Repeat set phrases (e.g., “I agree”, “I disagree”) and use non-verbal communication to propel discussions using sentence frames, word banks, and visuals</td><td>Make statements (e.g., “We can…” “We must…”) to propel discussions using sentence frames, word banks, and visuals</td><td>Paraphrase statements (“We agree that…”) to propel discussions using sentence frames and word banks</td><td>Pose and respond to questions (e.g. “I think we could…”) to propel discussions using sentence frames</td><td>Elaborate on responses to propel discussions using sentence frames (e.g., “I’d like to add to that...”, “Have you also considered...?”)</td></tr>
<tr><td colspan="6">ELD STANDARD 2: The Language of Language Arts
Topic: Bias</td></tr>
</table>

Content Standard: Delineate and evaluate the argument and specific claims in a text, assessing whether the reasoning is valid and the evidence is relevant and sufficient; identify false statements and fallacious reasoning.					
Reading	Locate language associated with fact and/or opinion from visually supported text with a partner using L1 or L2 and word banks (e.g. “I think”, “I believe” v. “data”, “fact”)	Locate language associated with fact and opinion from visually supported text with a partner using word banks (e.g., “70% of Latinos” v. “almost all Latinos”)	Locate language of opinion and bias from excerpts of texts following a model in small groups (e.g. “We as scientists agree…” v. “Scientists everywhere agree…”)	Sort language of bias from texts (e.g. by validity of reasoning/evidence) following a model in small groups	Infer author’s bias from texts in small groups
ELD STANDARD 3: The Language of Mathematics Topic: Right Triangles Content Standard: Understand that by similarity, side ratios in right triangles are properties of the angles in the triangle, leading to definitions of trigonometric ratios for acute angles. Explain and use the relationship between the sine and cosine of complementary angles. Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.					

Writing	Draw and label scenarios for right triangle word problems using illustrated phrase banks	Draw and describe scenarios for right triangle word problems using sentence frames and illustrated phrase banks	Reproduce right triangle word problems using sentence frames and phrase banks	Compose right triangle word problems using textbook models and phrase banks	Compose detailed right triangle word problems using textbook models
ELD STANDARD 4: The Language of Science Topic: Dependent & Independent Variables Content Standard: The investigation may also require student clarification of the question, method, controls, and variables; student organization and display of data; student revision of methods and explanations; and a public presentation of the results with a critical response from peers.					

Speaking	Describe the effects of modifying a variable using illustrated word banks in small groups	Give examples of the effects of modifying a variable using illustrated word banks and sentence frames in small groups	Explain the effects of modifying a variable using sentence frames and graphic organizers in small groups	Discuss the effects of modifying a variable using sentence frames and graphic organizers in small groups	Report on the effects of modifying a variable in small groups
ELD STANDARD 5: The Language of Social Studies Topic: Supply and Demand Content Standard: The student will understand the basic characteristics of markets and the role of prices in modern market economies. 1. Students will describe the determination of equilibrium market prices by applying principles of supply and demand to markets for goods and services. 3. Students will identify several factors that lead to variation in market prices and quantities exchanged by changes in supply and/or demand.					

Listening	Point to key terms related to supply and demand using visuals and bilingual dictionaries with a partner	Select language related to supply and demand to complete graphic organizers using word banks with a partner	Organize information related to supply and demand using graphic organizers in small groups	Identify examples of changes in supply and demand using graphic organizers in small groups	Infer reasons for changes in supply and demand in small groups

Extracted from WIDA (2012)

Focusing on meaning rather than form can assist English language learners in developing fluency and accuracy in all four language modalities, utilizing content-relevant tasks to enable students to build mastery of content knowledge (Gibbons, 2002). Employing an example from the science content area, Table 5 illustrates how teachers could differentiate the different features of academic for linguistic complexity at the discourse level, conventions and forms of language at the sentential level, and vocabulary and usage at the level of words and phrases.

Table 5: Differentiating Features of Academic Language at Different Linguistic Levels

	Levels 1-3	Levels 2-4	Levels 3-5
Linguistic Complexity Discourse	Illustrated word bank: Independent	The independent variable was carbon dioxide. We changed the	In our experiment, varying the amounts of carbon dioxide impacted

Level	variable dependent variable water Carbon dioxide stayed the same/ changed	amount of CO_2 each time. We saw the reaction slow down with less carbon dioxide and it did not occur without carbon dioxide.	the reaction. First, we dissolved sodium bicarbonate in water to release CO_2, our independent variable. We knew how much CO_2 to use in the experiment because we had the chemical equation for photosynthesis. Decreasing the amount of CO_2 in the experimental groups slowed down the reaction rate. Removing the carbon dioxide resulted in no reaction.
Language Forms & Conventions Sentence Level	Stayed the same Changed	We saw… with…and it…	Varying… Decreasing… Removing…
Vocabulary Usage	Stayed the same/changed	Changed reaction	Impact dissolve release

Word/Phrase Level	Same/different Slow/fast	each time without ….	chemical equation photosynthesis resulted in….

Extracted from WIDA (2012)

Incorporating Academic Language into English Language Standards for Kenyan Secondary Schools

It is important to recognize that language proficiency is not monolithic. A Kenyan student can be proficient using English to interact with an English speaking visitor but not proficient in using appropriate language in the classroom to talk about mathematics or science (Bailey, 2007). Students need to understand academic language to be successful in a school environment where English is the language of instruction (Goldenberg, 2008). In considering how English language standards for Kenyan secondary schools could incorporate academic literacy, one must first examine the current syllabus to identify how this might be done. Table 6 provides the secondary school English syllabus for forms 1 and 4. This includes where students should be at the end of their first year of secondary school and where they should be at the end of secondary school.

Table 6: Sections of Kenyan Secondary School English syllabus

Students should be able to:		
	Form 1	Form 4
Listening and Speaking	a) Demonstrate awareness that spelling in English may or may not be related to pronunciation; b) Pronounce correctly sounds they find problematic; c) Respond correctly to oral information on a variety of subjects; d) Communicate correctly, confidently and appropriately in different contexts; e) Demonstrate acceptable communication skills; f) Identify the features of ogre and trickster stories, and riddles.	a) Use tone to express and interpret attitude. b) Use stress to distinguish grammatical meaning in words. c) Respond appropriately to oral information on a variety of subjects. d) Maintain acceptable communication skills. e) Present oral reports on literary and non-literary topics. f) Identify the features of oral poetry and proverbs.
Grammar	a) Use parts of speech correctly; b) Identify the constituents and the functions of the noun phrase; c) Construct different types of simple sentences.	a) Demonstrate linguistic competence by writing sentences in a variety of ways. b) Use language structures creatively and competently. c) Use knowledge of grammar to interpret information from various sources.

Reading	A) Read efficiently and fluently b) Use the dictionary effectively c) Use the library effectively d) Enjoy reading literary and non-literary materials e) Trace the sequence of events in selected plays and short stories f) Demonstrate appropriate comprehension skills g) Build a wide range of vocabulary h) Demonstrate awareness of contemporary issues	a) Read and understand a range of texts, select essential points and apply inference and deduction where appropriate b) Demonstrate an understanding of the common and distinctive features of the literary genres c) Analyze critically prescribed novels, plays and short stories, drawn from Kenya, East Africa, Africa and the rest of the world d) Enjoy reading literary and non-literary materials e) Enhance vocabulary and knowledge of language use through reading. f) Demonstrate awareness of contemporary issues g) Acquire life-long interest in reading.
Writing	a) Write legibly and neatly; b) Apply spelling rules correctly; c) Use punctuation marks correctly; d) Write clear and correct sentences, and organize ideas in a logical sequence; e) Use appropriate register and format for a variety of writing tasks; and f) Take and make intelligible notes.	a) Present information in a variety of ways. b) Use proper forms of documentation. c) Use appropriate register and format for a variety of writing tasks. d) Demonstrate competence in using a wide range of sentence structures and vocabulary to create the desired effect.

Extracted from Kenyan Secondary School Syllabus

From this syllabus one can note that there is not an overt mention of academic language. There are several references to literary language; these are italicized in table 6. Much of the emphasis is on the form of the language and developing oral and written language as well as reading skills. Many of these are skills students would have been taught in primary school but need to consolidate at the secondary school level. However, these skills alone will not help students, particularly those whose proficiency in English is weak, to access academic texts.

Kenyan students' performance in national examinations between, 2006 and 2010 indicate that students are struggling in all the subjects. Students' mean scores have declined in English from 39.77 in 2006 to 38.91 in 2010, in History from 50.69 in 2006 to 45.84 in 2010, in Geography from 55.54 in 2006 to 46.15 in 2010. Although in Mathematics, Biology and Chemistry scores have slightly improved or remained the same during this time period, the scores are low, in the 20s (KNEC, 2011). Since students learn all of these subjects through the medium of English, the quality of English language instruction can be called into question.

In developing the norms for primary schools, Gathumbi (2008) purports that, the key stakeholders concern about children's failure to use English language effectively prompted the review of the teaching of English at the primary school level. Out of this review they developed a set of norms, or benchmarks, for teaching English at the primary school level, entitled the English Literacy Norms (ELN). There is the need for a similar review at the secondary school level. This review will need to consider the academic language students need to understand textbooks and other academic resources at increasing complex levels.

Implications for Teacher Education in Kenya

Any changes in the school curriculum directly impact teacher education as teachers must be prepared to implement the new changes. In Kenya, most of the secondary school teachers are themselves English language learners and have varying proficiency levels in English. All pre-service and in-service teachers, therefore, must be introduced to academic literacy. Although English teachers are the primary conduits for English language skills, subject teachers as well must be introduced to the academic language in their respective disciplines so they can highlight this language as they teach their subject. They cannot assume that all students understand this language and English teachers cannot be expected to teach specialized language of the different academic disciplines.

The WIDA standards framework discussed above provides a model for integrating content and language with attention to the varying proficiency levels of students. What can Kenya, and indeed other countries that use English as the language of instruction, take from this model? Each country has its own peculiarities with respect to language, but there are some universals with respect to academic language. Many of the textbooks are written in western countries with native English speakers as their audience. So even though Kenyan teachers may teach in a sheltered English language environment, since English is an additional language for most, if not all the students, at the higher levels of education they must be held to an international standard since their students must be able to access the advanced knowledge in the various disciplines, both in textbooks as well as the world wide web.

The focus on academic language is not new in the English language-teaching field. There are a variety of English for specific purposes (ESP) and English for academic purposes (EAP) courses typically targeted to adults seeking English language skills in specific. In the United States, there is a current emphasis on literacy across the curriculum requiring all teachers to be teachers of literacy, with focus on their specific content areas.

English language learners in the United States, even those new to English, need to develop this academic literacy in order to be successful in school. As Kenyan educators consider the development of standards and norms for secondary school English, they must include a review of the linguistic needs in the various academic disciplines. This will allow for focused English language instruction and can assist students in making connections to what they are learning in English class and their various other subjects.

References

Bailey, A. (Ed.). (2007) The language demands of school: Putting academic English to the test. New Haven, CT: Yale University Press.

Bunyi, G.W. (2008). Introduction to English language teaching and learning in Kenya. In T. Groenewegen (Ed.), Benchmarks for English education, pp. 25-44, Nairobi: Phoenix Publishers.

Calderon, M. & Minaya-Rowe, L. (2011). Preventing long-term ELs: Transforming schools to meet core standards. Thousand Oaks, CA: Corwin.

Cummins, J. (1983). Language proficiency and academic achievement. In J. W. Oller (Ed.). Issues in Language testing research. Rowley, Massachusetts: Newbury Publishers.

Cummins, J. (1984). Wanted: A theoretical framework for relating language proficiency to academic achievement among bilingual students. In: C. Rivera (Ed.), Language proficiency and academic achievement. (pp. 108-130), Clevedon, Avon: Multilingual Matters Ltd.

Cummins, J. (2003). BICS and CALP: Origins and rationale for the distinction. In C. B. Paulston & G. R. Tucker (Eds.), Sociolinguistics: The essential readings (pp. 322-328). London: Blackwell.

Echevarria, J., Vogt, M.E., & Short, D. (2000). Making content comprehensible for

English Language learners: The SIOP Model. Needham Heights: Allyn & Bacon.

Echevarria, J., Vogt, M.E., & Short, D. (2013). Making content comprehensible for English Language learners: The SIOP Model. 4th Edition. Upper Saddle River, NJ: Pearson

Freeman, Y. & Freeman, D. (2009). Academic language for English language learners and struggling readers: How to help students succeed across content. Portsmouth: NH: Heinemann.

Gathumbi, A. (2008). The process of developing English literacy norms. In T. Groenewegen (Ed.), Benchmarks for English education, pp. 45-88, Nairobi: Phoenix Publishers.

Gee, J. P. 2008. What is academic literacy? In A. Rosebery and B. Warren (Eds.). Teaching science to English language learners, 57–70. Arlington, VA: NSTA Press.

Gibbons, P. (2002). Scaffolding language, scaffolding learning: Teaching second language learners in the mainstream classroom. Portsmouth, NH: Heinemann.

Gibbons, P. (2003). Mediating language learning: Teacher interactions with ESL students in a content-based classroom. TESOL Quarterly, 37(2), 247-273.

Githiora C. 2002: Sheng: Peer Language, Swahili dialect or emerging Creole? Journal of African Cultural Studies. London: Routledge.

Goldenberg, C. (2008). Teaching English language learners: What the research does- and does Not-say. American Educator, (Summer), 8-44.

K.I.E. (Kenya Institute of Education, 2002). Secondary Education Syllabus. Vol. 1. Nairobi: Jomo Kenyatta Foundation.

Kioko, A.N. & Muthwii, M.J. (2001). The demands of a changing society: English in education in Kenya today, Language, Culture and Curriculum, 14(3), 201-13.

Momanyi, C. (2009). The Effects of ‘Sheng’ in the teaching of Kiswahili in Kenyan schools. Journal of Pan African Studies, 2(8), pp. 127-138.

Nagy, W. & Townsend, Do (2012). Words as tools: Academic vocabulary a language acquisition. Reading Research Quarterly, 47(1), 99-108.

Nzunga, M. P. K. (2002). Sheng & English: The booming offspring of Linguistic Intermarriage. In: I. Rissom (Ed.) Language in Contrast. Bayreuth: Eckhard Breitinger.

Schleppegrell, M.J. (2004). The Language of Schooling: A functional linguistics perspective. Mahwah, NJ: Erlbaum.

Short, D. (2002). Language learning in sheltered social studies classes. TESOL Journal, 11(1), 18-24.

Short, D. & Fitzsimmons, S. (2007). Double the work: Challenges and solutions to acquiring language and academic literacy for adolescent English language learners. Washington, DC: Alliance for Excellent Education.

Sure, K. & Ogechi, N. O. (2009). Linguistic human rights and language policy in the Kenyan education system, Addis Ababa: Organisation for Social Science Research in Eastern and Southern Africa (OSSREA).

Teachers of English to Speakers of other Languages, ainc. (TESOL). (2006). Pre K-12 English language proficiency standards. Alexandria, VA: TESOL

WIDA (2012). Amplification of the English Language Development Standards, Kindergarten–Grade 12. Board of Regents of the University of Wisconsin System. — www.wida.us.

Williams, C. (2009). Reflections on teaching English learners: Historical context, goals, and power practices. Ruidoso, NM: Teacher Writing Center.

APPRAISAL OF IMPLEMENTATION OF THE ENGLISH LANGUAGE CURRICULUM FOR STATE PRIMARY SCHOOLS IN BURUNDI

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Abstract

English as a foreign language was introduced alongside Kiswahili in the year 2005 in Burundi public primary schools. Until then, French and Kirundi were the only languages taught at this level. The initiative challenged the Education authorities into finding solutions to a number of problems that arose with the implementation process. This was particularly important given the multilingual situation in the classroom. While teacher unpreparedness and lack of text books caught attention of the authorities for having gained visibility, very little attention is given to the curriculum, which many would rightly regard as a major instrument in helping learners of English – in Burundi in general – achieve communicative competence, an area at stake in English language teaching in the country. The purpose of this study is to appraise the implementation of the curriculum with a view to analyzing and assessing its learning goals and expected outcomes; the nature of the curriculum content; the needs of the curriculum implementers and the methods used in enhancing learner ability to use language and contributing to his holistic development. This study will also propose activities and techniques that emphasize skill integration as an approach to learning in English as a Second Language context. Data will be obtained through document analysis, questionnaires and interviews involving teachers, curriculum developers and school principals. Classroom observation of English Language lessons will also be done. Data will be analyzed using descriptive and quantitative methods. Correlational and inferential statistics will also be applied. It is expected that the study will yield information significant and useful for Education authorities, curriculum producers, teachers and pupils, not just in Burundi but also in other countries grappling with issues of language of instruction.

1.0 Background

1.1 Recent Educational Reforms in Burundi

Recent reforms in Burundi Education have included the country's commitments to Primary Education for All by the year 2015, Free Primary Schooling and the restructuring of Tertiary Education into 3 stages of three, two and three years of academic instruction after which the students respectively qualify for a Bachelor’s Degree, a Master’s Degree and a Doctorate’s Degree. This system, commonly referred to as BMD, is said to be intended to facilitate the integration of Burundi´s tertiary institutions into other world systems of education as agreed in the Bologna Process (2003). The measures for the primary level have resulted in unprecedented levels of enrollment and efforts to expand the school infrastructures through competitive contributions of the grassroots. It has been noted, however, that most of the schools built in these circumstances are generally below the norm (Rwantabagu, 2011a; Mivuba, 2009b, Ndayisaba, 2008) due to the country’s limited resources. Successive periods of political crises followed by economic decline have had very negative impacts on the country’s financial capacities and resources at all levels.

The back-up initiatives to the above measures have been the building and rehabilitation of schools’ infrastructure with particular emphasis on disadvantaged areas and the encouragement of private education. The efforts to train and retrain an adequate body of teachers, which were also envisioned have hit against the said problem of financial constraints (Mivuba, 2008:25). Although improvements have been observed at all levels of enrollment including female and vulnerable children, they have not been followed by sustained efforts and initiatives at the instructional levels. The quality of learner achievement is, therefore, something still to be desired.

Among recent curricular innovations at primary level, one may mention the introduction of 3 new subjects, all from Grade One, namely English, Kiswahili and Civic Education. This reform, which dates from August 2005, occurred in the context of two events, which would from then onwards provide a rationale for the new subjects. The first is Burundi’s entry into the East African Community (EAC) in July 2007 and its implications on national language policies. Given the accord by the Community’s member states to use English and Kiswahili as their official and working languages (article 137 of the Treaty, it became an imperative for the authorities in Burundi to improve knowledge of these two languages by its population so that they could gradually become competent in them. Therefore, whereas English was taught from Form 2 of Secondary Education onwards, its beginning became shifted to the whole of Primary Education. Kiswahili, a language, which has so far been seen to be related to trade, was equally deemed necessary to start from with primary schooling.

The inauguration of the new Government (August 2005) and the earlier signing of a Peace and Reconciliation Agreement (2005) made it possible for the stakeholders in the Agreement to compete politically. For the newly elected leaders, integrating civic education in the primary education curriculum which already existed in the other levels was a way to foster peace and reconciliation among school children who, as the reality could tell, had not been exempted from the past socio-political turmoil. A particular feature of public primary schools at this time has been the mixture of children of different ages (6 to 15) in the classes, the older ones coming from the repatriated populations and the (formerly) internally displaced ones.

1.2 The Status of English

The status of English is better understood in the wider context of the linguistic situation of Burundi. To begin with, Burundi's population speaks one language, that is, Kirundi. In this respect, Burundi can be perceived as a monolingual country. Kirundi is both a subject and a medium of instruction with the latter status shifting to French when pupils in Primary reach Grade 5. This is so because it is understood that they are preparing for Secondary Education where French is the sole instructional language, except for the Kirundi and English subjects.

An earlier reform (1979) had established that Kirundi would be the absolute medium of instruction in the entire primary level, but the policy was met with gradual reluctance of (educated) parents who argued that French was the language of 'opportunity' - and that any drop in its level would "compromise the prospects of personal fulfillment and professional advancement" so far associated with it (Mivuba, 2008: 12; Rwantabagu, 2011: 467; Mazunya & Habonimana, 2009: 10). For some, though, "the freezing" of the principle was due to the "lack of terminologies for teaching various subjects at that stage" (which in fact provoked the parents' reluctance) as well as to the "lack of commitment on the part of policy-makers" (Bukuru, 2008:40).

Together with French, Kirundi acts as the official language of Burundi. The former will be used in encounters and activities involving intellectuals and foreigners, whereas Kirundi will convene in circumstances dedicated to the local population. Although Burundians start learning French at an early age, (currently from Grade 1) at the rate of 7 to 9 hours per week), proficiency in this language is comparatively lower, owing to the concurrence of Kirundi which, as was explained earlier, is spoken nationwide.

The third language used in the country is English, which has been taught since the early years of independence (1962) and mainly for purposes of diplomacy and international transactions. Use of this language in Burundi has been confined to the classroom, thus ascribing to it the status of English as a Foreign Language (EFL). It follows that in reality, French being spoken and understood by less than 15% of the population (Ntahonkiriye et al, 2010: 4), the idea of a second language (L2) is difficult to justify in the Burundi context. Regarding the legality of the status of respective languages in the country, the current Constitution (2005) (Article.7) stipulates that "La langue nationale est le Kirundi. Les langues officielles sont le Kirundi et les autres langues déterminées par la loi » [The national language is Kirundi. The official languages comprise Kirundi and other languages established by the law - translation mine]. One critical aspect of this provision is that, despite its existence since the Constitution of 1981 (Ntahonkiriye et al., 2010), these 'other languages' have never been instituted by law. It is important to point out, however, that the Reform of 2005 has contributed to renewed impetus for English (and Kiswahili) with some opinion (Mazunya & Habonimana, 2009) already forecasting its taking over French as the sister official language to Kirundi in the long term (Mazunya & Habonimana, 2009: 117; Habonimana, 2013).

1.3. English Instruction

As previously mentioned, English teaching started in Secondary Form 2 and continued till the end of Tertiary Education before the 2005 Reform. In most university faculties, the volume for English rarely exceeded 45 hours annually, while the curricula were left to the decisions of either adjunct or visiting lecturers. The situation is still the same. This is of course besides the all-English-language teaching in the faculties dedicated to English language literature (University of Burundi); or those solely dedicated to the education of teachers, namely the Institute for Applied Pedagogy (English-Kirundi Department) and the Higher Teacher-Training College (English-Kirundi Department).

As a marketing policy strategy, many private universities undertook an increase in the volume of English, which together with course diversification succeeded in attracting many students. Presently some have adopted a bilingual approach, with French and English being concurrently used for instruction. The level of language proficiency in all three languages (French, English and Kiswahili) in the country remains low. This is attributable to two factors. One is the status of English. The practice of English does not exist outside the classroom - or of the school for the enthusiastic students. Second, is the methodology used in language teaching – this to be understood within the general teaching framework in Burundi, which is generally exam-oriented both within the 3 stages of Primary, Secondary and Tertiary levels, and at the completion of each. Access to the last two stages depends on success in selective competitive national tests. The implication is that, teachers' pedagogies will themselves foster preparation for these tests and examinations (Mazunya & Habonimana, 2009; Mivuba, 2009). Secondly and more importantly, it has been observed that most instructional practices still emphasize theoretical approaches such as lecturing, which highly encourage 'rote' learning (Mazunya & Habonimana, 2009; Mivuba, 2009). This is a practice indeed observed in many developing countries as pointed out in Karras and Wolhuter (2010). In English for example, there will generally be limited or no space for language use. As could be expected, the likelihood of "Like father like son" is great when new teacher graduates embark on the job: they will duplicate the teaching techniques and experiences that were applied onto them as students; thus perpetuating the 'vicious' circle of poor teaching and learning methods.

English at the primary level began with 2 hours/week and was recently (2012/2013) reviewed to reach 4 hours/week. It is based on a set of books called English Primary Course comprising a Pupil's Book and a Teacher's Guide for each. Notes in the latter book are written in English and French to facilitate the teacher's understanding of the guidelines. The only source of English at this level, as in most of secondary schools, is the teacher - for where taped material might have existed, it has become worn out with time, but was not replaced (Junior Secondary and Scientific Sections). With the hours of English in Primary (i.e. last 35 minutes in the morning and 30 minutes in the afternoon) schools obey the principle of 'make shift' due to limited facilities and teachers. Make shift is a system that requires pupils to alternate for morning and afternoon classes on a weekly basis, yet keeping the same teacher for the day. English Primary Course is a locally produced curriculum, and was elaborated by the Curriculum Development Bureau for Primary Education (BEPEP). In Burundi, a primary school teacher is expected to teach any subject;

so teachers and courses are continuously relocated across the curriculum depending on the school principal's decision.

The note in the Prefaces of these course books that "it is important for the Burundi youth to 'speak' English…. to help reach the goal of regional integration" is an indication that educationally, the Education system is shifting its orientation for English language teaching to a language for communication as well as specific purposes (Celce-Murcia, 2010; Larsen-Freeman, 2012; Widdowson, 1978).

1.4. Challenges of the Primary School English Curriculum

In the light of the new geo-political alignment (EAC, COMESA), the political authorities at the highest level in Burundi have in fact "imposed" (Rwantabagu 2011:470) the teaching of English and Kiswahili. As this author explains,

> *These languages were introduced within a difficult context where 95% of teachers had no knowledge of Kiswahili whatsoever, while almost all of them had very little competence in English and even less in how to transmit it to primary school learners. The production of textbooks and other teaching materials has not followed the trend, making the pedagogical situation even more precarious for teachers and learners alike (p471).*

With this awareness in mind, it should not be surprising that the programme encountered problems as soon as its implementation was launched. Teachers found themselves unable to teach languages for which they had neither the competence nor the pedagogical preparation - for the sake of the argument; English in the teacher-training colleges is, as at present, taught only as a subject. Kiswahili does not exist. Equally, the book production planning might not have been accurate, since not all schools could - and still cannot - be adequately covered.

When the problems came to light, the Government initially took the measure of suspending the programmes (Order of 9th January, 2007) after a task force had been created (Decree of 31st March, 2006). The mission of the Task Force was “to validate teaching materials or design supplementary materials for English and Kiswahili, as well as to plan and organize in-service teacher training” (Article 2). It has slowly emerged that the ‘hastened’ (Mivuba, 2009b; Rwantabagu, 2008; Ndayisaba, 2008; Mazunya & Habonimana, 2009) implementation even as ‘trialling’ (Wilson et al., 1983:44) was not intended to assess the ‘teach-ability’ of the programmes.

There is yet another challenge about the teaching methods advocated by the curriculum designers. These are the communicative approach and skill integration, which are not only unfamiliar to the teachers from the theoretical point of view, but also may call for questioning in terms of their application in the Teachers’ Guides. Such a misconception becomes an issue in the sense that it not only affects the attainment of stated goals, but it also impedes learners’ achievement of desired communicative competence, while at the same time jeopardizing the principles of Quality Education that the Government vowed to commit to (All Policy Documents, 2010).

In view of the lags in the Government’s responses and with reference to the wider context of Education in Burundi, Giel’s (1976) reflection may be revealing:

> *Those seeking reforms should not ignore a substantial body of professional literature recognizing the characteristics of unsuccessful policy initiatives to improve school achievement: poor understanding of effective practice; serious problems of political organization and policy formation; and significant cost constraints (Giel, 1976:24).*

The underlying message in this statement is that good planning is a crucial stage in any educational project, especially if this involves a new curriculum. All aspects of the project must be carefully analyzed before implementation begins. More importantly, those with educational expertise in relevant areas of the curriculum should be associated in the "engineering" of the project.

2.0 The Problem

The various surveys carried out in connection with the effect of the 2005 Reform, particularly in the two areas of English and Kiswahili have been sufficiently dealt with regarding the issues of teacher unpreparedness and shortage of learning materials (Mivuba, 2009b; Rwantabagu, 2009). In response to the teachers' outcry, the Government has approached foreign donors for assistance; and interventions by UNESCO and UNICEF have been planned in this regard. (Mivuba, 2009). So far, however, very little has been done by policy makers in terms of research and interventions concerning the quality of the curriculum. Only Mazunya and Habonimana (2009: 144) have pin pointed the problem stating that, *La production des manuels scolaires pour les cours d' Anglais et de Kiswahili enseignés dès 2007 a été faite de façon pressée. C'est ce qui explique leur insuffisance quantitative et qualitative.* [The production of school materials for the English and Kiswahili subjects in Primary Schools in the year 2007 was done hurriedly to cope with a somewhat emergency situation. This explains the low quantity and poor quality of the materials - translation mine].

The problem, therefore, is that to date, no known formal analysis of the English curriculum has been done which could inform policy-makers on its effectiveness in achieving the desired learning outcomes. The development of the Primary English curriculum was not the result of a needs and situational analysis (Nunan, 1988a; Wilson et al, 1983). It is therefore important that an appraisal be carried out as a useful phase in any curriculum development process to yield this critically useful input. It is the contention of this paper that the government and BEPEP establish the extent to which the in-service training offered to English teachers has been efficient in boosting teacher classroom performance.

The purpose of an appraisal would, therefore, be to examine the curriculum with a view to analyzing and assessing the goals and outcomes assigned to it; the needs of its stakeholders deriving from the implementation process; the nature of its content and the quality of the suggested methods both in terms of enhancing learner ability to use the English language and providing him holistic development. In the light of the learners' growing needs for, and right to quality education, it is significant to propose activities and techniques which foster use of English and skill integration on one hand, and life skills acquisition on the other.

3.0 Research Questions

This study is guided by the following questions:

1. What are the needs of the stakeholders of the English Curriculum for public primary schools in Burundi?
2. What is the scope of coverage of language skills in this curriculum?
3. To what extent do the suggested activities and methods in it enhance learner communicative competence?
4. What language learning activities and techniques can best promote skill integration while at the same time creating opportunities for life skills acquisition?

4.0 Significance of the Study

This study raises awareness of the policy-makers and education authorities for the need for a curriculum, which broadens the learners' horizons beyond the boundaries implicitly imposed by examination-oriented teaching (Darling-Hammond, 1994:2). While teaching their different subjects, teachers are there to 'educate' as well (King, 1980: 217;

Karras & Wolhuter, 2010: 13). As communicative language teaching is the recommended approach in the curriculum, there should be room for “discovery of learner interests and needs” on the other hand, and for “opportunities to not only respond to, but also develop them through language use beyond the classroom itself (Celce-Murcia, 2001: 23). After all, she adds that, “the classroom is but a rehearsal.” By virtue of this arrangement, learners should also benefit in the sense that these activities would not only enhance their use of the target language, but also contribute to expanding their general knowledge (Giel, 1976: 44) as individuals who need to fully integrate in their society.

Finally, the research is of significance to the teachers and the curriculum writers by way of its identification of their needs (and thus making them visible to the authorities). The techniques and activities proposed as well as the clarifications of communicative language teaching, skill integration and audio-lingualism will go a long way in building the teachers’ linguistic and pedagogical competence. Curriculum designers could integrate these ideas in their future revisions of the curriculum and/or in the on-the-job training planned for the teachers, all to the satisfaction of the Quality Assurance Board. It is hoped that the latter will seize the opportunity to integrate appraisal in their regular tools for assessing curriculum efficiency at all levels of education in Burundi.

5.0 Methodology

This study adopts a descriptive and exploratory survey design. It will be carried out in two (out of 17) provinces of Burundi; namely, Bujumbura Municipality and Mwaro. The former is urban while the latter is rural. The target population comprises teachers of English, primary school principals, curriculum designers and pupils from grade one to six in sample schools. The curriculum designers will be purposively sampled while the rest of the respondents will be sampled through stratified proportional sampling. This gives a random sample of 177 teachers, 47 principals, 8 curriculum designers, 8 teachers for each of grades 5 and 6 for class observation. Content analysis of 6 texts will be done.

A content analysis of the English course book (Primary English Course - Teachers' and Pupils' Books) will be done. This will be necessary to get a grasp of the approaches and their practical applications. The Teacher´s Books will be assessed for their comprehensibility and facilitation to the teachers. It will also be important to establish whether the goals and objectives set for the curriculum are clearly identifiable. Questionnaires will be used to obtain feedback from teachers, school principals and curriculum designers on issues related to the curriculum implementation. Interviews will be mainly directed to the parents who are members of the schools' councils. In their position, they can easily seek and receive information (from the school principals) about relevant issues such as the operation of the English curriculum. Similar interviews will also be held with heads of schools to supplement the encounters with parents. Classroom observation will be carried out as a complement for the teachers' questionnaires, and their focus will be on teaching techniques and learner language use.

The instruments will be subjected to relevant reliability and validity measures at the piloting level before they are used for actual data collection. Data will be collected and analyzed by using quantitative and qualitative methods. Data will be subjected to statistical analysis using measures of central tendency and measures of variability. Analysis of variance (ANOVA) will be applied to determine if variations appearing among different school types, teachers and principals could be attributed to sampling error or to varying conditions. Correlational and inferential statistics (the t-test) will also be used to draw cause-effect relationships by addressing questions such as whether in-service training has an effect on teacher performance.

References

Ahmad, D. (2013) EFL materials: Their Types, Roles and Functions in ET/L Process. Retrieved from www.eslbase.com/articles/creating materials.

Apple, M. W. (2012). Theory, Research, and the Scholar Activist. Educational Research. Vol 39(2), 151-168

Celcee-Murcia, M. (ed.) (2010). Teaching English as a Second or Foreign Language (3rd ed.) Rowley: Heinle

Giel, K. (1976). Perspective of General Knowledge Teaching in the Early Years of Schooling. Institute for Scientific Cooperation. Vol. 13, 44-55. Tubingen: Federal Republic of Germany.

Habonimana, B. (2013). An Investigation into Burundi's Integration in EAC. Impact on the Government's English Language Policy. (Unpublished BA Dissertation). Bujumbura: University of Burundi.

Karras, K.G. and Wolhuter (eds.) (2010). International Handbook of Teacher Education Worldwide. Athens: Attrapos Editions

Larsen-Freeman (2012). From Unity to Diversity: Twenty-Five Years of Language Teaching Methodology. English Teaching Forum. Vol. 50(2), 28-37

Mazunya, M.and Habonimana, A. (2010). Les langues de Scolarisation dans I'Enseignement Foundamental en Afrique Subsaharienne Fancophone: Réalisation d'Etudes

Bibliographiques et d'Enquêtes de Terrain. In MAEE et al (eds.). Les Langues de Scolarisation en Afrique Francophone: Enjeux et Repères pour l' Action. Paris: Edition des Archives Contemporaines. 94-147.

Mivuba, A. (2009). Impact de la Langue d'Enseignement Sur les Résultats d'

Apprentissages dans les Ecoles Primaires du Burundi. Bujumbura: Action Aid Burundi.

Mivuba, A. (2009). Evaluation du Système Educatif Burundais. Bujumbura: Action Aid Burundi

Ministry of Education Burundi (2005). English Primary Course. Bujumbura: Ministry of Education.

Ministry of Education (2005). Order No 610/1187 of 25th August, 2005.

Ministry of Education 2006) Order No 610/295 of 31st March, 2006.

Ministry of Education (2007). Order No 610/027 of 9th January, 2007

Ndayisaba, J. (2010). Evaluation of the Mechanism of EFA Coordination. Bujumbura: UNESCO

Ntahonkiriye et al (2010). Politique Linguistique du Burundi. Bujumbura: UNESCO

Nunan, D.(2001). Syllabus Design. In Celce-Murcia, M. (ed.). Teaching English as a Second or Foreign Language (3rd ed.) pp. 55-65). Boston: Heinle & Heinle,

Rea, P.M. (1983). Evaluation of Educational Projects with Reference to Foreign Language Education. in Brumfit C.J. (ed)). Language Teaching Projects for the Third World (pp. 85-99). Oxford: Pergamon Press Ltd. République du Burundi (2005). Loi No 1/010 du 18/3/2005 Portant Promulgation de la Constitution de la République du Burundi. Bujumbura: République du Burundi.

République du Burundi (2005). President's Decree No 100/121 of 30/11/2005. Bujumbura: République du Burundi.

République du Burundi (2010). President's Decree No 44 of 9/3/2010. Bujumbura: République du Burundi.

République du Burundi (2012). President's Decree No 125 of 21/4/2012. Bujumbura: République du Burundi

République du Burundi (2008). Discours de Son Excellence Le Président de la République du Burundi à'l'Occasion du ler Anniversaire de son Investiture. Bujumbura: République du Burundi

République du Burundi (2009). Ijambo rya Nyenicubahiro Petero NKURUNZIZA Umukuru w' Igihugu Ku Musi wo Kwinjira Icese Amashure Abanyagihugu Biyubakiye Mu Ntara Zose. (President's Speech Upon the Inauguration of Schools Built with the Participation of the Grassroots in the Different Provinces). Ngozi: Republic of Burundi.

République du Burundi (2010). Discours de S.E. Monsieur Pierre NKURUNZIZA, Président de la République du Burundi, à l'Occasion des Cérémonies d'Investiture. Bujumbura: République du Burundi

Rwantabagu, H. (2011a). Education in Burundi: An Evolutionary Perspective. Bujumbura: University of Burundi.

Rwantabagu, H. (2011b) Problems and Progress in Education in a Changing Context: The Case of Burundi. Bujumbura: University of Burundi

UNESCO (1996). Teacher Education: Past, Present and Future. Dakar: UNESCO

Wilson, P. et al. (1983) Materials Design in Africa with Particular Reference to the Francophone Primary School Project, Cameroon. in Brumfit, C.J. (ed.). Language Teaching Projects for the Third World (pp. 29-59). Oxford: Pergamon Press ltd.

Wolf, A. (1976). Educational Planning and Educational Policy. Education. Vol. 13. Tubingen: The Institute for Scientific Cooperation.

World Bank (2007). The Education System of Burundi. Washington DC: The World Bank

RE-THINKING THE APPROACH TO TECHNOLOGY AND STUDENT LEARNING IN KENYA: EXAMINING THE ATTITUDES, NEEDS, EXPECTATIONS, AND CHALLENGES

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Abstract

The discipline of education is one of the areas most influenced by the enormous technological advances in modern society. However, evolving computer technologies do not have an educational value in themselves unless they are used effectively and purposefully by teachers in the classroom who are expected to possess specific subject knowledge and the appropriate instructional skills. Although there are valuable lessons that may be learned from best practices around the world, there are significant challenges that policy makers and planners, educators, education administrators, and other stakeholders in developing countries like Kenya need to consider. This paper attempts to explore the needs, expectations, attitudes and challenges of integrating technology in the primary school classroom with a view to improving pupils ICT competencies commensurate with the demands of the global market today. Any attempts to enhance and reform education through ICTs require clear and specific objectives, guidelines and time-bound targets, the mobilization of required resources, and the political commitment at all levels to see the initiative through. The ability to use digital technology, communication tools, and/or networks appropriately to solve information problems in order to function in an information society is very important. This includes the ability to use technology as a tool to research, organize, evaluate, and communicate information and the possession of a fundamental understanding of the issues surrounding the access and use of information.

Introduction

In the past decade there has been an exponential growth in the use of information and communication technology (ICT), which has made pervasive impacts both on society and on our daily lives. It is thus not surprising to find increasing interest, attention and investment being put into the use of ICT all over the world today. A number of master plans on basic ICT skills in education have been produced in many countries. Such plans reveal that educational innovations in ICT have been increasingly embedded within a broader framework of education reforms that aimed to develop learners capacities for self-learning, problem solving, information seeking as well as the ability to communicate and learn, abilities that were not given weight in previous school curricula. While ICT continues to advance in Western and Asian countries, African countries still experience a lag in its implementation and that continues to widen the digital and knowledge divides. Though there has been needs assessment and high expectations, there are many challenges that bedevil the efforts to access and use of technology for learning in Kenya.

1.1. Background to the Study

One key point of learning in the 21st Century, according to Magliaro, (2006) and Kearsley (2004), is that, we are defining essential literacy skills too narrowly. As any nation focuses on the basics, it is noteworthy that government, educators, and private industry must be unified in underlining the 21st century literacy skills that are part of everyday basics. Literacy in the 21st century means more than basic reading, writing, and computing skills (National Education ICT Initiative 2007). The illiterate people of the 21st century will not be those who cannot read and write, but those who cannot learn, unlearn, and relearn.

A teacher can never truly teach unless he is still learning himself (Barnes, et al. 2007). Today we live amidst an unprecedented revolution in the advancement of ICT; which could be an extremely powerful enabler in efforts to bring positive and sustainable development to countries around the globe. Kenya is embracing technology at a very fast pace. Almost every adult owns a mobile phone. In academia sub-sector, building capabilities and know-how would be the next step and which should be deeply etched in the country’s ICT master plan if the country aims to achieve global competitiveness. In Kenya there is a big gap between the primary teacher training and the market place. A lot of teachers who are graduating from colleges across the country are to a great extent unable to quickly adapt to the 21st century ICT demands, and hence, the ministry is being forced to take them through basic ICT training before the ICT education policy (2008) can fully be implemented. A vibrant education sector is fundamental for developing human capital within countries. With an active and transformative education policy and a supportive infrastructure, the development of a knowledge-based population can apply itself to a sustained and equitable growth. Information & Communication Technology (ICT) can play a vital role in increasing access to education as well as providing better quality education.

ICT can improve the quality of education and heighten teaching efficiency through pre-service training and programs that are relevant and responsive to the requirements of the education system. This will allow teachers to have sufficient subject knowledge, a repertoire of ICT teaching strategies and professional development for lifelong learning. The ICT training program will expose them to new modern channels of information, and will develop self-guided learning materials, placing more focus on learning rather than teaching (Yildirim 2007). However, it is important to point out that ICT is used to enhance teaching styles, and should not replace the role of the teacher. ICT helps create structured and systematic teaching.

ICT can enable teachers to transform their practices by providing them with improved educational content and more effective teaching methods. Continuous teacher training in updating and enhancing their methodologies is critical to effective education policy and practice to keep pace with the constant advancement of technology. Through online teaching resources and other interactive educational materials, teacher development can be greatly improved. ICT can improve the learning process through the provision of more interactive educational materials that increase learner motivation and facilitate the acquisition of basic skills. The use of various multimedia devices such as television, videos and computer software can offer a more challenging and engaging learning environment for learners of all ages. With a shift from the traditional teacher-centered pedagogy to more learner-centered methods, active collaborative learning environments facilitated by ICT contribute to the creation of a knowledge-based learner population (Magliaro & Ezeife 2007). In addition, ICT skills that come along with this shift in pedagogy are also useful for the learner hoping to transition into today's job market, which in many countries is increasingly demanding these skills. Developing a critical mass of knowledge workers with proficient ICT skills will greatly improve long-term economic opportunities.

Recognizing that technology is, and will continue to be a driving force in workplaces, communities, and personal lives in the 21st century, teaching and learning in the 21st Century should emphasize the importance of incorporating information and communication technologies into education from the elementary grades up (Mishra et al., Sasseville, 2004, Gulp, et al. 2005). For the country to be truly competitive, Kenya needs to incorporate ICT in all stages of its education sector. The ICT use should incorporate experiences that are relevant to learners' lives, connected with the world beyond the classroom, and based on authentic projects are central to the sort of knowledge appropriate for learning in the information age. In Kenya the ICT literacy levels essential for preparing learners to access knowledge in a 21st century world is missing from many basic education facilitators.

1.3. The Problem

In a rapidly changing world, basic education is essential for every individual to embrace ICT use in everyday experience. The Economic Commission for Africa has indicated that the ability to access and use ICT is no longer a luxury, but a necessity for development. Very few studies have addressed learning needs/expectations, users attitudes, challenges faced in ICT integration during teaching & learning. This paper set out to investigate the teachers' preparedness to integrate ICT in Kenya's primary school classroom with a view to improving pupils learning commensurate with the demands of the global society today.

1.4 Objectives

This study was guided by the following specific objectives:

1. To investigate teachers experiences and preparedness to use ICT in teaching & learning situations.

2. Find out teachers' opinions on the role and effective use of ICT in teaching, learning and learning experiences.

3. Explore the needs, expectations and challenges facing integration of ICT in the classroom.

2.0 Methodology

The study design used for this study was a descriptive survey. It was used to collect data on teachers' experiences in ICT use, their opinions on effective teaching and learning events, needs for ICT use and challenges faced in implementation. The participants consisted of twenty-five (25) teachers teaching standard 1—3 in five different zones of the Yatta Sub-county of Machakos County. Questionnaires and interview schedules were used to collect data. The two instruments were tried out on two teachers before being used for field study. Data collected were ordinal and were therefore analyzed purely descriptively.

3.0 Findings and Discussions

Training and Experience of Teachers

Findings of this study established that primary school teachers in Yatta Sub-county lacked technological literacy. This included lack of knowledge on how ICT works in the classroom, what purposes it can serve, how it can be used efficiently and effectively to achieve specific goals. It was also found out that they possessed little/no visual literacy. This is the ability to use, appreciate and create images and video using both conventional and 21st century skills in ways that advance thinking, creativity and communication and learning. Further, it found that teachers lacked information literacy, which includes ability to recognize when information is needed, locate, and synthesize it using technology applications.

Teachers' Views on Effective Teaching and Learning

The findings suggested that teaching effectiveness is an interactive process between subject matter knowledge and teaching ability and teachers felt that when they do this, it leads to pupil learning and achievement. In addition, it makes learners focus and pursue clear learning goals. They also asserted that learning occurs when teachers present clear simple content. Further, teachers felt effective T/L engages learner in learning by doing. Teaching with enthusiasm was a quality an effective teacher should possess so as to encourage and motivate the learner.

Teachers' Views on Learning Events

Teachers' views on what constitutes effective learning indicated a number of events which engaged learners are engaged in during lessons. This is shown in Table 1 below.

Table 1 Teachers views on learning events

Learning event	% of teachers engaging learners in event
Presentation of learning task(s)	75
Demonstration	68
Discussion	71
Hands-on practice	68
Practice drills	89

Learner exploration	56
Evaluation	45

Needs for ICT integration in the classroom

Teachers indicated the need for ICT integration in the classroom and gave reasons in support of their argument. These needs included a call to change from teacher-centered teaching to learner–centered teaching. They argued that ICT use brings a variety of instructional events & contextual experiences to realize discovering, sharing, arranging, doing, comparing ideas and knowledge to all learners. They also pointed out that use of ICT brings information to all to realize knowledge acquisition, creation and sharing in order to achieve the performance goals for all learners. However, teachers suggested that in the event of ICT use in class, there is need to appropriately align ICT content to expected instructional learning outcomes, sound teaching methods and learner conditions. However, they strongly argued that all these needs call for a very well ICT enhanced lecture room and language labs.

Teachers' Expectations of ICT Integration in the Classroom

Teachers pointed out their expectations of the benefits of ICT integration in teaching/learning situations. Some of them include are presented in Table 2 below

Table 2: Teachers' views on the benefits of ICT integration in instruction

Increasing pupils' motivation, improving presentation of materials
Making the teaching more enjoyable
Improving the content of the lesson
Making the lessons more fun for the pupils were considered by the teacher respondents to contribute to pupils' learning
Using IT lets pupils take more responsibility for their own learning

When using IT learners are not afraid of making mistakes, so they are more prepared and try more complex or difficult work
It can increase the quality of learning by keeping the focus on the learning objective

In the recent past, it has come to the attention of many that ICT resources help transform and expand the outlook of the learners to new horizons and thinking, to introduce to them a different world with different terms and viewpoints, to allow the learners to extend their scope in education. If we think of ICT as the tool to learning in schools, and not simply as a means to learn, we would churn out the kind of learners that Kenya needs to take charge. These are learners who are able to think and provide solutions to Kenya's problems, with a global perceptive and positive mindset.

The need for ICT use in Kenya primary schools cannot be underscored. In this technology-driven age, everyone requires ICT competence to survive. The ability to use computers effectively has become an essential part of everyone's education. New instructional techniques that use ICTs provide a different modality of instruments. For the pupils, ICT use allows for increased individualization of learning. In schools where new technologies are used, pupils have access to tools that adjust to their attention span and provide valuable and immediate feedback for literacy enhancement, which is currently under serious scrutiny in the Kenyan education system.

In June 2003, at the African Summit of the World Economic Forum held in Durban, South Africa, the New Partnership for African Development (NEPAD) launched the e-Schools Initiative, intended to equip all African high schools with ICT equipment including computers, radio and television sets, phones and fax machines, communication equipment, scanners, digital cameras, and copiers, among other things (Evoh, 2007). It was also meant to connect African students to the Internet. The aim of the initiative was to impart ICT skills into young Africans in primary and secondary schools, and to harness ICT to improve, enrich, and expand education in African countries (Aginam, 2006).

In Kenya, computer technology is not part of classroom technology in both primary and secondary schools. This implies that the chalkboard and textbook continue to dominate classroom teaching and learning activities. This means that if at all there is technology use in teaching, students' experience with ICTs and their proficiency in using them is very low. Participants in the e-Schools initiative stated that they had no experience at all in using computers. Other findings indicated that the school environment provided neither opportunity nor training in using ICTs, and that 75% of teaching staff had none or very limited experience and expertise regarding ICT educational applications.

Therefore, it is important to agitate for application of relevant technology in our classrooms. Teachers have a variety of teaching and learning technologies to choose from. These include, but not limited to, computers in the classroom. Having a computer in the classroom is an asset to any teacher. With a computer in the classroom coupled with an LCD, teachers are able to demonstrate a new lesson, present new material and illustrate how to use new programmes in ways that learners' attention and participation is secured.

Noisy classrooms are a daily occurrence in many educational settings and especially in crowded classrooms. With the help of wireless classroom microphones, students are able to hear their teachers more clearly. Children learn better when they hear the teacher clearly. The benefit for teachers is that they no longer lose their voices at the end of the day. Interactive whiteboards provide touch control of computer applications. These enhance the experience in the classroom by showing anything that can be on a computer screen. This not only aids in visual learning, but it is interactive so the students can draw, write, or manipulate images on the interactive whiteboard.

Schools that are able to provide technology within the classroom expose their students to a new means of learning, while the students in lower socio-economic schools (like those in the study) may miss out on these experiences. Most teachers in such schools are not trained in ICT. If a teacher, for example, is not well equipped and confident in utilizing a form of technology, those pupils will miss out on gaining the valuable skills required for today's society. The inability of the teacher to keep up with the ever-changing technology in the classroom is a major challenge.

Students who have grown up in a digital environment may be well acquainted with the on-going process of new technological innovation but may be lacking the guidance they need in order to use these technologies effectively. The study found that some learners have access to basic ICT such as the use of mobile phones and understand how to use them better than some of their teachers and parents. From the teachers' perspective, this could be an intimidating experience because something as foreign as the computer and internet must first be learned by the teacher and then taught to the pupils in a classroom setting. It is difficult to formulate a curriculum, which aims to integrate technology into the classroom, when the decision-makers are still in the process of learning about it themselves.

The teachers enumerated a horde of training deficiencies in their preparedness to integrate ICT in their everyday teaching experiences. Similar to learning a new task or trade, special training is vital to ensuring the effective integration of classroom technology. The current school curriculum tends to guide teachers in training students to be autonomous problem solvers. This has become a significant barrier to effective training because the traditional methods of teaching have clashed with what is expected in the present workplace.

Therefore, since technology is not the end goal of education, but rather a means by which it can be accomplished, educators must have a good grasp of the technology being used and its advantages over more traditional methods. If there is a lack in either of these areas, technology will be seen as a hindrance and not a benefit to the goals of teaching.

Another major issue arises due to the evolving nature of technology where teachers may find themselves acting as perpetual novices when it comes to learning about technology. This is because technology, including the internet and its range of applications, is always in a state of change and teachers must attempt to keep current. The ways in which teachers are taught to use technology is also outdated because the primary focus of training is on computer literacy, rather than the deeper, more essential understanding and mastery of technology for information processing, communication, and problem solving. New resources have to be designed and distributed whenever the technological platform has been changed. However, finding quality materials to support classroom objectives after such changes is often difficult even after they exist in sufficient quantity and teachers must design these resources on their own.

From the study, it was evident that even though technology can provide a personalized, collaborative, creative and informative approach to learning, it may be difficult to motivate the use of these contemporary approaches among teachers who have been in the field for a number of years.

By using technology and learning through discovery, teachers may feel that they are not able to cover the material needed to meet the requirements of the curriculum. Therefore, the traditional style of teaching, including the lecturing, is common in today’s classrooms. This is a barrier because it prevents the full integration of technology into the curriculum, the ability to learn through inquiry, and the collaborative problem-solving skills, which are essential for quality learning.

4.0 Conclusion

The adoption and use of ICTs in schools have a positive impact on teaching and learning. Despite the roles ICTs can play in education, primary schools in Kenya are yet to adopt them for teaching and learning. Efforts geared towards integration of ICTs into the school system, are yet to be actualized. Problems such as poor policy and implementation strategies and limited or poor information infrastructure militate against these efforts. To solve these problems, the government, academia and market place need to work together. The government should ensure that there is trained staff, all educational institutions have high-speed Internet access; they should also ensure that the computer labs are well equipped and maintained. (Not necessarily a laptop per child). The government should also find ways of incentivizing enterprises for continuous training as well as protecting them from poaching from multinationals and other larger institutions.

5.0 Recommendations

There is need to train primary school teachers on how to integrate ICT in the classrooms for teaching and learning as part of the in-service education and training (INSET) programme by the Ministry of Education. INSET programmes should take cognizance of the educational and training needs of teachers so that teachers can own the programmes. In this way, their attitudes will be easy to deal with and it will be possible to meet their expectations.

The government should ensure that ICT policy statements are translated into reality/practice. There should be a commission funded and given the power to provide ICT facilities in the schools to manage and monitor their use. This would mean borrowing a leaf from many privately run schools where computers are managed and used optimally.

References

Aginam, E. (2006). NEPAD scores students' ICT education in Africa Low. Vanguard. http://www.vanguardngr.com/articles/2002/features/technology/tec527092006.html

Barnes, K., Marateo, R. C., & Ferris, S. P. (2007). Teaching and learning with the net generation. Innovate, 3(4). Retrieved July 30, 2007 from http://www.innovateonline.info

Brakel, P.A., & Chisenga, J. (2003). Impact of ICT based distance learning: The African story. The Electronic Library 21 (5), 476-486.

Culp, K., Honey, M., & Mandinach, E. (2005). A retrospective on twenty years of education technology policy. Journal of Educational Computing Research, 32(3), 279-307.

Evoh, C.J. (2007) Policy networks and the transformation of secondary education Through ICTs in Africa: The prospects and challenges of the NEPAD E-schools Initiative. International Journal of Education and Development Using Information and Communication Technology (IJEDICT) 3 (1), 64-84. Available: http://ijedict.dec.uwi.edu/include/getdoc.php?id=2198&article=272&mode=pdf

Magliaro, E. (2006). Computer self-efficacy beliefs of preservice teachers: Implementation of a concurrent mixed-model. Unpublished Master's thesis. University of Windsor, ON, Canada.

Magliaro, J., & Ezeife, A.E. (2007). Pre-service teachers' preparedness to integrate computer technology into the curriculum. Canadian Journal of Learning and Technology, 33(3), 95-111

Markauskaite, L. (2007). Exploring the structure of trainee teachers' ICT literacy: the main components of, and relationships between, general cognitive and technical capabilities. Educational Technology Research and Development, 55(5), 547-572.

Mishra, P., & Koehler, M. (2006). Technological pedagogical content knowledge: A framework for teacher knowledge. Teachers College Record, 108(6), 1017-1054.

Montgomerie, C., & Irvine, V. (2001). Computer skill requirements for new and existing teachers: Implications for policy and practice. Journal of Teaching & Learning, 1(1), 43- 55.

Oblinger, D. (2005). The Next Generation of Educational Engagement. Journal of Interactive

Media in Education, 2004 (8). Retrieved December 5, 2007 from http://www-jime.open.ac.uk/2004/8/oblinger-2004-8.pdf

Sasseville, B. (2004). Integrating Information and Communication Technology in classroom: A comparative discourse analysis. Canadian Journal of Learning and Technology, 30(2), 5-27.

Yildirim, S. (2007). Effects of an educational computing course on preservice and inservice teachers: A discussion and analysis of attitudes and use. Journal of Research on Computing in Education, 32(4), 479-495.

Zogheib, S. (2003). Preservice teacher beliefs related to Internet usage. Unpublished Master's thesis, University of Windsor, ON, Canada.

Zogheib, S. (2006). Explaining computer use among preservice teachers: Towards the development of a richer conceptual model incorporating experience, demographic, motivation, personality, and learning style clusters of variables. Unpublished doctoral dissertation, University of Windsor, ON, Canada.

USING MOBILE DEVICES TO IMPROVE ACCESS TO EDUCATION FOR UNIVERSITY STUDENTS WITH VISUAL IMPAIRMENTS

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Developments in emerging mobile technologies have created opportunities for providing low cost and easily supported assistive technology to students with disabilities. In this paper, we report findings from a project using mobile devices iPods and iPads (iOS devices) done with students with visual impairments at Kenyatta University. These devices are easier to implement than other forms of assistive technology for visual impairments and enhance access to education for students with visual impairment. While iOS devices are more costly than other mobile platforms (i.e., Android), these devices are a fraction of the cost of specialized, dedicated assistive technology tools, such as a screen reader installed on a laptop. The refined and consistent user interface characteristic of iOS devices, along with robust, built in access functions, make these devices easy to use, flexible, and powerful. An iPad or iPod can serve as a screen reader, display large or high contrast text, recognize and describe colors, and connect to the Internet via Wi-Fi or mobile networks.

In June of 2012, a team from Syracuse University worked with four students with visual impairment at Kenyatta University. The students were provided with Apple iPod devices, a Bluetooth keyboard, and trained to use the devices with the built-in accessibility functions. In January 2013, 10 more students were provided with devices - this time iPad minis - and the students from June training played a key role in training the new students. In this paper, we discuss the implementation of this project, lessons learned in implementing mobile technology in the higher education context, and how these devices can be used to support access to education for blind students and students with other disabilities.

Implementation of this Project

One area of capacity building that emerged in the midst of our larger project on building capacity in teacher education is building capacity among students with visual impairments (VI) at Kenyatta University. KU has quite a number of students with VI. These students use Brailler machines in their classes to produce notes in Braille. They also use computer stations in a particular room in the library to use screen readers that can read any text on the computer, on the Internet, in documents, etc.

While these technologies are helpful, they do not give students with VI as much independence as students without VI. As we were planning to introduce iPads to the KU faculty members, we decided to bring some iPods and keyboards to introduce to some KU students with VI. On the first day, we met four students and some support staff and we gave a quick overview of what we would be working on. The next day, we began working with the four students. Staff members from the Office of Disability Services, from the Library, and a faculty member from Special Needs Education participated and supported the students. Additionally, a teacher from Kibos School for the Visually Impaired in Kisumu also participated in the workshop.

We first introduced the students to the iPod using the VoiceOver feature. The students learned how to use the iPod by tapping on the screen and learned about some applications (apps). The students were very excited and said they would keep working on becoming familiar with the iPod.

They came back the second day with increased skill levels and we introduced them to using a keyboard connected via Bluetooth. The students quickly caught on to using the keyboard to access the iPod instead of tapping on the screen. On the third day, each student set up an iTunes account on his or her iPod and downloaded some free apps. We established a wireless network using a mobile phone for the students to use.

By the fourth meeting, the students had made great progress in mastering the apps on their iPods and were creating documents, downloading music, recording videos of things to listen to, listening to text, taking photos of documents and creating OCR (optical character recognition) documents. Currently, the students are very enthusiastic about the new technology tools and say that they are greatly impacting their learning and their lives.

Lessons Learned

Building on the work we did in June 2012 to train four Kenyatta University students with visual impairments to use iPods and keyboards to read and create documents, we had these four students train 10 additional students with visual impairments using iPad minis and keyboards. Within two days, all of the students were checking and sending email messages, listening to music, checking Facebook, along with reading and creating documents using the assistive technology. We are working with the Directorate of Disability Services and the Department of Special Needs Education at Kenyatta University to find funds to purchase more equipment so that more students with VI can make use of this equipment.

The four students who have been using iOS equipment since June told us how much the equipment has changed their lives, from supporting their academic work to allowing them to check the color of their socks (using an app). All four students reported that they are able to be much more independent than they were without the equipment.

Supporting Access to Education

Due to the lack of infrastructure (including people with the requisite technical experience) to support and maintain assistive technology for students with visual impairments, we sought to develop a community of practice around the use of mobile devices as assistive technology. Simply defined, “communities of practice are groups of people who share a concern or a passion for something they do and learn how to do it better as they interact regularly.” One of our goals in this work has been to develop a community of practice among the Kenyatta University students with visual impairments.

A community of practice can have multiple benefits. Through it, people can be connected who might not otherwise have the opportunity to interact, either as frequently or at all. A community of practice provides a shared context for people to communicate and share information, stories, and personal experiences in a way that builds understanding and insight. It can also enable dialogue between people who come together to explore new possibilities, solve challenging problems, and create new, mutually beneficial opportunities.

A community of practice can also stimulate learning by serving as a vehicle for authentic communication, mentoring, coaching, and self-reflection. It can capture and diffuse existing knowledge to help people improve their practice by providing a forum to identify solutions to common problems and a process to collect and evaluate best practices. A community of practice can further introduce collaborative processes to groups and organizations as well as between organizations to encourage the free flow of ideas and exchange of information.

We have worked, and are continuing to work, with Kenyatta University students with visual impairments to strengthen the community of practice that has already developed. We intend to expand upon the number of students with visual impairments who have iOS devices, as well as work with the two secondary schools in Kenya for students with visual impairments – Thika School for the Blind and Kibos School for the Visually Impaired.

References

Wenger E. (2006). Communities of practice: A brief introduction (p. 1). Available from:

http://wenger-trayner.com/wp-content/uploads/2012/01/06-Brief-introduction-to-communities-of-practice.pdf

SECONDARY PRE-SERVICE TEACHERS' UNDERSTANDING OF THE CONCEPT OF INVERSE FUNCTION

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Abstract

The importance of the concept of function in the school curriculum has sought considerable attention from mathematics education researchers. This research study reports the findings obtained in a qualitative study that examined 10 pre-service teachers' content knowledge of the concept of inverse function enrolled in a secondary pre-service teachers' program at a medium-sized university in the northeastern part of the United States. Ten participants answered five questionnaire tasks, while eight of them participated in task-based interviews. The data was analyzed using Even's (1990) theoretical framework and Hierbert's (1986) notion of procedural and conceptual knowledge. The findings revealed that these secondary pre-service teachers had profound misconceptions of the inverse function. Additionally, the findings showed a strong procedural approach to the concept of inverse function, coupled with serious misconceptions between the one-to-one and onto properties, on one hand, and the vertical and horizontal line tests on the other hand. Further analysis of the data showed that pre-service teachers had limited understanding of the inverse function representation, which was complicated by a limited understanding of restriction of the domain and finding the inverse function of constant functions. Overall, these pre-service teachers' conceptual and procedural knowledge of the concept of inverse function were disjointed.

Key words: Function, inverse function, pre-service, secondary

Evidence from existing studies shows that the concept of function is an extremely difficult one for students (Sfard & Linchevski, 1994; Sierpinska, 1992;Tall, 1996; Thompson, 1994), including pre-service teachers (Even, 1993). Sometimes this difficulty has been associated with students' concept images of a function (Vienner, 1992). Vienner argued that a student's concept image of a function might be narrow and vague because of a student's lack of understanding that a function can be represented in multiple ways. For example, a student might think that a function must always be an equation, ignoring that not all equations are functions. This study is organized into several major sections that include a review of the literature, purpose of the research, the research methods, findings, and discussion and conclusion. I will discuss these sections in the order listed above.

Review of the Literature

Research that has focused on pre-service teachers' understanding of functions has investigated: pre-service teachers' mathematical and pedagogical knowledge about functions and inverse functions, and the complexity related to understanding of functions and, in particular, the inverse function as experienced by pre-service teachers. Before discussing this research, I will highlight a few theoretical frameworks that have been used to study the understanding of the concept of function, including the theoretical framework that was developed by Even (1990), which I will use for this study.

Theoretical Framework

Even (1990) proposed a theoretical framework that is suitable for investigating content knowledge as well as pedagogical content knowledge for teachers with regard to a particular mathematics topic. The framework is made up of seven aspects that are based on integrated knowledge from the following bodies of work:

> the role of and importance of the topic in the discipline of mathematics and the curriculum, research and theoretical work on learning, knowledge and understanding of mathematical concepts in general and the specific topic in particular, and research and theoretical work on teachers' subject matter knowledge and its role in teaching. (Even, 1990, p. 523)

This framework is made up of the following seven aspects:

1. Essential features: This aspect addresses the characterization of a person's thinking in terms of the notions of concept definition and concept image (Vinner, 1992). The concept image is the distinction between the formal definition that an individual holds of a certain concept and what he or she thinks about the concept (Lloyd & Wilson, 1998).

2. Different representations: A mathematical concept can be represented differently, with each representation stressing different characteristics of the concept. For example, a function can be represented by a table, a graph, an equation, or even a verbal description.

3. Alternative ways of approaching: Mathematics ideas appear in different notations, representations and labels in various disciplines. For example, when students are required to explain how to graph a function, some students may start by making a table for x and y values, while other students may either look for x and y intercepts, or identify the slope.

4. The strength of the concept: Certain concepts in mathematics are important and appear in unique ways. For example, inverting functions as discussed previously has been fundamental in the development of calculus, differentials, and analysis.

5. Basic repertoire: A concept should include powerful examples that illustrate the basic knowledge of that concept. Teachers should possess a wide range of examples and counter-examples that highlight certain properties of concepts. They should be familiar with properties, theorems, and principles of the topic that they will be teaching.

6. Knowledge and understanding of a concept: This aspect deals with the ideas related to conceptual and procedural knowledge of a concept. Learning a new concept means making a connection to existing knowledge that creates a deep understanding.

7. Knowledge about mathematics: This refers to the general knowledge in mathematics that guides the construction of conceptual and procedural knowledge and it is acquired through deductive and inductive reasoning.

I modified Even's (1990) framework and clustered together various aspects that are closely related as follows: (1) essential features, knowledge and understanding of a concept; (2) strength of a concept, different representations, and alternative ways of approaching; (3) basic repertoire; and (4) knowledge of mathematics.

Content and Pedagogical Content Knowledge

Researchers have conducted a number of studies examining pre-service teachers' understanding of functions, confirming frequent difficulties that pre-service teachers encounter when confronted with this concept. One such study was done by Wilson (1994) who examined the evolving knowledge and beliefs of one pre-service secondary mathematics teacher as she participated in a mathematics education course that emphasized pedagogical connections and applications of the concept of a function. Wilson found that the student valued highly determining if a function was a relation or not and ignored other aspects of the function concept, such as graphs, domain and range, tables and equations. She was also not able to use graphs to organize collections of functions and was unable to use functions to help her solve problems. Wilson recommended that pre-service teachers be exposed to numerous activities that would encourage them to make connections between functions and real-world phenomena, as well as with other areas of mathematics.

Other research studies have shown that teachers' content and pedagogical conceptions have a strong impact on instructional practice. Bayazit and Gray (2004) who examined the relationship between two teachers' instructional practices and students' learning in the context of the function concept conducted one such study. These researchers found that the teaching approaches of two experienced teachers were very different. For the teacher who exhibited a determination to align the concept of inverse function by making connections through representations and by giving conceptually demanding tasks, students showed a greater fluency in using one-to-one and onto properties, and graphing inverse functions. The other teacher exhibited a procedural approach to this topic by teaching algorithmic skills that were only applicable to algebraic expressions; the teachers disregarded other representations such as graphs and ordered pairs, students in this class revealed weaknesses when working with inverse function graphs.

Another research study that documented pre-service teachers' knowledge of functions and its teaching was conducted by Sánchez and Llinares (2003). These two researchers identified a clear link between pre-service teachers' content knowledge and pedagogical reasoning for the topic of function and its representations. The results from their study showed that student teachers gave a priority role to algebraic representation and computational activities, over the problems of reading and interpreting graphs. Similarly, Even (1998) illustrated that knowledge about different representations was not independent, but was interconnected with knowledge about different approaches to functions, knowledge about context of the presentation, and knowledge of underlying notions. She also observed that students who used a global approach (looking at behavior of a function from a graph etc.) in the analysis of graphical representation understood graphical and symbolic representation more than students who used a point-wise approach (means to plot or read discrete points of a graph). Likewise, Evangelidou et al. (2004) observed that students who strongly connected functions with representations, in the form of mapping diagrams and Cartesian graphs, had a higher level of success in the conceptual understanding of functions. Even (1989) pointed out that pre-service teachers have difficulties in translating between different representations, and there is also lack of knowledge between the informal meaning of inverse as ‘undoing’ and the formal definition of inverse function. These studies show that different representations of functions contribute to the conceptual understanding of functions.

Even (1990) argued that deficiency in the understanding of the basic repertoire (one of the seven aspects of her theoretical framework) hinders pre-service teachers from conceptually grasping the concept of functions and, in particular, inverse functions. Even argued that pre-service teachers need to have a deeper understanding of the mathematics that they will have to teach by enrolling in special courses where they can learn mathematics for teaching. From this brief review of the literature, it is apparent that the concept of function, in particular inverse function, is complex and multifaceted for teachers and students as well, and the power and richness of the concept of inverse function permeates all areas of mathematics (Wilson, 1994). The complexity of the concept of function, together with the enormous duty of preparing teachers, has made researchers put emphasis on the best practices to prepare prospective mathematics teachers (Kieran, 2007).

Purpose of the Research

The research literature showed that a substantial amount of research has focused on students’ understanding of the broad concept of functions. Limited studies have examined pre-service teachers’ content knowledge of the inverse function. My goal for this study was, therefore, to gain insight into the pre-service teachers’ content knowledge of the inverse function. In particular, this study aimed to answer the following research questions:

How do prospective teachers conceive of and understand the concept of inverse function?

1. What level of mathematical proficiency do pre-service teachers have in linking inverse functions using different representations?

2. A good understanding of the concept of inverse function includes several mathematical ideas: (1) understanding of the necessary and the sufficient conditions to define a function, knowledge of the domain, the range, and the vertical line test, (2) knowledge of the one-to-one property, the horizontal line test, and the line of symmetry ($y = x$), and (3) knowledge of multiple representations of inverse function.

Research Methods

I employed qualitative methods for this study because of their usefulness to answer complex questions related to pre-service teachers' content knowledge of the inverse function. In this section, I will discuss the context and participants, the instruments, data collection, and data analysis.

Context and Participants

This study involved 10 pre-service teachers (6 females and 4 males) who were enrolled in a teachers' preparation program at a medium-sized research university, in the northeastern part of the United States. The pre-service teachers had studied mathematics courses that consisted of challenging topics, including functions, a topic found in the middle school and high school curricula. Four of the participants were enrolled in a master's program, while six participants were enrolled in an undergraduate program. I solicited input from a mathematics education professor in the selection process of these participants. Participation for this study was on a voluntary basis.

Mathematical Tasks

I used five questionnaire tasks, in which I expected respondents to interpret the inverse functional situations, define inverse functions, compose functions, classify relations as having inverse functions or not, and work with logarithmic, linear, and quadratic functions. I scored the tasks using a general five-point rubric that I adapted from Kimani (2008). Additionally, I conducted task-based interviews as outlined by Davis (1984). In order to have more detailed information about the subset of the respondents, I interviewed eight participants who showed a willingness to be interviewed with the aim of getting clarification about particular tasks from the questionnaire.

Data Collection and Analysis Procedures

I collected data for this study between October 13 and November 19, 2010. A total of 10 participants completed the questionnaire tasks, and eight participated in the semi-structured interviews. I audiotaped a total of approximately 510 minutes from the eight interviews; after which I transcribed the recordings into Word documents for analysis. The challenge for this study was to make sense of the data by identifying patterns of what participants said. In the preliminary analysis, I coded the data by observing frequent texts, segments, and phrases from each data set that emerged as themes. The following section consists of the findings from the data analysis.

Findings

I first analyzed the questionnaire data using Hiebert's (1986) notion of conceptual and procedural knowledge, followed by thematic analysis of task-based interview data using Even's (1990) theoretical framework. To adhere to research ethics and protect the participants' confidentiality, I have used pseudonyms in this study.

Analysis of Mathematical Tasks

This section presents the findings from the questionnaire tasks. The analysis showed some relationship between procedural knowledge and conceptual knowledge of pre-service teachers based on their understanding of the concept of the inverse function. Patterns from the data showed that pre-service teachers had strong procedural knowledge on tasks consisting of composition of functions, and graphical, and algebraic representation of inverse function. However, I found that pre-service teachers had difficulties with questions that assessed conceptual knowledge (e.g., definition of the inverse function, and the one-to-one and onto properties). However, these pre-service teachers showed a fair understanding of the definition of a function.

Next, I found that pre-service teachers showed sound knowledge of certain concepts. For example, pre-service teachers showed good understanding of finding the inverse function of algebraic functions. However, that was not always true for constant algebraic functions. These pre-service teachers used "switching" or "reversing" x and y to find the inverse function of $f(x) = 3x - 2$. However, they encountered difficulties when they tried to find the inverse function of $g(x) = 5$ using procedural skills. The misconceptions that these pre-service teachers demonstrated gave me the motivation to conduct task-based interviews.

Analysis of Task-based Interviews

I intended to use the task-based interviews to probe what pre-service teachers thought about certain ideas of the inverse function. From the preliminary analysis, I identified four broad themes or patterns from what the respondents said about the inverse function: multiple representations of the inverse function, understanding of the inverse function, the line tests, and the one-to-one and onto properties. I will discuss each of these themes in this section.

Multiple representation of the inverse function: I identified five different ways that these respondents represented the inverse function. Research shows that multiple representation of a concept can amplify ones' understanding of a concept. Multiple representations discussed in this section include graphical, tabular, symbolic, algebraic, and diagram representations. I will discuss each of these representations from the perspectives of these pre-service teachers' understanding of the inverse function.

The graphical representation of inverse functions is a familiar and widely used concept among the students studying mathematics. Three pre-service teachers—Rosalind, Ernest, and Lucy—could not explain verbally how a graph and its inverse function were related. Another pre-service teacher, Ryan, understood that the graph of $y = x^2$ did not have the inverse function. Unlike other pre-service teachers in this study, Ryan had a fairer understanding about the knowledge of restricting the domain. Indeed, in his thinking about restricting the domain of a function, he talked about the "imaginary part" and "function-wise" functions (RA, Interview data, 10/29/2010, lines 112-118), as a way to create an inverse function:

Ryan: Oh yeah! You can do that. If you are talking graphically, we have the basic, eh, x^2 function…something to that effect and the square root of x, and they should both cross…function wise that is it.

Lenny: What you do mean by function-wise?

Ryan: If you are talking about imaginary numbers, you have to draw the second half of the square root parabola. (RA, Interview Data, lines 112-118)

Ryan was referring to piece-wise functions. Imaginary part of a function exists when a number under the square root sign is negative. From Ryan's perspective, to avoid such situations, it is necessary to restrict the domain of a function so that the values under the square root are positive.

When a function and its inverse function were represented in tabular form, these pre-service teachers had difficulties reading the values from the table. For example, Lucy confused the values of $g^{-1}(x)$ and $g\ (x)$. Although she understood the process of finding the inverse function, there value of x was a hindrance to her explanation:

Lenny: In (3b) you did not get to the point that was required. Can you tell me how you figured $g^{-1}(x)$?

Lucy: (Laughs). I think I was…..I would say $g^{-1}(-3)$ is 5. What gives back to -3? But it was not here so I skipped for -1, I got 2 that was my process. But I think I know how to find $f(x)$ 'cause I did not know what $g(-3)$ was. So I did not know how to do it. (SL, Interview Data, 11/19/2010, Lines 404-409)

Similarly, Carol agreed that she was confusing the values of $f(x)$and $g(x)$with the values.

Lenny: What is this value? Is it x or $f(x)$?

Carol: I put it in as x.

Lenny: If it is an x, then I am saying $f(-2)$.

Carol: $f(-2)$ gives us 6, oh yeah I was interpreting this as x, which should not be (CA, Interview Data, 10/19/2010, Lines 494-498)

Understanding the inverse function is a sophisticated mathematical skill, even though it may seem straightforward that these pre-service teachers could have read the values from the table. In these two cases, Lucy and Carol had difficulties finding the value of $f(g^{-1}(-3))$ from the table, just like the rest of the respondents. The presence of composition of function in this function complicated their understanding. These pre-service teachers showed lack of many experiences in dealing with "doing" and "undoing" when an inverse function is represented in tabular form.

Many students studying mathematics are familiar with equations. The findings of this study showed that many of these pre-service teachers were not quite familiar with the relationship between functions and equations. Most of these pre-service teachers said that equations were functions and vice versa. For example, Ronald said that "equations are two in one"…, (RS, Interview data, 10/15/2010, lines 306-309)….. "a function is always an equation". (RA, Interview data, 10/29/2010, line 368)

However, both Ernest and Lucy offered a differing thinking about the relationship between functions and equations. Ernest said that "Functions are special types of equations, because an equation must have equal-to sign" (SL, Interview data, 10/20/2010, lines 352-357), and Lucy gave the following argument:

> Lenny: You said that functions can be represented by equations, but don't have to be. Tell me something about that statement that you made.
>
> Lucy: I just said an equation is like a formula. So, I gave kids a rule that can apply to a function but there can be functions that don't have equations. So that was why. That is, I would look at them and an equation can represent a function but not true. A function is stronger. (SL, Interview Data, 10/19/2010, lines 328-335)

These findings indicate that pre-service teachers have varied views of the relationship between functions and equations; Lucy offered a better justification of the relationship between functions and equations compared to the rest of the participants. Her justification was supported by her own pedagogical experiences. Most of the other pre-service teachers viewed equations as functions, but they did not see the connections between equations and other representations of functions such as graphs, tables, and diagrams.

Indeed, most of these pre-service teachers were not familiar with symbolic and diagram representation of the inverse function. Although several of the pre-service teachers used $f^{-1}(x)$ as a symbol to represent the inverse function and none of the pre-service teachers explicitly connected the symbol to represent the inverse function. Furthermore, Susan and Ronald said that they were "not familiar with diagrams," particularly the Venn diagrams, as a way to represent functions. These pre-service teachers were able to talk about graphical, tabular, and algebraic representation of the inverse function. Indeed, multiple representation of the inverse function was fairly understood among these pre-service teachers. My conclusion was that they lacked the knowledge of restricting the domain, composition of the inverse function when a function and its inverse are represented in a table, and distinguishing between equations and functions.

Understanding the inverse function. Understanding the concept of the inverse function involves understanding the components of defining the inverse function, finding the inverse function, multiple representations of the inverse function (discussed above), the one-to-one properties, and the composition of function. In this section, I will discuss some of these features, and how these pre-service teachers understood them.

The participants gave me varied definitions of the inverse function. For instance, Rosalind talked of the inverse function as ‘something that undoes’, but Ronald and Lucy talked of “reversing” and “switching” of x and y, respectfully. Ernest said that the inverse function is “not a function”. Their definitions lacked the necessary and sufficient conditions to define the inverse function. (This data is from the questionnaire tasks).

The process of finding an inverse function either algebraically or graphically was well understood by most participants. For example,

Lenny: Let me ask you…how would you show the relationship between a graph of a function and a graph of its inverse?

Ronald: It is flip…not rotated it is reflected over $y =$ line.

Lenny: Do you want to sketch that?

Ronald: The points are reflected over this line here $(y = x)$. (RS, Interview Data, 10/15/2010, lines 215-220)

This excerpt revealed that Ronald had strong procedural knowledge of finding an inverse function graphically, when he talked about reflecting the function over the line $y = x$. Similarly, Susan exhibited a strong procedural knowledge of finding the inverse function algebraically:

Susan: Umm one of the basic ones is a linear function. That is $f(x) = 3x + 4$. The way I always know to do inverses is take your x and y and switch their positions.

Lenny: Okay.

Susan: I would have, $x = 3y + 4$, and then I solve for y and I get $y = \frac{1}{3}(x - 4)$.

Lenny: Yeah.

Susan: If I wanted to go for more complicated one, I could take umm, may be an exponential $y = e^{2x}$ and then there being the main function again, x is switched, equaling $y = log_2 x$. (SW, Interview Data, 10/15/2011, lines 94-104)

Although Susan was successful in finding the inverse function algebraically, she did not first find out if the function was one-to-one. This complicated finding the inverse function of a constant function.

Evidence from the questionnaire tasks indicated that these pre-service teachers were not able to find the inverse function of a constant function ($f(x) = c$), where c is a constant. For example, Susan, Josie, and Ernest followed the same procedure described above of finding the inverse function of $g(x) = 5$, which they gave as $x = 5 = g^{-1}(x)$. Teresa wrote that $\frac{1}{5} = g^{-1}(x)$. Carol and Lucy said that the inverse function did not exist without justifications of their statements.

These pre-service teachers showed an understanding of the relationship between the inverse function and composition of functions. Ryan, like most of the other pre-service teachers, showed strong conceptual knowledge of using composition of functions. For example;

Ryan: …another function $g(x)$ so that we have our function such that our $g(x) = f^{-1}(x)$ or something like that, we probably don't need to go that far but….umm, then……we could say something like….I don't know if this is something you would want….

Lenny: go ahead that is fine.

Ryan: then $f(x) \circ g(x)$….ahhmm would be x. x would be the domain, the original domain of $f(x)$….(RA, Interview Data, 10/29/2010, lines 152-159)

Ryan was familiar with the symbolic notation of composition of functions and how it was used define the inverse function. However, Ryan did not talk of x as the identity element. This finding was consistent from the findings from other participants in this study.

These findings showed that pre-service teachers' knowledge of defining the inverse function was limited. None of these pre-service teachers defined the inverse function using the one-to-one property. Most of these pre-service teachers showed good procedural knowledge of graphing a function. However, their graphical knowledge of finding an inverse function was complicated by their limited knowledge of restricting the domain of a function and the graphs of constant functions. These pre-service teachers had good procedural knowledge of composing functions. However, finding the inverse function of constant functions algebraically was challenging for most pre-service teachers especially "switching x and y", when y is a constant function.

The line tests. Line tests in this case refer to the vertical line test and the horizontal line test. The pre-service teachers used the vertical line test to verify if a graph was a function or not. Evidence showed that these pre-service teachers had strong procedural knowledge of the vertical line test. All pre-service teachers were unanimous that a vertical line can check if a graph is a function or not. For example,

Lenny: Is it important to teach line test of graphs to students?

Lucy: I think they should know it and why it works. I think many students leave high school knowing vertical line test but they don't know why it works…why? If it hits a function twice is not a function, which goes against the definition of a function. We try to look that in that in a table of values and see is p a function of q or whatever. The same output can occur more than once but you cannot have input matching with two outputs. I think most of them got that. (SL, Interview Data, 11/19/2010, lines 225-232).

Lucy was aware that students first encounter the vertical and horizontal line tests during their high school education. She indicated strong conceptual knowledge of the definition of a function, and she went on to give me other variables p and q as examples to support her statement. However, this kind of understanding was not evident in all participants: for example,

Lenny: What do you understand by line test of a graph?

Ernest: The horizontal and vertical line test?

Lenny: Yes. You want to tell me about that?

Ernest: The vertical line test tells you if it is a function or not…and horizontal… (EK, Interview Data, 10/15/2010, lines 149-152).

Although Ernest understood the purpose of the vertical line test, he could not explain why it worked. This difficulty was evident among most of these pre-service teachers because they knew how the vertical line worked, but they could not explain why it worked. Similarly, these pre-service teachers had difficulty explaining how the horizontal line test works and why it works. This limited understanding of the horizontal line test was an indicator of how these pre-service teachers understood the inverse function. For example,

> Lenny: There are two line tests, vertical and….
>
> Ryan: And the horizontal, which shows a graph is onto I belief.
>
> Lenny: Which one shows onto?
>
> Ryan: The horizontal line test? I believe. The vertical line test is one-to-one functions. (RA, Interview Data, 10/29/2011, lines, 220-224)

Although the horizontal line test can determine if a function has an inverse function, Ryan thought that the horizontal line tested the on to property. This misconception was also evident when he associated the vertical line test with the one-to-one property.

The one-to-one and onto properties. The concept of one-to-one is critical for understanding the inverse function. The findings showed that these pre-service teachers confused the 'onto and the one-to-one properties.' This misconception became more complicated when line tests came into the picture. These pre-service teachers seemed to distinguish (without justification) between the one-to-one and onto properties. Most of the pre-service teachers said that they could not remember the concept of one-to-one. However, Ryan reasoned about the one-to-one property as follows:

> Lenny: There is this equation $f(x) = 4$Ry
>
> Ryan: You are supposed to talk about the one-to-one and onto properties. You said it is one-to-one.

because for each input value you get a single output value. Which is four.

Lenny: umm.

Ryan: But I did not think from my knowledge of onto, I did think it was onto because everything equals the same output values, which is four.

Lenny: Supposing I have drawn the graph of $f(x) = 4$, that means I can have $(1,4), (2,4), (3,4)$. And so on, does that mean it is one-one?

Ryan: That would mean it is one-to-one because, each of the input values is only, is sent to a single output value of x. (RA, Interview Data, 10/29/2011, lines, 390-401)

Clearly, the concepts of the one-to-one and onto properties were particularly confusing among these pre-service teachers. For instance, Ryan and Carol, just like other pre-service teachers, thought that a graphical function is one-to-one if it passes the vertical line test. Carol, like other pre-service teachers, thought that the horizontal line test was related to the 'onto property.' These misconceptions of the one-to-one and onto properties made the inverse function a difficult concept to understand among these pre-service teachers. What we know is that the constant $f(x) = 4$ is not onto because only one value of the range, 4, is used for this function. These pre-service teachers' conceptual knowledge of the one-to-one and onto properties was very complex and not well formulated. There was an apparent confusion of these two concepts and how they were related to the vertical and horizontal line tests. In addition, many of the pre-service teachers said they did not know, or they had forgotten what the one-to-one and onto properties were.

Discussion and Conclusion

As I have discussed previously, there is limited research in the area of pre-service teachers' knowledge of inverse function. However, the findings from this study are consistent with Even's (1992) findings of respondents who had naïve conceptions and inadequate relationships between procedural and conceptual knowledge. My findings were also consistent with Even (1990) and Lucus (2005) who found that pre-service teachers had difficulties with different representations of inverse function. In this study, I aimed at contributing to the body of knowledge of teaching secondary mathematics and to the mathematics teachers' preparation programs. I found that pre-service teachers' knowledge of the inverse functions is limited and that the relationship between conceptual and procedural knowledge implied how the pre-service teachers understood the concept of inverse function. In conclusion, these pre-service teachers showed weak conceptual understanding of the concept of inverse function. The study showed that conceptual and procedural knowledge were critically related and strongly influenced the pre-service teachers' understanding of the concept of inverse function.

References

Ayers, T., Davis, G., Dubinsky, E., & Lewin, P. (1988). Computer experiences in learning composition functions. Journal of Research in Mathematics Education, 19(3), 246-259.

Bayazit, I., & Gray, E. (2004). Understanding inverse functions: the relationship Between teaching practice and student learning. In M. J. Honies & A.B. Fuglestad (Eds.), Proceedings of the 28th Conference of the International Group for the Psychology of Mathematics Education (pp.103-110). Bergen, Norway: Bergen University College.

Bogdan, R. C., & Biklen, S. K. (2007). Qualitative research for education: An introductory to theory and methods. Boston, MA: Pearson.

Confrey, J., & Smith, E. (1991). A framework for functions: Prototypes, multiple representations, and transformations. In R. Underhill & C. Brown (Eds.), Proceedings of the Thirteenth Annual Meeting of the North American Chapter of the International Group for the Psychology of Mathematics Education (pp. 57-63). Blacksburg, VA: Virginia Polytechnic Institute & State University.

Cooney, T. J., & Wilson, M. R. (1993). Teachers' thinking about functions: Historical and research perspectives. In T. Romberg, E. Fennema, & T. Carpenter (Eds.), Integrating research on the graphical representation of function (pp. 131-158). Hillsdale, NJ: Lawrence Erlbaum.

Davis, R. B. (1984). Learning mathematics: The cognitive science approach to mathematics education, Norwood, NJ: Ablex Publishers.

Dreyfus, T., & Eisenberg, T. (1982). Intuitive functional concepts: A baseline study on intuitions. Journal for Research in Mathematics Education, 13, 360–380. Dubinsky, E., & McDonald, M. A. (2001). APOS: A constructivist theory of learning in undergraduate mathematics education research. In Derek Holton, et al. (Eds.), The teaching and learning of mathematics at university level: An ICMI Study (pp. 273–280). Kluwer Academic Publishers, Dordrecht, Netherlands.

Evangelidou, A., Spyrou, P., Elia, I. & Gagatsis, A. (2004). University students' Conceptions of function. In M. Johnsen Høines & A. Berit Fuglestad (Eds.), Proceedings of the 28th Conference of the International Group for the Psychology of Mathematics Education (pp. 351-358). Bergen, Norway: Bergen University College.

Even, R. (1989). Prospective secondary mathematics teachers' knowledge and understanding about mathematical functions. Unpublished Doctoral dissertation, Michigan State University, East Lansing, MI.

Even, R. (1990). Subject matter knowledge for teaching and the case of function.

Educational Studies in Mathematics, 21(6), 521-544.

Even, R. (1992). The inverse function: prospective teachers' use of "undoing". International Journal of Mathematics Education in Science and Technology, 23(4), 557-562.

Even, R. (1998). Factors involved in linking representations of function. Journal of Mathematical Behavior, 17(1), 105–121.

Even, R., & Tirosh, D. (1995). Subject matter knowledge and knowledge about students as sources of teacher representations of the subject matter. Educational Studies in Mathematics, 29, 1–20.

Hiebert, J. (1986). Conceptual and procedural knowledge: The case of mathematics. Hillsdale, NJ: Erlbaum.

Hiebert, J., & Wearne, D. (1986). Procedures over concepts: The acquisition of decimal number knowledge. In J. Hiebert (Ed.), Conceptual and procedural knowledge: The case of mathematics (pp. 199-223). Hillsdale, NJ: Erlbaum.

Hitt, F. (1998). Difficulties in the articulation of different representation linked to the concept of function. Journal of Mathematical Behavior, 17(1), 123-134.

Kaput, J. J. (1989). Linking representations in the symbol systems of algebra. In S. Wagner & C. Kieran (Eds.), Research issues in the learning and teaching of algebra (pp. 167-194). Reston, VA; National Council of Teachers of Mathematics; Hillsdale, NJ: Erlbaum.

Kieran, C. (2007). Learning and teaching algebra at the middle school through college levels. In F. K. Lester (Ed.), Second handbook of research on mathematics teaching and learning (pp. 707–762). Charlotte, NC: Information Age Pub.

Kimani, P. (2008). Calculus students' understandings of the concepts of function transformation, function composition, function inverse and the relationships among the three concepts. Ph.D. dissertation, Syracuse University, United States -- New York. Retrieved July 31, 2010, from Dissertations & Theses @ Syracuse University. (Publication No. AAT 3333570).

Lloyd, G. M., & Wilson, M. (1998). Supporting innovation: The impact of a teacher's Conceptions of functions on his implementation of a reform curriculum. Journal for Research in Mathematics Education, 29(3), 248–274.

Lucus, C. A. (2005). Composition of functions and inverse function of a function: Main ideas, as perceived by teachers and pre-service teachers. Unpublished doctoral dissertation, Simon Fraser University, Burnaby, British Colombia, Canada. Retrieved from: http://ir.lib.sfu.ca/retrieve/728/etd1606.pdf

Moschkovich, J., Schoenfeld, A., & Arcavi, A. (1993). Aspects of understanding: On multiple perspectives and representations of linear relations and connections among them. In T.A. Romberg, E. Fennema, & T.P. Carpenter (Eds.), Integrating Research on the Graphical Representations of Functions (pp. 69-100). Hillsdale, NJ: Lawrence Erlbaum Associates.

Nyikahadzoyin, M. R. (2006). Prospective Zimbabwean "A" Level mathematics teachers' knowledge of the concept of a function. Unpublished doctoral dissertation, University of Western Cape, South Africa. Retrieved from: http://etd.uwc.ac.za/usrfiles/modules/etd/docs/etd_gen8Srv25Nme4_7108_1182811696.pdf

O'Callaghan, B. R. (1998). Computer-intensive algebra and students' conceptual knowledge of functions. Journal for Research in Mathematics Education, 29(1), 21-40.

Sánchez, V., & Llinares, S. (2003). Four student teachers' pedagogical reasoning on functions. Journal of Mathematics Teacher Education, 6(1), 5–25.

Schroeder, T. L., Schaeffer, C. M., Reisch, C. P., & Dovan, J. P. (2002). Pre-service teachers understanding of functions: a performance assessment based on non-routine problems analyzed in terms of versatility and adaptability. Paper Presented at the Annual Meeting of the American Educational Research Association, New Orleans, LA.

Sfard, A., & Linchevski, L. (1994). The gains and pitfalls of reification: The case of algebra. Educational Studies in Mathematics, 26, 191-228.

Sfard, A., & Thompson, P. W. (1994). Problems of reification: Representations and mathematical objects. In D. Kirshner (Ed.), Proceedings of the 16th Annual Meeting of the North American Chapter of the International Group for the Psychology of Mathematics Education (pp. 3-34). (ERIC Document Reproduction Service No. ED383 533).

Sierpinska, A. (1992). On understanding the notion of function. In G. Harel & E. Dubinsky (Eds.), The concept of function: Aspects of epistemology and pedagogy (pp. 25-58). Washington, DC: Mathematical Association of America.

Tall, D. (1996). Functions and calculus. In A.J. Bishop et al. (Eds), International Handbook of Mathematics Education (pp. 289–325). Dordrecht, The Netherlands: Kluwer Academic Publishers.

Vinner, S. (1992). The function concept as a prototype for problems in mathematics learning. In G. Harel & E. Dubinsky (Eds.), The concept of function: Aspects of epistemology and pedagogy (MAA Notes, Vol. 25, pp. 195-213). Washington, DC: Mathematical Association of America.

Wilson, M. R. (1994). One pre-service secondary teacher’s understanding of function:

The impact of a course integrating mathematical content and pedagogy. Journal for Research in Mathematics Education, 25(4), 346–370.

SOCIAL MEDIA IN THE CLASSROOM: IMPLICATIONS FOR TEACHING, LEARNING AND SCHOOL POLICIES ON CELL PHONE USE IN SCHOOLS

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Abstract

A research agenda on Social Media pedagogy has started to take shape and it points to how targeted use of Social Media can increase student motivation and participation in learning. Similarly, challenges that these media pose to conventional ways of teaching and the nature of knowledge itself are becoming clear. A common example is the effect of the short message service (sms) on the development of spelling and grammar in language classes. Policy implications are also emerging that seek to identify tested ways in which schools can balance between cell phone use as a teaching resource and the interference it brings to student discipline and classroom management. This paper highlights the research in these areas around three major themes; 1) what pedagogies are in place that apply the use of the Social Media in the classroom? 2) What challenges to student learning arise from Social Media and Social Media use, in teaching and learning? 3) What school policies need to be put in place or changed to reflect the Social Media presence in schools and in teaching and learning?

Introduction

Social Media has become commonplace as a means of communication and socialization across the human spectrum but especially among teenagers and young adults. The Social Media such as Facebook and Twitter occur through cell phones, and other internet-enabled devices. Educational institutions are grabbling with the question of how teaching and learning can take advantage of these modes of communication to enhance teaching and learning. On one hand is the question of what kind of pedagogies call to the use of this kind of communication in teaching and learning and on the other hand is the question of how this kind of pedagogy will impact school policies on the use of cell phones and similar gadgets in schools.

In today's world of near abundance of mobile devices in students' hands, it would be self defeating for educators at all levels of schooling and learning instructions to fail to take advantage of the possible opportunities that these devices bring to the teaching and learning environment. Research on the time spent at Social Media sites show that the total time spent on Social Media in the U.S. across PC and mobile devices increased by 37 percent to 121 billion minutes in July 2012 compared to 88 billion minutes in July 2011(Nelson, 2011). The framework for 21st century learning described the 21st century learner as one desiring a 24/7 access to information, surrounded by a culture of creativity and innovation, innately seeks social and emotional connection and desires relevance in school curriculum. Social Media takes a center stage in helping today's leaner meet these needs outline in the framework. Social Media is defined as interactions among people in which they create, share, and exchange information and ideas in virtual communities and networks (Kaplan & Haenlein, 2010). Social Media utilizes Internet-based applications that build on the ideological and technological foundations of what is known as Web 2.0, and that allow the creation and exchange of user-generated content. The users of these tools can work in web communities through which they can share, co-create, discuss, and modify user-generated content. The communal nature and aspects of Social Media lent themselves to modern teaching approaches that require students to be active participants in learning by collaborating, creating, thinking critically and communicating about their learning.

Types of Social Media

There are several types of Social Media often categorized by what they do and how they function. There are six broad categories of Social Media. However, it is important to note that these are the six different types of Social Media; there can be overlap among the various services. The first category is social networks. The social networks offer services that allow the user to connect with other people of similar interests and background. Usually they consist of a profile, various ways to interact with other users, and ability to setup or join groups. The most popular of these categories are *Facebook and LinkedIn.*

In the second category are Media sharing sites such as YouTube and Flickr, which allow the user to upload and share various Media such as pictures and videos. Most of the services in this category allow for additional social features such as creating profiles and commenting on the postings of other users.

Microblogging is another category of Social Media. These are services such as Twitter that focus on short updates that are pushed out to anyone subscribed to receive the updates.

Another category is the Blog Comments and Forums. These are online forums that enable members to hold conversations by posting messages. Blog comments are similar except they are attached to blogs and usually the discussion centers around the topic of the blog post. There are many popular blogs and forums such as Wordpress among others.

Bookmarking Sites are another category of Social Media. These offer services that allow the user to save organize and manage links to various websites and resources around the Internet. Most allow for “tagging” links to make them easy to search and share. Some examples in this category include Delicious and StumbleUpon.

The final category of Social Media is social news. Social news services allow people to post various news items or links to outside articles and then allow users to “vote” on the items. The voting is the core social aspect as the items that get the most votes are displayed the most prominently. The community decides which news items get seen by more people. The most popular are Digg and Reddit.

What Pedagogies are in Place that Apply the Use of Social Media in the Classroom?

The quest for the use of Social Media in teaching and learning ought to be driven by an understanding that a majority of young learners in today's classrooms are digital natives to whom technology is seen as one of the basic senses with which they use to interact with the environment (Project Tomorrow, 2013). As such, the goal of using technologies within learning and teaching processes should not be to redefine the task of learning but rather to rethink learning processes to the extent that we are dealing with an entirely different set of experiences in the digital native (Hedberg, 2011). The various degrees to which Social Media can be used for teaching purposes can be derived from the building blocks of Social Media. According to the honeycomb framework developed for business use of Social Media (Kietzmann & Hemkens, 2011), there are specific functional building blocks that describe the nature and functional values of a Social Media. These building blocks can be summarized as shown in the figure below as identity, conversations, sharing, presence, relationships, reputation and groups. While this framework is derived from the business world, it can be applied to education in similar ways based on what the teacher and students seek to achieve.

1. Identity
- The extent to which users reveal their identities.

2. Conversations
- The extent to which users communicate with other users.

3. Sharing
- The extent to which users exchange, distribute, and receive content.

4. Presence
- The extent to which users can know if other users are accessible. Knowing where others are, in the virtual world and/or in the real world.

5. Relationships
- The extent to which users can be related to other users.

6. Reputation
- The extent to which users can identify the standing of others, including themselves, in a social media setting.

7. Group
- The extent to which users can form communities and sub-communities.

Figure 1. The functional blocks of Social Media

Many teachers in the classrooms are using Social Media in a variety of ways. Some examples of how teachers are applying Social Media in the classroom will illustrate more how the honeycomb model can be transferred to education. Through the use of a classroom or school Facebook site, students and teachers can post celebrations of students' success and student activities while allowing students to post and comment on issues related to these activities. Through the use of Twitter, teachers and school administrators use the site to push out calendar notices, classroom tips, celebrations, links, polls, and for quick formative assessments. The Twitter and *Facebook* accounts can be interlinked to increase presence and sharing. The *SchoolTube* site is a good opportunity for flipping classrooms. Teachers can create short (five minutes or less) videos to flip their classrooms. Students can watch the videos from home, in the hallway, or on the bus. When they come to class, instead of spending time in class watching the video, the teacher can use that time to engage students in discussion, analysis or reflection on the video depending in the required outcome. Another common Social Media site used in education is *Edmodo*. This is a controlled social learning network where Facebook meets *Blackboard.*

Overall, Social Media offers the opportunity to capitalize on the learning that occurs when the students choose to learn rather than when they are forced or required to learn. It also provides multiple ways for students to be involved in developing the 21st century skills of critical thinking, collaboration, communication and creativity.

What Challenges to Student Learning Arise from Social Media and Social Media use, in Teaching and Learning?

Much of the criticism of Social Media are about its exclusiveness as most sites do not allow the transfer of information from one to another, disparity of information available, issues with trustworthiness and reliability of information presented, concentration, ownership of Media content, and the meaning of interactions created by Social Media. However, it is also argued that Social Media has positive effects such as allowing the democratization of the internet and information (Kaplan & Haenlein 2010) while also allowing students to advocate for themselves, showcase their abilities and form friendships and communities (Wellmann, 2012).

Due to the increase in Social Media websites, there seems to be a positive correlation between the usage of such media with student behaviour issues and social misdemeanours, including cyber bullying, online sexual predators, the decrease in face-to-face interactions, exposing children to images of alcohol, tobacco, and inappropriate sexual behaviours (Munni, 2013).

What School Policies need to be put in Place or Changed to Reflect the Social Media Presence in Schools and in Teaching and Learning?

Policies regarding the use of Social Media in school should be framed in the larger context of technology use in schools since they fall in the same category. However specific policies may be necessary for focusing on the uniqueness and non-locational nature of Social Media. They should be framed around the belief that educators should consider the appropriate role of technology in education so that technology use is not the end goal but rather one of many tools available for improving student learning. Some considerations that need to be put in place with regard to Social Medial use include:

- School policy on mobile/cell phone use - Most students access Social Media through cell phones
- School provided technology resources versus Bring your own Device (BYOD)
- Parental Involvement
- Consider non phone based mobile devices

Training of and support for teachers also needs to be considered in the resources and manpower policy considerations. Teachers need to be taught about Social Media, just like they needed to be taught about using the web and email and it’s not a generational thing, as much as it is an attitude thing.

Specific consideration about technology use in school can be framed around the phases of the implementation process. A four phase to iPad implementation is suggested by Hillbrook High School Ohio who applied this four phase process in their one-on-one iPad project (Orth, 2012). In documenting the process of iPad implementation at Hillbrook School, Orth identified these phases to include the need for a clear vision. This involves clarifying the need for mobile devices in the first place, identifying leaders who will guide the process, allocating appropriate human and fiscal resources, and understanding how the technology might enhance curriculum and instruction.

Once the vision is established, many key decisions must be made (phase two). This involves formulating policies that guide implementation and evaluation and ensuring that all stakeholders are working cohesively toward the vision. Key decisions include choosing the model of implementation (1:1, Bring Your Own Device, iPad carts), reacting to existing infrastructure realities, deciding how apps would be purchased and distributed, and identifying training and sustainability resources.

Hillbrook School identified preparation, implementation, and evaluation as phases three and four in a successful pilot. Initially, this includes operationalizing the decisions made in phase two and then offering training, providing support in terms of both hardware and pedagogy, clarifying expectations for pedagogical uses, and evaluating strengths and areas for improvement.

In conclusion when used properly, Social Media tools can boost student engagement, link students to content experts and real-world examples of classroom lessons, and help them establish an online body of work. Social Media tools can help students develop proficiency with technology; learn to create, critique, analyze, and evaluate multimedia text; and manage, analyze, and synthesize multiple streams of information.

References

Kaplan A. M. & Haenlein M. (2010), Users of the world, unite! The challenges and opportunities of Social Media. Business Horizons, Vol. 53, Issue 1 (page 61).

Kietzmann, H. J. & Hemkens, K. (2011). Social media? Get serious! Understanding the functional building blocks of social media. Business Horizons 54: 241–251.

McCoid, J. M. (2011). Common core state standards: Building a solid foundation. [S.l.]: Janet M. McCoid.

Munni, R. (2013). "Effect of Electronic Media on Children". Springer-Verlag. Retrieved 4 February 2013.

Nielson "State of the media: The social media report 2012". Featured Insights, Global, Media + Entertainment. Nielsen. Retrieved 30 June 2013.

Orth, D. (2012). Four phases to iPad implementation. iTunes University.

Project Tomorrow. (2013). Are teachers of tomorrow prepared to use innovative technology? www.tomorrow.org/speakup/tomorrowsteachers_report2013.html

Wellman, B. (2012). Networked: The New Social Operating System. MIT. ISBN 0262017199.

CHALLENGES FACING THE IMPLEMENTATION OF NEPAD E-SCHOOLS' INITIATIVE IN KENYA

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Abstract

Using the policy network theoretical framework, this paper will examine the challenges facing the implementation of New Partnership for Africa's Development (NEPAD) e-schools initiative in Kenya. Based on qualitative research approach, this study aims to critically evaluate the challenges facing the implementation of e-schools collaborative initiatives under the auspices of the NEPAD.The image of a NEPAD e-school is one, which is connected to the NEPAD e-schools network via satellite and equipped with the necessary ICT infrastructure. However, till today, 2013 this agenda has not been reached since most high school graduates are not ICT literate. There is therefore need to find out the challenges that are inhibiting such a noble agenda of NEPAD and seek lasting solutions. The purpose of this study will be to investigate the challenges facing the implementation of ICT in NEPAD schools and coming up with possible solutions to address these challenges so that the project establishes a steady and sustainable process in which Kenyan graduates from secondary schools are equipped with basic and vital skills that will enable them to function effectively in the emerging information society and to contribute meaningfully to the development of their immediate society. The research findings will be subjected to statistical analysis to find out the challenges facing the NEPAD's e-school initiative in Kenya. Statistical Package for Social Sciences (SPSS) programme will be used to process the data collected, interpreted and inferences made. The data collected will be analyzed and presented using descriptive statistics using frequency tables, percentages, and means.

Introduction

Improved secondary education is fundamental to the creation of effective human capital in any country. In an effort to eradicate poverty and ensure sustainable socio-economic development in Africa, the newly formed New Partnership for Africa's Development (NEPAD) recognizes that a key issue is the development of human resources in the region.

The crisis facing human resource development in Africa is clearly manifested in the secondary education sub-sector in forms of limited access and poor quality. The World Bank (2005) describes secondary education as the crucial link between primary schooling, tertiary education, and the labor market. As the World Bank (2005) notes, the task confronting education policymakers in Africa is to transform secondary education institutions and current schooling practices to align them with the fast growing demands of globalization and the technology-driven world.

The main focus of the education policy process in Africa is to address the twin challenges of increasing access to, and improving quality and relevance of secondary education for all young people in the region. This underscores the imperative to transform teaching and learning in primary and secondary schools in African countries. This is what the NEPAD e-school projects want to accomplish with a new paradigm of educational curriculum delivery. This new and integrated strategy for socio-economic development in Africa paves a new way for the improvement in quality and expansion of access to public education in the region. The NEPAD e-school projects aimed at equipping secondary schools (and later primary schools) in Africa with information and communication technologies (ICTs) to enable educational transformation to meet the demands of the 21st Century. In the long run, modern communication technologies were expected to be widely deployed for teaching and learning in primary and secondary schools across Kenya. This broad-based technology enhanced education was to be implemented through a collaborative partnership system in African countries.

E-learning refers to the purposeful use of electronic systems or computer in support of the learning process (Allen, 2003). Therefore, the presence of ICT infrastructure in a school is a pointer to an enabling environment for e-learning. It means that e-learning is only possible when ICT infrastructure has been put in place. The Sessional Paper No.1 of 2005 emphasizes that ICT skills play a key role in promoting the economic development of a country (MOEST, 2005). As a result, the government recognizes that an ICT literate workforce is the foundation on which Kenya can acquire the status of a knowledge economy. The government as a result has made education the avenue for equipping the nation with ICT skills in order to create a vibrant and sustainable economic growth. The National ICT policy was launched in 2006 in response to issues raised in Sessional Paper No. 1 of 2005 according to MOE (2006). It was also meant to assist the nation to achieve part of the Millennium Development Goals. Its principal objective was to facilitate sustainable economic growth and development, and poverty eradication through productive and effective technologies. It further aims at pursuing progress towards full socio-economic inclusion of citizens through universal access (e-learning). It was on this background that New Partnership for Africa Development (NEPAD) was initiated to address challenges facing African countries like Kenya.

ICT infrastructure was identified as a priority action area for inducement of conditions for sustainable development. In 2003, NEPAD prioritized efforts towards bridging of the digital divide between Africa and the developed world. One of the six high priority areas identified was the NEPAD e-school initiative. Its main aim was to integrate ICT in the delivery of education curriculum at secondary and primary school levels in order to improve access, quality and equity in education among member states. In Kenya, the participating schools were: Maranda boys, (Nyanza province), Chavakali boys (Western province), Menengai High (Rift Valley), Wajir girls (North Eastern), Mumbi Girls (Central province) and Isiolo girls (Eastern province).

Background

The 37th Summit of the AU in July 2001 formally adopted the strategic framework document (New Partnership for Africa's Development [NEPAD], 2005). With focus on education, health, regional infrastructure, agriculture, market access and preservation of the environment, NEPAD operates within the larger framework of the African Union. The framework has been described as a holistic, comprehensive integrated strategic approach for the socio-economic development of Africa.The New Partnership for Africa's Development (NEPAD) e-Schools Initiative was publicly launched in Durban, South Africa at the Africa Summit of the World Economic Forum on June 12, 2003. The NEPAD e-Schools Initiative has been adopted as a priority continental undertaking aimed at ensuring that African youth who graduate from African schools are endowed with the skills that will enable them to participate effectively in the global information society. The aim of the initiative was to impart ICT skills to young Africans in primary and secondary schools to utilize the potential of ICTs as well as harness ICT technology to improve, enrich and expand education in African countries. (e-Africa Commission, 2006).

Objectives of NEPAD e-school initiative

The objectives of the NEPAD e-schools initiative are to:

1. Provide ICT skills to young Africans in primary and secondary schools to enable them function effectively in the emerging information society and knowledge economy;

2. Make African students health literate;

3. Provide teachers with ICT skills in order to enhance teaching and learning;

4. Provide school managers in Africa with ICTs skills to facilitate efficient management and administration in schools; and

5. Establish "health points" in each school in order to provide health information to students, parents, healthcare workers and the broader community (The NEPAD e-School Initiative, 2005).

This technological intervention in education was announced on June 12th 2003 at the Africa Summit of the World Economic Forum in Durban, South Africa (The NEPAD Dialog, 2004).

NEPAD e-school Implementation Structure

The NEPAD's e-schools policy implementation is under the aegis of the e-Africa Commission. This is the department responsible for driving NEPAD's ICT Programs. The implementation structure of the e-school project has two broad levels:

1. The core tasks of supervising the installation and operation of the hardware and software in the schools, deploying teachers and curriculum delivery will be managed at the national level; while

2. The tasks of formulation, co-ordination, monitoring and evaluation of the project will be performed as a continental collaboration through the NEPAD e- Africa Commission (NEPAD, 2004).

A major aspect of the e-school system is the NEPAD e-school Satellite Network. This project is expected to provide a central and harmonized Internet connectivity for all schools in the NEPAD e-School system in Africa. In addition to connecting African schools to the Internet, the satellite network is expected to facilitate the distribution of educational contents in Africa.

The satellite will be linked to major distribution content centers in each country from which educational contents will be distributed to schools (Malapile, 2006). This mechanism is expected to enrich the quality of secondary education contents in Africa, especially among those countries that are still using outdated and ineffective educational curricula.

Delivery targets have been set to turn all African secondary schools into NEPAD e-schools within five years of the implementation start date and all African primary schools into NEPAD e-schools within 10 years of the start date.

Implementation

The implementation of this technological intervention in secondary education includes the following processes:

1. Installation of ICT equipment, software and infrastructure in schools;

2. The training of pre-service and in-service teachers to use this technology to impart ICT skills to the students, as well as facilitate preparation and delivery of course materials in all other subjects;

3. The use of ICT to develop appropriate course materials and make them available to schools and teachers;

4. The establishment of an African-wide satellite network that will connect schools to the internet, as well as to points within each country from which educational content will be fed to the schools on a continuous basis (NEPAD Dialog, 2004. p. 8).

The e-School Pilot Projects

The implementation of ICT in education policy under NEPAD is organized in phases, starting with pilot or demonstration projects. The e-schools demonstration (e-schools demo) projects are critical initial steps for the implementation of the e-Schools

Project. Phased implementation of the e-school initiative ensures that the implementation process is manageable and the development of best practices and lessons learned is gradual. It also provides opportunities for evaluations, so that the policy can be revised and fine-tuned through the feedback process. In general, the demo projects aim to accrue empirical knowledge about the implementation of ICT in schools across Africa. The acquired body of knowledge from the demo will serve as a forerunner to a full scale and extended rollout of the broader e-schools initiative (NEPAD Dialog, 2004). Thus, the dynamic concept of the e-schools demo project involves the notion of a learning community in which the various stakeholders are both learners and contributors to the education reform process through ICTs. This will provide a good basis for the successful implementation of ICT in education policy in the region.

Through formative and summative evaluations of lessons from the e-school demo projects, the best practices and lessons learned can be integrated in the ICT in education policy in Africa. The demo projects, which started in July 2005, are expected to establish a total of 96 secondary e-schools in 16 countries (six schools in each of the participating countries will initially benefit from the e-schools demo). The demo project is expected to directly impact approximately 150,000 African learners and teachers in the participating countries (NEPAD, 2004).

The following 16 countries are currently participating in the demo project: Algeria, Burkina Faso, Cameroon, Egypt, Gabon, Ghana, Kenya, Lesotho, Mali, Mauritius, Mozambique, Nigeria, Rwanda, Senegal, South Africa and Uganda. The e-Schools Demo, which was designed to run for 12 months, would be monitored and evaluated by the Commonwealth of Learning and the INFODEV program of the World Bank. The e-school demonstration projects in each country will be under the sponsorship of private partners for a period of 12 months.

Importance of demo e-schools

Among other things, the e-school demo projects are expected to provide a platform for:

1. Determining typical e-school scenarios and requirements in various circumstances in Africa;
2. Highlighting the challenges inherent in the large-scale implementation of e-school programs;
3. Monitoring the effectiveness of multi-country, multi-stakeholder partnership;
4. Determining 'best practice' and working models for the large-scale implementation of e-school;
5. Demonstrating the benefits of the envisaged satellite-based network; and
6. Demonstrating the benefits of ICTs in African schools (NEPAD, Dialog, 2004).

Demonstration schools in the first phase of the NEPAD e-school implementation process will serve as models for ICT integration. These schools could encourage the staff to share their experiences and expertise with staff from other schools, or they could post their teachers to other schools that wish to start ICT integration. Alternatively, staff from other schools could be attached to these demonstration schools to observe best practices and immerse themselves in a culture that supports ICT integration during the second phase of the implementation process.

The e-school demo projects have also benefited from the inputs of other organizations in Africa working in the field of educational technology. The e-Africa Commission consulted with organizations, such as the Mindset Network organization and the Khanya

Educational technology Project, which have been involved in technology-enhanced education projects in South Africa for many years.

Schools selected for the e-school demo projects provide a reasonable representation of the spectrum of African secondary school environment. The schools are required to comprise a mixture of rural and urban schools with differences in demography and infrastructural provision (Chetty, 2005). Therefore, ministries and departments of education in different countries participating in the e-schools demo projects are required to provide the basic infrastructural amenities, such as good roads, classrooms and electricity for rural and remote schools selected for the e-school demo project.

E-learning in Kenya

E-learning is facilitated through the use of ICTs. It can cover a spectrum of activities from supported learning to blended learning (the combination of traditional and e-learning practices) and learning that is entirely online. E-learning is often used in distance learning programmes and is offered through electronic media such as CD-ROMs, mobile phones, video conferencing, e-mail, web sites, interactive TV and satellite broadcasts.

Because Africa has a severe shortage of electricity, telecommunications, computers and trained teachers, it has become increasingly important to encourage e-learning as a viable means of enabling large numbers of students to access education (Gunga & Ricketts, 2006). The advantage of e-learning is its capacity to serve both on-campus and distance learning students at the same time.

International Organizations

International organizations have been attracted to the country as a result of new government policies on the adoption of ICT. The mission of these organizations, which include Computer Aid International, Computers for Schools Kenya and the New Partnership for African Development (NEPAD) e-schools, is to provide computers to secondary, primary and tertiary institutions so as to strengthen e-learning and other ICT education programmes.

The Ministry of Education is working closely with NEPAD to introduce e-learning in primary and secondary schools (Sankale, n.d.). Six secondary schools have already been chosen to serve as models for the implementation of the e-project. These schools will have access to computers and the Internet. Other e-learning initiatives in Kenya include: Click online, a pilot project using handheld computers, which is geared towards reducing the cost of education in poor countries; the Schoolnet initiative; and ongoing SMS technology development to enhance data collection and provide online support for teachers.

Several organisations support and promote learning initiatives in Kenya. These include Computers for Literacy in Kenya (see http://www.clik.org) and Schoolnet Kenya (see http://www.schoolnetafrica.net). Schoolnet Kenya is a nongovernmental organisation that works in partnership with various stakeholders to foster and support the realisation of access and equity in education through the use of ICTs. Its mission is to ensure development in access to and use of **ICTs in primary and secondary school education in Kenya**

The Kenya Educational Network (KENET) is constructing the terrestrial fiber-optic network that will connect most towns in Kenya (Thairu, n.d.). KENET is an organization that strives to establish a platform for communication and networking among educational institutions in Kenya. The objectives of KENET include establishing a high-speed national IP-based network connecting all learning and educational institutions, providing sustainable and permanent Internet access to all institutions, creating at least one learning centre in each institution to support e-learning, developing a comprehensive national education portal with an appropriate e-learning platform, and training sufficient faculty and ICT support staff to collaborate with educational institutions and the public in the development of relevant content and to generate research within Kenyan and other external institutions.

Piloting

The pilot project was launched in all the countries in the year 2005 with the Kenya launch taking place at Isiolo Girls in Eastern province. Piloting took just one-year from the time of the launch after which the programme was officially handed over to each government for expansion on a wider scale through the respective ministries of education. According to NEPAD e-Commission (2003), Ministry of Education, Science and Technology (MOEST), in partnership with three companies: Microsoft Corporation, Oracle Corporation and Digital Satellite Television (DSTV) did the program implementation in Kenya.

The Problem

To date less than ten percent of secondary schools offer computer studies despite its perceived role in the nation's socio-economic development (Okuogo, 2006). The few schools that have an ICT programme have limited the number of candidates who take up the subject, considering it a specialty whereas this is an essential subject just as would be compulsory subjects like mathematics and languages. The ideal situation would be where ICT was mainstreamed in all school subjects such that it would be seen in Geography, History, Business Studies, and Physics and so on. This could be done more easily if schools had access to e-materials and the relevant ICT infrastructure including the Internet. The NEPAD schools were set up (Ayere et al. 219) as model centers of excellence in ICT education for other schools to copy (MOE, 2006).

This is what made it necessary for these schools to be fitted with the necessary ICT infrastructure. The main ones being: Computers, E-materials, Internet appliances and Trained personnel. But to gauge their success, as centers of excellence there was need to survey their contribution to the school and the surrounding community and provide information on ICT implementation especially the e-learning component. This would only be possible if their usefulness to the school and surrounding community in terms of their e-learning programme was checked against the contribution of the already existing programmes to justify the investment.

Specifically, the study will identify levels of integration of ICT in curriculum subjects, survey the use of e-materials in education research, examine availability of e-libraries, and identify academic performance of the NEPAD schools attributed to e-learning. NEPAD's project team further explained that Kenya's Ministry of Education, Science and Technology (MOEST), in partnership with three companies (Microsoft Corporation, Oracle Corporation, and Digital Satellite Television (DSTV)), would carry out the program implementation in Kenya.

Microsoft sponsored the programmes in Maranda Boys, Chavakali Boys' and Wajir Girls. While Oracle, (2005) sponsored the programmes in Mumbi Girls, Isiolo Girls and Menengai Mixed High school. A DSTV was provided to all the schools, a satellite dish, 20" Television (T.V) sets, Video cassette recorder, Satellite decoder, and a Very Small Aperture Terminal (V-SAT) system for Internet access via the African Computer Services Centre in Nairobi.

According to the Ministry of Education (2006), the schools were to provide infrastructure to be used while each company was to provide the kit for hardware and the software. Within the school, each classroom was to have a computer served from the laboratory for the teacher's use. Besides the kits, Microsoft and Oracle were also mandated to train the teachers in the Kenyan schools on how to adapt these programmes. Earlier on, in 1996 the government, through MOEST, declared that all secondary schools should introduce computer studies. It was not clear how schools were to acquire the computers; as a result most schools failed to comply (Odera, 2002). The government in the same year approached UNESCO to fund its computer education programme. UNESCO responded by not only supplying some national schools with computers, but also trained the Principals and a few of the teachers to start off the programme. To date less than ten percent of secondary schools offer computer studies despite its perceived role in the nation's socio-economic development (Avgerou, 2003; Okuogo, 2006; Sahlfeld, 2009; Weiner & Rumiany, 2007). The few schools that had an ICT programme limited the number of candidates who could take up the subject, considering it a specialty despite its being an essential subject as are compulsory subjects like Mathematics and Languages. According to Rodrigo (2003), this would bring out the threefold usage of ICT – as objects of study, as support tools, and as catalysts for learning.

The NEPAD programme was expected to integrate ICT in all subject areas and to empower the school community with ICT skills (Ogule, 2009; Tilvawala et al., 2009). The government decided to use six schools instead of expanding the provision of computers to more secondary schools in the country. The New Partnership for Africa's Development (NEPAD) schools were set up as centers of excellence in Information and Communication Technology (ICT) integration, so that other schools could copy their model in e-learning. It was for this reason that they were provided with computers, e-materials, Internet appliances and trained personnel.

According to the outline of the NEPAD e-school agenda, within five years (by the end of 2008), each youth graduating from an African high school would have been ICT-literate, and within ten years (by the end of 2013), each child graduating from an African primary school will be ICT-literate (NEPAD, 2004). By these dates, it was expected that each one of these schools in the respective category would have been converted into a NEPAD e-school. The image of a NEPAD e-school is one which is connected to the

NEPAD e-schools network via satellite and equipped with the necessary ICT infrastructure (computers, TV sets, radio-sets, telephones and telephone lines, fax machines, digital cameras, VCR’s, scanners, photocopiers, communication terminals etc). However today 2012, this agenda has not been reached since most high school graduates are not ICT literate. There is therefore need to find out the challenges that are inhibiting such a noble agenda of NEPAD and seek lasting solutions.

Challenges Facing the Implementation of NEPAD’s E-Schools Initiative in Kenya

Factors Affecting the Implementation

The main problem facing the sector of e-learning in Kenya is the lack of application of ICT skills and knowledge in schools and the surrounding community. Various factors are contributing to this. There is lack of equipment and materials in the schools such as computers, cameras, scanners etc. It is important to note that no e-learning will take place if these materials are absent.

Teachers are not trained or they are inadequately trained on handling the ICT materials; some teachers even have not handled a computer, leave alone the internet. This hinders the development of electronic knowledge in the country.

There is a lot of theoretical approach to ICT teaching in schools. Schools that offer computer studies as a subject do a lot of theoretical teaching than practical teaching. Furthermore there is an acute scarcity of teachers; the education sector in Kenya requires almost 80 teachers so that teacher student ratio can improve. This alone in addition to inadequacy in training draws back the efforts put in the e-learning development.

Kenya is a third world country and has limited resources from which it can draw funds to develop an expensive ICT sector. The partners who offer to assist only do so in few schools leading to discriminations of some schools.

The government's ICT policy is poor. All the policies laid down for ICT and e-learning are never followed to the letter and therefore the projects that would have begun well finally stall.

Inputs

To develop the ICT curriculum in schools, the government should ensure that there is the provision of enough equipment and materials, training of teachers on integration of ICT into the curriculum, in service of teachers to achieve ICT skill proficiency, and change ICT curriculum objectives to emphasize application

Conclusion

If all these inputs are put in place then the following outcomes will be realized: there will be improved learner performance, improved teaching methods on integration of ICT, improved acquisition of practical ICT skills, and increased ICT application areas.

References

Aaron D. S. (2001) "Building Implementation Networks: Building Multi-organizational, Multisectorial Structures for Policy Implementation." A dissertation submitted to the Faculty of the Virginia Polytechnic Institute and State University in partial fulfillment of the requirements for the degree of Doctor of Philosophy in Public Administration and Public Affairs.

Akinsanmi, T. (2005) "Encouraging the effective and sustainable use of information and communication technologies for promoting education and development." In Bonnie Tracey and Terry Culver, Harnessing the Potential of ICT in education: A Multi-stakeholder Approach. New York: The United Nations Information and Communication Technologies Task Force

Akoojee, S. & McGrath, S (2005) Post-Basic Education and Training and Poverty

Reduction in South Africa: Progress to 2004 and Vision to 2014. Post-Basic Education and Training Working Papers Series - Nº2 October 2005. Centre of African Studies, University of Edinburgh

Boaduo, N.A (2005) "Secondary Education Provision In Africa: What Form Should It Take In The Twenty-First Century?" The African Symposium: An online Journal of the African Educational Research Network. Volume 5, Number 4; December 2005 (pp.1-14) URL: http://www2.ncsu.edu:8010/ncsu/aern/TAS5.4Boaduo.pdf [Accessed on 01/31/2013]

Bregman, J. & Stallmeister, S. (2002). "Secondary Education in Africa (SEIA): A Regional Study of the Africa Region of the World Bank" in World Bank (2002) Secondary Education in Africa: Strategies for Renewal. World Bank presentations at the December 2001 UNESCO/BREDA-World Bank Regional Workshop in Mauritius on the Renewal of African Secondary Education

Bregman, J. & Bryner, K (2003) "Quality of Secondary Education Africa." Paper presented at the ADEA Biennial Meeting, Grand Baie, Mauritius. December 3-6, 2003

Bridges.org. (2001) "Spanning the Digital Divide: Understanding and tackling the issues." URL http://www.bridges.org. [Accessed on January 22, 2013]

Butcher, N. (2003) Technological Infrastructure and Use of ICT in Education in Africa: An Overview. Paris: Association for the development of Education in Africa (ADEA).

Chasia, H (2004) "NEPAD ICT Program", a paper presented at ICT Stakeholder Forum, Mauritius, July 7-9, 2004

Chavez, R. et al, (1996) "Improving Educational Quality (IEQ) Project, South Africa

Monitoring and Evaluation Handbook.” Institute for International Research in collaboration with Juarez and Associates, Inc. and The University of Pittsburgh

Chetty, M. (2005) “Summary of the NEPAD e-School Demonstration Project (DEMO).

Darkwa, O. & Mazibuko, F. (2000) “Creating Virtual Learning Communities in Africa: Challenges and Prospects.” First Monday, volume 5, number 5 (May). URL: http://firstmonday.org/issues/issue5_5/darkwa/index.html [Accessed on 12/22,/2012]

Dugger, W. & Naik, N. (2001) “Clarifying misconceptions between technology education and educational technology.” The Technology Teacher, 61(1), 31-35. e-Africa Commission, (2006) “NEPAD e-School Initiative” URL: http://www.eafricacommission.org/nepad_eschool_initiative.html [Retrieved 12/20/2013]

Farrell, G. (2006) “First Interim Report: NEPAD e-Schools Demonstration Project.” January 2006. Commonwealth of Learning & Information for Development Program

Gunton, T. (1993) Dictionary of Information Technology and Computer Science. London, Penguin

Hawkins, R.J (2002) “Ten Lessons for ICT and Education in the Developing World” in Geoffrey Kirkman (ed) The Global Information Technology Report 2001-2002: Readiness for the Networked World. New York: Oxford University Press

Hanushek, A. E. & Kim, D. (1995) “Schooling, Labor Force Quality, and Economic Growth,” NBER Working paper, No.5399. Cambridge IMFUNDO (2001) “A review of experience with information and communications technologies in education projects” IEC, Cambridge May, 2001.

Isaacs, S. (2002) “IT’s Hot for Girls! ICTs as an instrument in advancing girls’ and women’s capabilities in school education in Africa.” United Nations Division for the advancement of Women Expert Group Meeting “Information and Communication Technologies and their impact on and use as an instrument for the advancement and empowerment of women” Seoul, Republic of Korea, 11-14 November 2002

James, T. ed. (2001) An Information Policy Handbook for Southern Africa: A Knowledge Base for Decision-Makers. Johannesburg, International Development

Research Center’s (IDRC) Regional Office for Southern Africa

Kennis M. & Volker, S. (1991) “Policy Network and Policy Analysis: Scrutinizing a new analytical tool.” In Marin, B. & Mayntz, R (eds) Policy Networks: Empirical Evidence and Theoretical Considerations. Boulder, Colorado: Westview Press.

Kinyanjui, P. (2003) “NEPAD e-School Initiatives and Teacher Development.” A Keynote Address Program Commissioner/Coordinator e-Africa Commission,

NEPAD NAIROBI – KENYA 4TH–6TH NOVEMBER 2003

Kinyanjui, P. (2004) “NEPAD e-School Partnership Model.” A key note Address presented at the ITU Public and Private Sectors Partnership Forum Kampala, Uganda. October 31 – November 2, 2004

Leask, M. (2003) “ICTs in School Classrooms: Planning to avoid costly mistakes.” Insights Education Issue #1, February 2003.

Lewin, K.M. (2004) “Beyond Primary Education for All: Planning and Financing Secondary Education in Africa.” A paper presented at the Donor Conference on SEIA, held at the Vrije Universiteit Amsterdam (VUA) October 2004.

Malapile, S. (2006) “The Status, of the NEPAD e-School Initiatives, April 2006.”

Mbarika, V. (2002) “Re-thinking Information and Communication Technology Policy Focus on Internet versus Tele-density Diffusion for Africa’s Least Developed Countries.” The Electronic
Journal of Information Systems in Developing Countries (EJISDC). Vol. 9 No. 1. Pp 1-13

Merriam, S .B. (1998) Qualitative Research and Case Study Applications in Education. San Francisco, Jossey-Bass Publishers

Mutula, S.M. (2003) “Assessment of Africa’s Telematics, Policy and Regulatory Infrastructure: Potential for e-learning.” A paper delivered at the NTESU International Conference in Durban, University of Natal, South Africa. Theme:“Changing Working Conditions in High Education.” July 9-11th, 2003. URL: http://www.ntesu.org.za/html/conference/papers/mutula.pdf

NEPAD (2001) NEPAD Framework Document. URL: http://www.nepad.org/2005/files/documents/inbrief.pdf [Accessed on September 23, 2012]

NEPAD, (2004) “NEPAD Schools National Implementation Structure,” as agreed to by participants at the work of the NEPAD e-School Phase ONE Countries. May 13-15, 2004, Johannesburg, South Africa

NEPAD, (2005) Report of the NEPAD e-School Co-coordinating body workshop held in Pretoria, South Africa, January 24-26, 2005.

NEPAD Communications and Outreach & the MMI Group, (2005) “NEPAD e-Schools project is ready to roll in the first 20 countries” URL: http://isaafrica.com/english/nepad/2005/news030605.htm [Accessed on February 12, 2013]

NEPAD Dialogue (2004) Focus on NEPAD e-Schools Initiatives, Issue 54, February

2004 Nsubuga, Y.K. (2003) “Equitable Access and management of Secondary Education in Uganda” Paper presented at the First Regional Sub-Saharan Africa Conference for Secondary Education in Africa (SEIA), Kampala, Uganda. June 9 – 13, 2003

Osin, L. (1998) “Computers in Education in Developing Countries: Why and How?” Education and Technology Series, Vol. 3. No. 1 (pp. 1-14)

Organization for Economic Co-operation and Development, (2001), Learning to Change: ICT in Schools, OECD: Paris

O’Toole, L.J. (1988) “Strategies for Intergovernmental Management: Implementing Programs in Inter-organizational Networks.” Journal of Public Administration, 11(4) pp. 417-41.

Parrott, M. (2003) “Towards a New Literacy: The Impacts of Information Communications Technology“ in International Outlook, Issue No. 13 [On-Line] http://www.cie.org.uk/CIE/WebSite/Data/NewsLetter/International.pdf Access December 10, 2012

Perraton, H. & Creed, C. (2000) “Applying new technologies and cost-effective delivery systems in basic education,” World Education Forum, Dakar, Senegal. April 26 – 28, 2000. UNESCO: Paris

Patton, M.Q. (1990). Qualitative Evaluation and Research Methods Newbury Park, CA: Sage Publications, Inc.

Psacharopoulos, G. (1986) Financing Education in Developing Countries: An Exploration of Policy Options. Washington D.C, The World Bank

Psacharopoulos, G. & Patrinos, A. (2002). Returns to education: A further update. World Bank Policy Research Paper, No. 2881. Washington, D.C: World Bank

South African Institute of Distance Education (2005) Online Access and Connectivity of Primary School Teachers in Sub-Sahara Africa. Johannesburg, South Africa: SAIDE

The World Bank (2005). Expanding Opportunities and Building Competencies for Young People: A New Agenda for Secondary Education. Washington DC: The World Bank

The World Bank, (2001), A Chance to Learn: Knowledge and Finance for Education in Sub-Saharan Africa. Washington DC: the World Bank UNESCO (1999) Reforming Secondary Education Consortium Paris: UNESCO Unwin, T. (2005) Partnership in Development Practice: Evidence from multi-stakeholder ICT4 partnership practice in Africa. Paris: UNESCO.

USAID & Improving Education Quality (n.d) "Secondary Education Reforms in the Sub-Saharan region" URL: http://www.ginie.org/cstudies/africa/index.html [accessed on December 22, 2012]

Venezky, R. & Davis, C. (2002) "Quo Vademus?" The Transformation of Schooling in a Networked World." OECD/CERI. URL: http://www.oecd.org/dataoecd/48/20/2073054.pdf [Accessed September 9, 2012]

SEARCHING FOR TECHNOLOGICAL SOLUTIONS TOWARDS THE TEACHING OF MATHEMATICS TO LEARNERS WHO ARE DEAF

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Abstract

To be able to recognize and understand mathematical properties, one needs to be able to look at all the components of a mathematical problem and recognize each item in relation to the other relevant entities. The full meaning of any single mathematical element in a problem task can be understood only by recognizing its relation to the other mathematical elements. Unfortunately, the evidence suggests that deaf adults and children have difficulty in understanding the component relationships in multidimensional complex tasks. Over 25 years ago, research showed that deaf individuals performed significantly less well than their hearing peers on tasks that required considering the relationship between two or more dimensions (Ottem, 1980). In a more recent study that examined the reasoning of deaf and hearing college students involving 4- and 5-term series problems, Marschark and Johnson-Laird (2003) found that for both deaf and hearing students who drew external models showing relationships among the elements of the 4-term series problems, their performances were comparable; but for those students who did not draw external models, the hearing students' performances were significantly better. In a memory study, Banks, Gray, and Fyfe (1990) showed that deaf children's recall of text tended toward disjointed parts or facts instead of more meaningful whole conceptual units. This article, therefore, sets out to analyse documented literature on technological strategies for teaching mathematics to learners who are deaf and hard of hearing (DHH).

Statement of the Problem

Hearing loss, per se, is not a cause of poor mathematical performance but rather more of a risk factor related to the timing, type of instruction, and learning opportunities provided to (Nunes & Moreno, 1998). A generalized disparity in mathematical performance between deaf students and their hearing peers is well documented in the educational literature.

Purpose of the Analysis

ICT creates new possibilities, dilemmas, and directions and encourages teachers to harness the new opportunities that ICT offers to make teaching and learning more meaningful and rewarding. The ability to utilize information and communication technology has become the new literacy for the 21st century. As such, new technologies call into question many of our long-held assumptions about education. In other words, ICT can change teaching and learning by being a source of knowledge, a medium for transmitting content, and an interactive resource furthering dialogue and creative exploration. This is why we set out to explore documented works on how technology might be used to enhance learning of mathematics for learners who are DHH by reviewing what has been documented around the globe.

Introduction

Worldwide research has shown that ICT can lead to improved student learning and better teaching methods. A report by the National Institute of Multimedia Education in Japan argued that an increase in student exposure to educational ICT through curriculum integration has a significant and positive impact on student achievement, especially in terms of Knowledge Comprehension, Practical skill, and Presentation skill in subject areas such as mathematics, science, and social study (Freedman 2013). Light (2010) stated that, around the globe, ministries of education are promoting information and communication technologies (ICT) as an element of the modern education systems they strive to build. Governments and international organizations are providing both infrastructure and training to educators in developing countries to achieve this goal.

Marschark and Hauser (2008) noted that specific legislative and community efforts to improve special education appear to have been guided by emotion, opinion and politics rather than science and facts. As a result, educational interventions intended for students with diverse needs have only yielded limited gains, with those aimed at students who are deaf and hard of hearing noteworthy for their slow progress in reading, writing and mathematics (Qi & Michelle, 2007; Stinson & Kluwin, 2003; Traxler, 2000).

It has been noted by Zlotnikova and van der Weide (2011) that there are significant attempts to implement ICT educational policies in Sub-Saharan Africa. Almost all African countries currently have either ICT policies or ICT educational policies or both. There are also numerous ICT educational projects initiated by both governmental and non-governmental organizations (NGOs). However, the provision of technology alone will not optimally harness the potential of ICTs to enhance access, student achievement and the transformation of teaching and learning (Swarts, 2006).

In Kenya, achievement in mathematics raises a lot of concern not only to students and parents but also to employers and researchers (Kiboss, 2012). This concern is derived from the Kenya National Examination's (KNEC) continued reports of dismal results in the field of mathematics. KNEC further notes that mathematics presents challenges to both teachers and students.

What does Mathematics Mean to Learners with Hearing Loss?

The American Heritage Dictionary (2000) defines mathematics as "the study of the measurement, properties, and relationships of quantities, using numbers and symbols" (1048). The Compact Oxford English Dictionary (2000), defines mathematics as "the abstract science, which investigates deductively the conclusions implicit in the elementary concepts of spatial and numerical relations" (p. 1048).

Marschark's (2003) review of cognitive functioning in deaf adults and children suggested that they focus primarily on the individual words and pieces of text rather than adopting a more holistic, relational approach to abstracting the meaning. To be able to recognize and understand mathematical properties, one needs to be able to look at all the components of a mathematical problem and recognize each item in relation to the other relevant entities. The full meaning of any single mathematical element in a problem task can be understood only by recognizing its relation to the other mathematical elements. Unfortunately, the evidence suggests that deaf adults and children have difficulty in understanding the component relationships in multidimensional complex tasks. The sections that follow, therefore, focus on various ICT strategies that can fill this void for learners with hearing loss.

Traxler (2000) carried out an analysis of deaf and hard-of-hearing students' performance on the Stanford Achievement Test 9th Edition, which showed that they fell largely in the "Below Basic" and "Basic" levels on the "Mathematics Procedures" and "Mathematics Problem Solving" subtests. These levels are indications of partial mastery of the mathematical knowledge and skills in grades 1 through 9 and these difficulties continue into college.

Is Assistive Technology a Panacea?

New assistive technologies have helped many people to lead more comfortable lives. However, modern information and communications technology (ICT) is especially important for people with special needs. DHH people are at an additional disadvantage because their handicap is practically "invisible' from the outside with the exception of visible cochlear implants or hearing aids. The public understand that people who cannot walk need a wheelchair or that blind people need Braille, but the need of the deaf for their native language as a sign language is often overlooked. ICT can help here, especially with regard to multimedia technology, broadband connections and video capacities to enhance learning (Hilzensauer, 2006). It has been noted that persons with disabilities are not homogenous, which means every category of disability has unique educational needs and barriers to learning.

As mentioned above, learners who are DHH encounter a number of challenges in their quest to learn mathematics. One of the obstacles that make mathematical vocabulary difficult to learn is lack of opportunity (Paul & Sinha, 2010).

Barrier-free Access to the Internet

One of the requirements of our communication society is access to information on the Internet. A lot has already been done for barrier-free access, but sign language is usually seen as only a desirable addition, not a top priority. The Web Content Accessibility Guidelines (WCAG) of the Web Accessibility Initiative (WAI), where sign language is mentioned as a “nontext equivalent of text”, the focus is still on clear and simple written language, which also benefits sign language users. While this is true, most deaf people would prefer sign language. The lack of sign language videos may be due to simple thoughtlessness. Hearing people without direct contact to the deaf community are usually convinced that deaf people can easily compensate by reading written texts, but the costs of preparing such videos may act as a deterrent.

ICT and the Learning Environment of the DHH Learner

Education must reflect the diversity of needs, expectations, interests and cultural contexts. This poses particular challenges under conditions of globalization given its strong tendency towards uniformity. The challenge is to define the best use of ICT for improving the quality of teaching and learning, sharing knowledge and information, introducing a higher degree of flexibility in response to societal needs, lowering the cost of education and improving internal and external efficiencies of the education system. Easterbrooks and

Stephenson (2006) note that, as important as empirical data on technology application for learning with learners who are DHH, technologies can be very important tools during classroom instruction because they enhance visual support. Easterbrooks and Stephenson also add that, from the available studies, it has been documented that technology can be useful in enhancing students' comprehension in the content areas.

A study by Nunes and Moreno (1998) showed that with appropriate instructional intervention, 68.2% of deaf students outperformed their own predicted score according to the NFER-Nelson Age Appropriate Achievement Test. Although their findings also showed slower reaction times (RTs) for deaf students on basic numerical and arithmetic skills' tasks, the corresponding RT graphs showed general developmental processes and processing methods similar to their hearing peers. This translates into the fact that given a level playing ground, the deaf are also capable of performing well on arithmetic tasks.

Teaching Mathematics using a Signing Math Dictionary

Poor achievement in mathematics demonstrated by students who are deaf or hard of hearing may be attributed to several factors, including lack of successful mathematics learning experiences, difficulties with language, and inadequate methods of instruction (Nunes & Moreno, 1998). With regard to language, aspects of English within mathematics such as multiple ways of expressing an idea and the use of words that have different meanings in and out of the classroom create barriers to acquiring the mathematical concepts being expressed (Pagliaro, 2006).

According to Marzano (2004), direct vocabulary instruction has an impressive track record of improving students' background knowledge and the comprehension of academic content. Stahl and Fairbanks (1986) found that vocabulary instruction leads to improved comprehension. For many students who are deaf or hard of hearing, schools implement a bilingual approach that uses sign as the first language of instruction and written English as a second language. Although the need for direct vocabulary instruction is apparent, unique challenges to teaching and learning vocabulary exist for students who are deaf or hard of hearing.

Students often do not know the signs for the mathematical terms they encounter or, even if they can mimic a sign, they do not understand its meaning. For this reason, teachers frequently omit many standards-based mathematics topics from their instruction because they consider them linguistically too complex for their students and, therefore, inaccessible (Pagliaro & Kritzer, 2005). In addition, almost all DHH students face obstacles associated with interpreters assisting them with mathematics learning. Although interpreting is generally the only means of communication between hearing and deaf persons, there can be many disadvantages in the use of human interpreters, including: high cost, scarce availability, lack of training in educational skills, loss of privacy, and no guarantee of accuracy among others.

This is what prompted Vessel and Robillard (2013) to examine the use of a Signing Math Dictionary (SMD) to help a group of students to access the vocabulary required to master mathematics content. The study included eight separate classes and a total of 39 participants—eight teachers and 31 students—representing grades 4–8. The research design incorporated a descriptive case study methodology that involved observing (a) teaching mathematics without the SMD, (b) preparing students to use the SMD, (c) teaching mathematics with the SMD. The results suggest that, when used in actual classroom settings, the SMD may be a resource that supplements effective teaching and learning of the vocabulary of mathematics.

SMD is a complete assistive tool that includes approximately 1,000 standards-based mathematics terms drawn from instructional materials. This interactive assistive technology was universally designed according to the principles of the Universal Design for Learning

(UDL) framework to maximize its potential to remove any barriers, individualize instruction, and increase access to information for deaf and hard-of-hearing students (Rose, Hasselbring, Stahl & Zabala, 2005).

Wireless Network

A study by Liu, Chou, Liu and Yang (2006) explored the possibility of wireless technology, including wireless network and Tablet PCs, augmenting student-teacher interaction, reducing cognition load, and facilitating formative assessment. In search of solutions, a WiTEC (wireless technology–enhanced classroom) environment combining Tablet PCs, a wireless network, and software applications was developed to facilitate mathematics teaching and learning activities based on the requirements of the hard of hearing students in a self-contained classroom.

A shared whiteboard on Tablet PCs where the teacher lectures on the shared whiteboard using the stylus of the Tablet PC, and projects the shared whiteboard onto a large screen can be used. When this strategy is employed, the hard of hearing students can ask questions, respond to the teacher's questions, and solve mathematical problems using their Tablet PCs and styli. All the questions, responses, and course work can be transmitted to the teacher's Tablet PC and projected onto the shared whiteboard. A scaffold component records all the steps performed by the teacher to solve a mathematical problem as part of the learning scaffold for the consolidation stage, which shows learners the crucial step to solving the mathematical problem. The students can then follow the teachers' steps on their Tablet PCs to solve a mathematical problem and also transfer their course work to the teacher's Tablet PC via the wireless network. Teachers assess student course work instantly, and show all the assessment processes on the shared whiteboard to fulfill formative assessment (Liu, Chou, Liu & Yang, 2006).

Making use of Scaffolding Tools

Scaffolding is described as a process in which the teacher gives the learner support throughout the learning process (Sawyer, 2006). Technical scaffolding is a newer approach in which computers replace the teachers as the experts or guides, and students can be guided with web links, online tutorials, or help pages (Yelland & Masters, 2007). Educational software can help students follow a clear structure and allows students to plan properly (Lai & Law, 2006).

Scaffolding tools provide hard of hearing students with the guidance to do course work and, further, to prevent them from answering questions impulsively. Scaffolding tools support the activities of the development and consolidation stages, including demonstrating examples and practicing course work. The tools enable the teacher to divide a complicated mathematical problem into simple steps, which help students solve similar problems, thus reducing cognition load. The teacher sets up the steps and explains the solution of each step alongside demonstrations of the solution of a complex mathematical problem. The scaffolding tools record all the steps and explained solutions. Students can then solve similar problems by following the steps demonstrated and recorded by the teacher (Liu, Chou, Liu & Yang 2006).

Cognitive Tech Tools

Suh (2010) defined Cognitive Tech Tools as having the capability to graph, model, compute, visualize, simulate and manipulate. All these inputs amplify mathematical properties and concepts and also broaden the representational tools that are available to teachers and students. The first example is using interesting and complex problem solving contexts that utilize real-world simulations and rich three-dimensional interactive animations. In another scenario, students can use a spreadsheet to graph plans. By so doing, the students get more time to analyze the plans instead of spending time manually plotting points on graphs. Technology therefore amplifies the opportunity available for students to interact with the math problem, make conjectures, and test those conjectures to confirm or reject the hypotheses (Suh 2010). Kaput (1992) noted that the impact of technological tools in mathematics learning and teaching is the ability to off-load some routine task, in this case creating a line graph from scratch which enhances learners efficiency in terms of compacting and enriching experiences. Through these, students get an opportunity for critical thinking from which they use their interpretative skills.

Students can also be introduced to the concept of balancing a linear equation using a dynamic algebra balance. The virtual balance scale explicitly links a dynamic balance scale with the symbolic representation of algebraic equations that are presented on the scale hence scaffolding the process of solving for x, doing and undoing algorithmic process and explicitly providing the connection between the equations and the actions of the balance scale (Suh, 2010). The linked representations in the virtual algebra balance environment offer metacognitive support such as maintaining a record of the user's actions and numeric notations. By doing all the above, learners are able to use their cognitive capacity to observe and reflect on the connections and relationships among the representations.

The Project Sove (2003) designed a web site to provide a large bank of mathematics word problems to solve with guided help. The help provided is based as much as possible on what is known from educational research about the linguistic and experiential factors that explain why deaf and hard of hearing struggle with a variety of mathematical word problems.

Captioning

Stinson and Stevenson (2013) cite Lewis and Jackson (2001) who defined captions as a text display of the audio component of a television program, which is generally displayed at the bottom of the screen. Captioning is one of the special adaptive instructional tools that can be used and may offer learners who are DHH a new approach to providing access to classroom teaching and discussions (King & Quigley, 1985) and Jensema (2003) affirmed that captions availed to children who are DHH enable them to have a level playing ground with their hearing counterparts.

Murphy-Berman and Whobrey (1983) observed that without audio input, the visual components of content might be frustratingly inadequate for full comprehension; strong arguments have been advanced for providing captions for hearing-impaired viewers. Today, captions are so ubiquitous that Google has enabled captioning of YouTube, clearly moving captions into the realm of new literacies (Strassman & O'Dell, 2012). They cited previous research (Boyd & Vader, 1972; Cambra, Leal & Silvestre, 2010; Lewis & Jackson, 2001; Murphy-Berman & Jorgensen, 1980; Nugent, 1983) that shows that d/Deaf and hard of hearing viewers' comprehension of captioned programs is better than their comprehension of text alone, though the understandings gleaned from the linguistic (auditory or captioned language) input are different from those derived from visual input.

Real Time Captioning

Students who are DHH may also benefit from real-time captioning, where spoken text is typed and projected onto a screen. Adamo-Villani, Doublestein and Martin (2005) opined that there are many advantages in technological approaches to communication with DHH students. Most significant are assistive device technologies for enhancing access to classroom lectures in mainstream classes. One of the most exciting assistive device technologies is real-time captioning.

Open and Closed Captioning

Captions may be open where everyone watching the displayed content on a television or projection screen sees the captions, or they may be closed calling upon the viewer to make settings for the closed-captioned decoder (Stinson & Stevenson, 2013).

Open captions are captions that have been decoded, thus becoming an integral part of the picture and cannot be turned off (Burgstahler, 2006).

Conclusion

Based on the aforementioned findings, we drew the following conclusions:
In order to successfully implement information technologies in schools, it is necessary to understand the complex classroom interactions between teachers, students, and technology through rigorous research on strategies that work.

Although this paper has analyzed studies that show how technology can be used to enhance learning of mathematics by DHH, organizational factors such as funding and equipment issues, lack of time to experiment and develop lessons and units pose a major challenge.

Empirical data are needed on each of the different technology categories to determine the effectiveness of technology enhancements relative to time and cost factors. For instance, real-time captioning can be very costly due to its technicalities.

References

Adamo-Villani, N., Doublestein, J., & Martin, Z. (2005). Sign language for K-8 mathematics by 3D interactive animation. Journal of Educational Technology Systems, 33(3), 241-257.

Easterbrooks, S. R., & Stephenson, B. (2006). An examination of twenty literacy, science, and mathematics practices used to educate students who are deaf or hard of hearing. American Annals of the Deaf, 151(4), 385-397.

Ansell, E., & Pagliaro, C.M. (2006). The relative difficulty of signed arithmetic story problems for primary level deaf and hard-of-hearing students. Journal of Deaf Studies and Deaf Education, 11, 153-170.

Jensema, C. J., McCann, R., & Ramsey, S. (1996). Closed-captioned television presentation speed and vocabulary. American Annals of the Deaf, 141, 284-292.

Kiboss, J. (2012). Effects of special e-learning program on hearing-impaired learners' achievement and perceptions of basic geometry in lower primary mathematics. Journal of Educational Computing Research, 46(1), 31-59.

Lai, M., & Law, N. (2006). Peer scaffolding of knowledge building through collaborative groups with differential learning experiences. Journal of Educational Computing Research, 35, 123-144.

Levin, T. & Wadmany, R. (2008). Teachers' views on factors affecting effective integration of information technology in the classroom: Developmental scenery. Journal of Technology and Teacher Education, 16(2), 233-263.

Light, D. (2010). Multiple factors supporting the transition to ICT-rich learning environments: The Intel® Teach Essentials Course and changing teacher practice in India, Turkey, and Chile. International Journal of Education and Development using ICT [Online], 6(4). Available: http://ijedict.dec.uwi.edu/viewarticle.php?id=1097.

Chen-Chung, L., Chien-Chia Chou, Liu, B., & Jui-Wen, Y. (2006). Improving mathematics teaching and learning experiences for hard of hearing students with wireless technology-enhanced classrooms. American Annals of the Deaf, 151(3), 345-55.

Marschark, M. (2003). Cognitive functioning in deaf adults and children. In M. Marschark, & P.E. Spencer (Eds.), Oxford handbook of deaf studies, language, and education (pp. 264-277). New York: Oxford University Press, New York.

Marschark M., & Johnson-Laird, P.N., (April, 2003) Models, images, and reasoning in deaf Individuals. Presented at the European Workshop on Imagery and Cognition, Pavia, Italy.

Marschark, M., & Hauser, P. C. (Eds.). (2008). Deaf cognition: Foundations and outcomes. NY: Oxford University Press, Inc.

Marquez, I.P., & Domantay, D. (2006). Educational technology for the 21st century in developing countries like Philippines. In C. Crawford et al. (Eds.), Proceedings of Society for Information Technology & Teacher Education International Conference 2006 (pp. 1269-1273). Chesapeake, VA: AACE.

Marzano, R. J. (2004). Building background knowledge for academic achievement: Research on what works in schools. Alexandria, VA: ASCD.

Murphy-Berman, V., & Whobrey, L. (1983). The impact of captions on hearing-impaired children. The Journal of Special Education, 17(1), 46-62.

Nunes, T., & Moreno, C. (1998). The development of mathematical skills: Is hearing impairment a cause of difficulties in learning mathematics? In C. Donlan (Ed.). Adding It Up: Helping Children Learn Mathematics. (p. 227-254). Hove, Britain: Psychology Press.

Ottem, E. (1980). An analysis of cognitive studies with deaf subjects. American Annals of the Deaf, 125, 564–575.

Oxford University Press (2000) The compact Oxford English dictionary (2nd ed.). New York: Oxford University Press, Inc.

Pagliaro, C. M., & Kritzer, K. (2005). Discrete mathematics in deaf education: A survey of teachers' knowledge and uses. American Annals of the Deaf, 150(3), 251–259.

Pagliaro, C. (2006). Mathematics and the deaf learner. In D. F. Moores, & D. S. Martin (Eds.), Deaf learners: New developments in curriculum and instruction (pp. 179–200). Washington, DC: Gallaudet University Press.

Paul, M., & Sinha, A. (2010). Effect of proficiency in English on the performance of

B. Tech students in group discussion. African Journal of Business Management, 4(8), 1464-1467

Rose, D., Hasselbring, T. S., Stahl, S., & Zabala, J. (2005). Assistive technology and Universal design for learning: Two sides of the same coin. In D. Edyburn, K. Higgins, & R. Boone (Eds.), Handbook of special education technology research and practice, 507-518.

City, State: Publisher.

Sawyer, R. K. (2006). The Cambridge handbook of the learning sciences. New York: Cambridge University Press.

Stahl, S. A., & Fairbanks, M. M. (1986). The effects of vocabulary instruction: A model-based meta-analysis. Review of Educational Research, 56, 71–110.

Stinson, M., & Stevenson, S. (2013). Effects of expanded and standard captions on deaf college students' comprehension of educational videos. American Annals of the Deaf, 158(4), 453-467.

Strassman, B. K., & O'Dell, K. (2012). Using open captions to revise writing in digital stories composed by d/Deaf and hard of hearing students. American Annals of the Deaf, 157(4), 340-357.

Suh, J. M. (2010). Tech-knowledgy & diverse learners. Mathematics Teaching in the Middle School, 15(8), 440-447.

Swarts, P. (2006). ICT and the third revolution in education policy. Retrieved from http://digitallearning.eletsonline.com/2006/09/ict-the-third-revolution-in-education-policy-2/

Traxler, C.B. (2000). The Stanford Achievement Test (9th ed): National norming and performance standards for deaf and hard of hearing students. Journal of Deaf Studies and Deaf Education, 5(4), 337–348.

Vesel, J., & Robillard, T. (2013). Teaching mathematics vocabulary with an interactive signing math dictionary. Journal of Research on Technology in Education, 45(4), 361-389.

Yelland, N., & Masters, J. (2007). Rethinking scaffolding in the information age. Computers and Education, 48, 362-382.

Zlotnikova, I., & van der Weide, T. (2011). An approach to modeling ICT educational policies in African countries. International Journal Of Education and Development Using Information & Communication Technology, 7(3), 50-73.

MASTERY LEARNING: IT'S IMPACT ON TEACHING AND LEARNING OF KISWAHILI IN SECONDARY SCHOOLS IN NYANDO DISTRICT, KENYA

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Abstract

For effective teaching and learning to take place in any learning institution or situation, appropriate instructional methods must be put to use. Teaching and learning is a two-way system that involves the teacher and the learner. For effective and meaningful teaching and learning to take place, there is a great need to make use of stimulating and motivating instructional methods that tend to promote content mastery without which it becomes difficult. Mastery learning is an alternative method of teaching and learning that involves the student reaching a level of predetermined mastery on units, topics and contents of instruction before being allowed to progress to the next unit. It is based on the concept that all students can learn when provided with conditions appropriate to their situation. Mastery learning uses differentiated and individualized instruction, progress monitoring, formative assessment, feedback, corrective procedures, and instructional alignment to minimize achievement gaps. A major implication of this study is that teachers should avoid dominating teaching and learning activities in the classroom but rather promote learner oriented study methods. Learners taught through this approach also develop high liking towards the subject as it provides opportunities to play and perform activities as well as the success experiences that they get while learning. This paper addresses one of these non-traditional methods i.e. mastery learning.

Introduction

The idea of learners having particular learning styles has implications for teaching strategies. For effective teaching and learning to take place in any learning institution or situation, appropriate instructional methods must be put to use. Teaching and learning is a two-way system that involves the teacher and the learner. For effective and meaningful teaching and learning to take place, there is a great need to make use of stimulating and motivating instructional methods that tend to promote content mastery without which it becomes difficult to attain the goals of education.

Robinson (1992) states that student characteristics as well as societal expectations have changed, though traditional methods and modes of instruction are still employed by a large number of educators. This is leading to a growing concern that the nation's schools are unable to educate the youth and therefore, nontraditional methods and modes of instruction must be evaluated. Some of the commonly used instructional methods include:

- Holistic approach
- Diagnostic prescriptive approaches
- Team/group/cooperative teaching
- Thematic teaching
- Individualized Education Programme (IEP)
- Direct instruction/learning
- Unit teaching
- Task analysis
- Projects
- Assignments
- Field trips
- Exploratory learning
- Peer tutoring

- Centre of interest

Self-directed learning

In this category of instructional methods, some of them are considered to be traditional methods of instruction. In the past, such methods were very useful and effective but due to societal changes, they have proven to have short falls in the teaching and learning process. School systems must therefore recognize that traditional methods of teaching and learning are unsuccessful for many students. Mastery learning is an alternative to the unsuccessful traditional methods of teaching and learning. Robinson (1992) states that a change from traditional curriculum and instruction models and adoption of a new method will require major restructuring of how the schools are organized and how teachers are prepared and empowered. School systems have the task of defining success, determine what it requires to be successful in the twenty-first century, and evaluating research outcomes, and discussions of which method would best be implemented to meet each individual's needs.

Traditional instruction holds time constant and allows achievement to vary within a group of students. Mastery learning, on the other hand, holds achievement constant and lets the time students spend in pursuit of the objectives vary. According to Davis D. and Sorrell J. (1995) mastery learning is an alternative method of teaching and learning that involves the student reaching a level of predetermined mastery on units of instruction before being allowed to progress to the next unit. It is very much in order to state that students and teachers have known about this principle for a long time. For example, if you have ever had trouble learning something, you very likely believed you could master it if you were given enough time and if you worked hard enough. That is a very simple statement aimed at explaining the principle of mastery learning.

Mastery learning is not a new concept; it was introduced into American education over 70 years ago. It is a process whereby students achieve the same level of content mastery but at different time intervals. The literature indicates positive effects of mastery learning on students, especially in the areas of achievement, attitudes toward learning, and the retention of content. School systems that have implemented mastery learning have found it to be a very effective teaching and learning method (Davis and Sorrell1995).

Major Components of Mastery Learning

One aspect of mastery learning that receives much consideration is time. Mastery learning theorists, especially Bloom (1971), contend that mastery learning techniques reduce the amount of time needed to achieve mastery. Arlin and Webster (1983) conducted an experiment to test these time claims. Mastery learning students were compared to non-mastery students. The variables assessed were achievement, time, and learning rate. The authors found significant increases in learning rate and achievement in the mastery group. In summary, these authors state it is possible to significantly raise achievement levels using mastery learning, but the time needed for this increase is considerable.

Mastery learning takes into account the elements cited by Carroll which state that given enough time and help, about 95 percent of the learners in any group can gain complete mastery of the designated instructional objectives. Mastery learning is not synonymous with pass/fail grading, nor does it imply that standards should be lowered. When mastery learning is successful, high standards are articulated and students receive ample time and help to meet these standards.

Another important component of mastery learning is mastery teaching. Okey (1974, 1977) examined the materials necessary in order to teach mastery learning, teachers and students attitudes toward mastery learning, and student achievement. Significant positive effects were discovered in all areas. Instructors were found to incorporate new teaching strategies into the classroom that positively influenced both themselves and their students toward the learning process.

Implementation and practice of mastery learning

In a mastery learning classroom, teachers follow a scope and sequence of concepts and skills in instructional units. Following initial instruction, teachers administer a brief formative assessment based on the unit's learning goals. The assessment gives students information, or feedback, which helps identify what they have learned well to that point (diagnostic) and what they need to learn better (prescriptive). Students who have learned the concepts continue their learning experiences with enrichment activities, such as special projects or reports, academic games, or more challenging/involving and demanding problem-solving tasks. Students who need more experience with the concept receive feedback paired with corrective activities, which offer guidance and direction on how to remedy their learning challenge. To be effective, these corrective activities must be qualitatively different from the initial instruction by offering effective instructional approaches and additional time to learn. Furthermore, learning goals or standards must be aligned with instruction (or opportunities to practice), corrective feedback, and evaluation.

Mastery learning uses differentiated and individualized instruction, progress monitoring, formative assessment, feedback, corrective procedures, and instructional alignment to minimize achievement gaps (Bloom, 1971; Zimmerman & Dibenedetto, 2008). The strategy is based on Benjamin Bloom's Learning for Mastery model, which emphasizes differentiated instructional practices as strategies to increase student achievement. Drawing from the principles of effective tutoring practices and learning strategies, mastery learning uses feedback, corrective procedures, and classroom assessment to inform instruction. Rather than focusing on changing content, this strategy endeavours to improve the process of mastering it.

The mastery learning method divides subject matter into units that have predetermined objectives or unit expectations. Students, alone or in groups, work through each unit in an organized fashion. Students must demonstrate mastery on unit exams, typically 80%, before moving on to new material. Students who do not achieve mastery receive remediation through tutoring, peer monitoring, small group discussions, or additional homework. Additional time for learning is prescribed for those requiring remediation. Students continue the cycle of studying and testing until mastery is met. Block (1971) states that students with minimal prior knowledge of material have higher achievement through mastery learning than with traditional methods of instruction.

Brief History of Mastery Learning

The mastery learning concept was introduced in the American schools in the 1920's with the work of Washburne (1922, as cited in Block, 1971) and others in the format of the Winnetka Plan. The program flourished during that decade; however, without the technology to sustain a successful program, interest among developers and implementers steadily diminished (Block, 1971). Mastery learning was revived in the form of programmed instruction in the late 1950's in an attempt to provide students with instructional materials that would allow them to move at their own pace and receive constant feedback on their level of mastery.

During the 1960's, Bloom's (1968) Learning for Mastery focused new attention on the philosophy of mastery learning. Bloom (1968) is now generally recognized as the classic theoretical formulation on the mastery model. He is widely viewed as the major theoretician and promulgator of mastery learning. Bloom made a number of specific predictions about the gains from mastery learning procedures. One is that in classes taught for mastery, 95% of the students will achieve at the level previously reached by the top 5%.

That means that typical scores in a mastery classroom should be around the ninety-eighth percentile, or approximately two standard deviations above the mean.

Bloom has also argued that students do not have to put in much more time on school tasks to achieve this level of proficiency. Although students taught for mastery may need more time to reach proficiency in the initial stages of a course, they should need less time to master more advanced material because of the firm grasp of fundamentals that they should gain from their initial efforts. Bloom maintains that besides mastery of the material to be learned, mastery learning increases the attitude and interest of students (Fehlen, 1976). He and his students have conducted many empirical studies that demonstrate the effectiveness of mastery programs in a wide variety of circumstances (Levine, 1987). Bloom suggests that mastery learning procedures are likely to enhance learning outcomes in almost all subject areas. However, he suggests that effects will be largest in mathematics and science since learning in these subject areas is generally more highly ordered and sequential (Guskey& Gates, 1986). This therefore implies that Kiswahili can also be effectively taught using mastery learning strategies to enhance its learning outcomes.

Effectiveness of Mastery Learning

From John Carroll (1963), Bloom derived a critical and quantitative ingredient of instruction time. In Carroll's formulation, learning is a function of time spent divided by time needed. One important variable related to time needed is student aptitude, which Carroll defines as the amount of learning time necessary for a student to master an objective under optimal conditions. Carroll indicates that if a student is allowed the time he/she needs to achieve a particular level and if he/she spends the amount of time needed, he/she should achieve at that level. Bloom has attempted, through mastery learning techniques, to ensure that almost all students demonstrate high levels of competence on school material and to reduce the amount of time the student needs to learn school-related content. Kiswahili being one of the school materials to be learnt, its outcome can be tremendously good if mastery learning strategies are employed in its teaching and learning process.

Research on mastery learning across grade bands has shown positive cognitive and effective learning outcomes in students in general, including learners considered at risk of academic failure (Guskey & Gates, 1986). Considering that most learners do poorly in this subject their performance trends can be reversed if mastery learning is fully embraced in its teaching. Most empirical research on this strategy was conducted over two decades ago; however, its founding principles have guided more recent effective instructional and measurement practices. Most of its components, such as the use of feedback, correction, and differentiated instruction, are well-documented key tools in the education of students with special needs and English language learners. Results of observations in mastery learning classrooms have shown increased student achievement, retention of learned material, involvement in learning activities, and positive student affect (attitude and demeanor). In addition, the successful use of mastery learning has positive effects on teachers as well as their expectations for student achievement. The outcome of this finding is an indicator that Kiswahili standards can be improved if this strategy is employed since it is a language just like English.

Guskey and Gates (1986) conducted a meta-analysis, which contained 27 studies addressing five areas: student achievement, student retention, time variables, student affect and teacher variables. They found that achievement results were overwhelmingly positive, but varied greatly from study to study. Students in mastery learning programmes at all levels showed increased gains in achievement over those in traditional instruction progamme; effects were somewhat larger in elementary and junior high school classes than at the high school level. Effects in language arts and social studies classes were slightly larger than those attained in science and mathematics classes. Students retained what they had learned longer under mastery learning, both in short-term and long-term studies. Students were engaged in learning for a larger portion of the time they spent in mastery classes and required decreasing amount of corrective time over a series of instructional units. Students developed more positive attitudes about learning and about their ability to learn. Finally, teachers who used mastery learning developed more positive attitudes toward teaching, higher expectations for students, and greater personal responsibility for learning outcomes.

It is important to note that research and implementation studies on mastery learning show significant positive effects in each of these areas. By using mastery learning programs in the basic skills areas, the academic foundation for success in the twenty-first century can easily be reached by the vast majority of our student population.

The Mastery Learning Instructional Strategy for teaching Mathematics at standard II was found to be effective in producing significant proportion of masters. There was a significant gain in the students' liking for mathematics as a result of learning through the mastery learning instructional strategy. A significant difference was found in achievement of competencies in mathematics between the students taught by the investigator using the MLIS and those taught by the teacher using conventional approach. A significant difference was found between the experimental group students and comparison group students in their liking for mathematics (Shailaja P. Shanbhag). Mastery learning approach helps shape learners' attitude and motivation towards the subject being taught and this can help better the negative attitude held by most learners towards Kiswahili.

Research has been conducted comparing the effects of mastery learning alone, mastery learning with teams, teams alone, and traditional instruction on student achievement (e.g., Mevarech, 1985; Slavin&Karweit, 1984). These studies were similar in their design, yet the end result of each study was very different. Slavin and Karweitt reported that student achievement was affected by the team treatment and not the mastery learning treatment. Mavarech reported that mastery learning was the indicator that significantly increased achievement. He stated that the team component of the study had little to do with achievement. Mavarech theorizes that, the difference in the results of the two studies is related to socioeconomics. The subjects in Slavin and Karweitt's study were all from low-income families, whereas Mavarech's subjects were middle-class families. Dunkelberger and Heikkinen (1984) performed a very specific research study investigating only one aspect of mastery learning: repeatable testing. Achievement was examined using subjects who were allowed to repeat tests and subjects who were allowed only one attempt at the test. The findings of the study showed no significant correlation between achievement and repeatable testing. The authors state that cognitive gains obtained from mastery learning are related to a combination of remediation and retesting, not retesting alone.

Clark, Guskey, and Benninga (1983) examined the effect of mastery learning achievement and motivation. The study examined a mastery learning group and a traditional group that used the lecture format. The main variable for this study was motivation and its effect on student achievement. These authors found that the mastery learning group demonstrated higher levels of achievement, fewer absences, and more motivation toward learning course material. In a similar study, Ritchie and Thorkildsen (1994) examined achievement and accountability. This study compared two mastery learning groups. The treatment variance was that one group was aware they were in a mastery learning program while the other group was unaware. These authors found a statistically significant difference between the two groups with the informed group showing higher levels of achievement. They theorized this difference may have been related to the awareness and the subjects may have been more motivated to meet the specific goals. That is, the informed group may have altered their attention to the learning environment. Both of these studies challenge claims of mastery learning critics which conclude that mastery learning programs increase achievement solely by increasing instructional time because of remediation.

Wentling (1973) compared mastery learning and non-mastery learning as to how feedback relates to achievement. This study examined four specific areas: immediate cognitive achievement, attitude toward instruction, time spent on instruction, and delayed cognitive achievement. Each group received feedback in one of the three forms: no feedback, partial feedback (knowledge of correctness of response) and total feedback (knowledge of correct response). The findings from this study showed superior achievement for both immediate achievement and long-term retention in groups with partial feedback. However, time spent on instruction and attitude toward instruction showed no significant difference. The author states low ability students spent more time on instruction than the high ability students for the no feedback treatment and the partial feedback treatment, but within the total feedback treatment high ability students spent more time than low ability students.

The developers of mastery learning assert that it is most useful with basic skills and for slow learners at both elementary and secondary levels. Group instruction is often given to the entire class by the instructor with individual time for learning provided until mastery is met. The goal of mastery learning is success for the student. It is asserted that success in achievement, attitude, and motivation in the education or learning environment makes learning more effective. If these factors are put into consideration, the performance of Kiswahili among learners can be very impressive compared to the current trend.

This method of instruction also helps teachers to develop individualized instruction that is tailored to meet individual learners' needs. It is an instructional method that enables a learner to work on appropriate tasks or content under conditions that are motivating. Each learner is therefore accorded daily instruction based on the educational needs. Considering the wide curriculum area in the subject, learners can be exposed to various content areas and activities in Kiswahili depending on their educational needs so as to attain content mastery effectively.

Challenges of Mastery Learning

In as much as this instructional method is very effective in terms of promoting content mastery among learners, it has its own negativities/shortcomings. Some of these are: Grouping of students and scheduling may become difficult. Teachers often find it easier to force people to work at a constant pace and to complete tasks at a predictable rate than to permit wide variations in activities within a class.

While slow learners spend extra time on minimum standards, the faster learners may be forced to wait when they could be progressing to higher levels of achievement. The structure of the secondary school curriculum that spells out what is to be covered in every class yearly makes it challenging in following the demands and requirements of mastery learning as most administrators (DQUASO, HOD'S, Principals etc.) focus more on the syllabus coverage rather than content mastery.

The period a learner is to spend in secondary school is well spelt out and the Ministry of Education does not give room or even encourage repetition for those who have not fully mastered certain content areas. This makes it very tricky for teachers to ensure mastery of the content before a learner proceeds to the next level of learning.

The present number of students in a classroom (population) is quite great making it very challenging to fully utilize mastery learning format.

The students' entry behaviours differ making it difficult to handle them as specified in the syllabus since the beginning point for the learners is specific and similar for all irrespective of their differences in content mastery at the previous level.

In as much as the instructional method is considered to be quite effective, most teachers still consider it a very demanding method that may not be practically used considering the current state of affairs in the curriculum considering the syllabus structure.

The content to be covered in each subject is much and quite demanding yet specific time is allocated to each per week regardless of the wide content coverage area. In addition, the learners are expected to go through several other subjects before narrowing down to some at form 3 and 4 levels. This makes it difficult for each teacher to successfully attain content mastery with ease as the learner is subjected to a heavier workload than if he/she was to specialize right from **form** one.

Way-forward/Recommendations

It is necessary and important to note that these problems are not insurmountable. We can overcome them by providing individualized attention, setting high but attainable standards, and making additional materials available for learners who master objectives more quickly than others or still make available to them acceleration programmes instead of waiting for their slow counterparts.

Levine (1985) suggests some major points for school systems to explore when considering implementing a mastery learning program. Foremost, the principal must take on the role of instructional leader. Instructional leadership involves an understanding of mastery learning principles, a commitment to preparing and supporting staff, constant awareness, and a system for setting and monitoring goals, directions, and results of the program. Another important point is planning prior to the implementation of the mastery learning program. Principles must be developed and all involved must have a clear understanding of the program. Selecting material that is well organized and conforms to the principles enables easier transition to the program for both the student and teacher.

The plan must also include a method to monitor student achievement as well as student and teacher attitude toward the mastery learning program. Concrete results have been observed in the areas of student achievement, improved attitude, and increased expectations in all school systems addressed. Each school system should review literature and voluntarily choose the mastery learning approach. By implementing mastery teaching and learning these school systems have shown the capability to attain the scholastic excellence that is increasingly demanded in today's changing economy.

There is a great need to spell out what is to be covered by the end of the four year period and leave it free for the teachers to come up with their own system of instruction but ensure that the whole curriculum is properly tackled before learners are subjected to the final testing at national examination level. This will therefore imply that only learners who are through with the content coverage and are confident with the content mastery that they have attained are examined and not all learners as long as they have covered the whole syllabus.

The system should be left untimed bound so as to enable learners to work more on content mastery rather than reflect more on the period spent to cover the specified content/workload. It is necessary to let the learners to spend as much time as they can to master the content before being allowed to graduate out of the secondary system or even transit to the next level and not graduate them after the period stipulated that the content needed to be learnt has been covered.

There is need to advocate for smaller classes in terms of population to make the use of mastery learning more practical and achievable. A consideration of classroom population of between 20 to 25 learners should be looked into as this will give the teacher ample time to attend to the learners bearing in mind that they are of varied standards and abilities. Each learner should be allowed to start at their level of content mastery and not begin unanimously with the rest of the class as this can make some learners start at low levels or even be forced to handle contents that may be complex to them.

Teachers need to be taken through mastery learning as an effective teaching methodology to make them have a change of attitude towards it and be more comfortable in making use of it fully in the teaching and learning of students at secondary school level. In order to attain content mastery among leaners, it is necessary to accord time for content coverage without specification of lessons required to cover each subject and adapt a flexible format and do away with the rigid one of lesson specification. Also, students should be allowed to begin specializing in fewer subjects right away from form one so as to have enough time for content mastery inclusive to all regardless of their academic abilities.

Conclusion

In summary, mastery learning is not a new method of instruction and school systems need to recognize that traditional methods of teaching and learning are unsuccessful for many students. Mastery learning is an alternative to the unsuccessful traditional methods of teaching and learning. However, it is important to note that a change from traditional curriculum and instruction models and adoption of a new method will require major restructuring of how the schools are organized and how teachers are prepared and empowered. School systems have the task of defining success, determine what it requires to be successful in the twenty-first century, and then evaluating research, outcomes, and discussions of which method would best be implemented to meet each individual's needs.

Since preferred modes of input and output vary from one individual to another, it is critical that instructors use a range of teaching strategies to effectively meet the needs of individual learners. Instruction should incorporate a variety of teaching methods intended to complement the learning styles of learners.

One way of meeting the individual needs of learners is by using an Individualized Education Programme (IEP) approach. IEP is a strategy that fully involves learners in active learning while allowing them to learn at their own style and speed convenient to each one of them. Mastery learning is based on the concept that all students can learn when provided with conditions appropriate to their situation. The student must reach a predetermined level of mastery on one unit before they are allowed to progress to the next. In a mastery learning setting, students are given specific feedback about their learning progress at regular intervals throughout the instructional period. This feedback helps students identify what they have learned well and what they have not learned well. Areas that were not learned well are allotted more time to achieve mastery. Only grades of "A" and "B" are permitted because these are the accepted standards of mastery. Traditional instruction holds time constant and allows mastery to vary while mastery learning or systematic instruction holds mastery constant and allows time to vary.

It is also evident from various researches that all the learners taught through the mastery teaching approach master all competencies in the subject being taught. Learners taught through this approach also develop high liking towards the subject as it provides opportunities to play and perform activities as well as the success experiences that they get while learning. Teachers are therefore encouraged to be more systematic and explicit when giving instructions and incorporate visual representations whenever possible in their teaching.

References

Arlin, M., & Webster, J. (1983). Time costs of mastery learning. Journal of Educational Psychology, 75(2), 187-195.

Block, J. (1971). Mastery learning: Theory and practice. New York: Holt, Rinehart, & Winston.

Bloom, B. (1968) Learning for mastery. Evaluation Comment 1, 2, 1-5.

Bloom, B. (1971). Mastery learning. New York: Holt, Rinehart, & Winston.

Bruner, J.S.(1966) Towards a Theory of Instruction. Harvard University Press, Cambridge,Mass.

Carroll, J. (1963) A model for school learning.Teachers College Record 64, 723-733.

Clark, C., Guskey, T., &Benninga, J. (1983). The effectiveness of mastery learning strategies in undergraduate education courses. Journal of Educational Research, 76(4), 210-214.

Davis, D., & Sorrell, J. (1995). Mastery Learning in Public Schools downloaded from http://teach.valdosta.edu on 05/03/2013.

Dunkelberger, G., &Heikkinen, H. (1984).The influence of repeatable testing on retention in mastery learning. School Science and Mathematics, 84, 590-597.

Fehlen, J. (1976). Mastery learning techniques in the traditional classroom setting. School Science and Mathematics, 68, 241-245.

Guskey, T., & Gates, S. (1986). Synthesis of research on the effects of mastery learning in elementary and secondary classrooms. Educational Leadership, 43(8), 73-80.

Levine, D. (1985). Improving student achievement through mastery learning programs. San Francisco: Jossey-Bass.

Okey, J. (1974). Altering teacher and pupil behavior with mastery teaching. School Science and Mathematics, 66, 530-535.

Okey, J. (1977). Consequences of training teachers to use a mastery learning strategy.Journal of Teacher Education, 28(5), 57-62.

Patterson, W. (1993) Moving toward mastery learning: one school's approach. NASSP Bulletin 77, 554, 96-99.

Robinson, M. (1992). Mastery learning in public schools: Some areas of restructuring. Education, 113(1), 121-126.

Shailaja P. Shanbhag Effectiveness of A Mastery Learning Instructional Strategy In Attainment f Competencies in Mathematics.

Wentling, T. (1973). Mastery versus non-mastery instruction with varying test item feedback treatments. Journal of Educational Psychology, 65(1), 50-58.

DETERMINANTS OF IMPROVED PERFORMANCE IN KISWAHILI IN SECONDARY SCHOOLS IN NYANDO DISTRICT, KENYA

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Abstract

This paper discusses the determinants of improved performance in Kiswahili in some selected Nyando District secondary schools. In Kenya Kiswahili is taught as an examinable subject and it is also the country's national as well as official language. Kiswahili is a compulsory subject in the secondary school curriculum especially for learners without hearing difficulties. Despite the fact that it is a compulsory subject that is also examinable, some students still treat it as an optional subject. This is greatly depicted in their attitude, response, performance and especially classroom participation. Such learners believe that they need not pass Kiswahili to get a chance at the University to pursue higher education. In addition, some have embraced the idea that Kiswahili will not add value to their lives after their KCSE examinations as it is considered a language of the touts. Considering that university entry has nothing to do with a student's grade in the subject they gain more confidence in disregarding the subject. There are four basic language skills (listening, speaking, reading and writing) that any learner should acquire in order to be considered competent. One of the aims of teaching Kiswahili is to improve on the student's mastery of oral, reading and writing skills. Communicative competence is a requirement in every person's language use and learners are expected to have developed and achieved this skill. However, it is evident that students make certain mistakes while communicating in this language. Listening and speaking skills are not examinable in KCSE examination making most teachers ignore them. For effective teaching and learning of Kiswahili to take place there is need to embrace learner-centered teaching methods and also use integration of language skills during teaching. Integration of ICT in teaching also needs to be considered, adequate teaching and learning resources should be availed and be effectively used as tools for instruction and effective content delivery.

Introduction

Kiswahili is a compulsory subject in the secondary school curriculum especially for learners without profound hearing difficulties. Despite the fact that it is a compulsory subject that is also examinable, some students still treat it as an “optional subject”. This is greatly depicted in their attitude, response, performance and especially classroom participation. Some of such learners believe and imagine that they need not pass in Kiswahili to get chances at the University to pursue higher education. Considering that university entry has nothing to do with a student’s grade in the subject, such students gain more confidence in disregarding the subject.

It is however important and very necessary to recognize it as a key language not only in Kenya but also internationally. Globally, Kiswahili is taught as a language in universities such as Harvard, Yale, Germany, Osaka-Japan, China, South Korea, South Africa, Ghana and Nigeria just to mention a few. Further, the African Union meetings recognize Kiswahili as one of the languages of communication.

Kiswahili is an important subject since at the moment it is both a national and official language in Kenya and needs to be taught, taken with much interest and promoted in use across the nation. The emphasis of teaching Kiswahili language in Kenya is becoming commonplace. There are four basic language skills (listening, speaking, reading and writing) that every learner is required to acquire in order to be considered competent in the language. Communicative competence is a crucial requirement in any person’s language use. Learners are expected to have developed and achieved communicative competence in all aspects to use language independently, appropriately and fluently as an indicator that the learner has acquired sufficient command of the language at the end of secondary school. However, listening and speaking skills are not examinable in KCSE examination making most teachers ignore them or rather tackle them lightly as compared to the reading and writing skills.

Statement of the problem

There has been unstable (keeps fluctuating) result of Kiswahili in the country at National examination and especially within Nyando district. From district mocks and national examination results, it is evident that Kiswahili's mean grade is relatively low as compared to the other subjects. The performance of Kiswahili could be caused by among other factors; teacher factors, unavailability of teaching and learning resources, lack of Information Communication Technology (ICT) integration, attitude, motivation and students' entry behaviour.

This study sought to establish the relationship between the various variables and the possible interrelatedness between the variables and achievement. The school administration though an intervening variable also have an impact on the performance of Kiswahili. The study was guided by Gagne's (1974) information processing model. In his model, Gagne determines that it is from the environment that the learner receives information using the five senses (receptors). The environment is provided for by the set-up of the learning situation that can be either favourable or not depending on various factors for example the noise level, accuracy of information (stimulus) intended, its clarity, mode of presentation and so on.

In light of the more or less consistent trend of poor performance in the subject in the country, and noticing that this trend really needs to be reversed, it prompted the researcher to look into the determinants of improved performance in Kiswahili in Nyando district.

Objectives of the study

The purpose of the proposed study was to look into determinants of performance in Kiswahili. The specific objectives of the study were:

1. To establish the relationship between students' attitude towards Kiswahili and its effect on performance.

2. To establish how teachers' perceptions about learners' ability affect the performance of Kiswahili.

3. To establish whether teachers' instructional methods influence the students' attitudes towards the subject and its performance.

4. To establish the relationship between the resources for teaching Kiswahili and its performance.

Research Questions

This study sought to answer the following main questions;

1. Do students' attitudes towards the subject (Kiswahili) affect their performance in Kiswahili?
2. Do teachers' attitudes towards learners' ability affect their performance in Kiswahili?
3. Do the teachers' instructional methods affect students' attitudes towards the subject and performance?
4. Do resources for teaching Kiswahili affect performance?

Research Methodology

The study was carried out in selected schools within Nyando District. The research design used was descriptive survey design. Stratified random sampling was used to get the school samples used in the study while random sampling was used to get the samples for the students. Purposive sampling was used to identify the heads of Kiswahili subject and school heads in the sampled schools to form part of the informants in the study. The instruments used in the research were questionnaires, interview and observation schedules. An observation guide was also used to see the various instructional methods and resources used by teachers of Kiswahili in the sampled schools. Data was analyzed using a descriptive method. The study found out that among the many other factors that affect performance in Kiswahili, attitude towards the subject plays an important role in determining whether a learner performs well or not.

Summary, discussion and conclusion

Introduction

The study sought to look into determinants of performance in Kiswahili in secondary schools in Nyando district, Kenya. To do this, data was collected from students, school heads, teachers and heads of language and/or Kiswahili departments. This section provides a summary of the study and a brief discussion. Conclusions and recommendations are also made.

After analysis of data, the following summary can be drawn from the findings of the study.

a) The attitude of students towards Kiswahili was found to be a major contributing factor in the performance of Kiswahili. Majority of the learners had negative attitudes towards the subject as they had a feeling and imagination that the subject was tough and quite complex. Those who had a negative attitude performed dismally in the subject compared to those who had a positive attitude towards it.

b) Performance and attitude are related. In schools where attitude in Kiswahili is high, performance is also relatively higher. Not many learners want to be associated with a subject that is poorly performed and this made most of them disassociate themselves with it in schools where its performance was way below the standards.

c) Usage of locally available materials and other teaching aids like charts in the teaching of Kiswahili is not fully embraced in most secondary schools. Improvisation in the Kiswahili classroom was not evident among the subject teachers. Teachers of Kiswahili did not show a high degree of creativity and innovativeness to help boost the learners' interest in the subject and to make the lesson more enjoyable and motivating. This finding is in line with studies done by various scholars that have continued to show lack of instructional resources at different institutions and levels of learning. Such studies were done by Ole Shunguya (1995), Kimui (1988), Nyongesa (1990), Gacegoh (1990), Okoko (1991), Kimani (1999), Orina (2001), Mogeni (2005) and Kwaka (2009) among others.

d) Integration of Information and Communication Technology (ICT) in teaching and learning is increasingly becoming an important agenda in educational reform initiatives. In support, various research studies associate ICT integration with improved quality of education. In addition to facilitating professional development of the teacher (Gaible & Burns, 2005), ICT may help to increase student motivation (Osborne & Collins, 2000), facilitate clearer thinking and develop data interpretation skills (Newton & Rogers, 2003), and support independent inquiry, shared knowledge building, and promote collaboration amongst students (Bingimlas, 2009). Moreover, technology can help overcome the limitation of time; size and space, making learners enjoy learning and retain more information for longer periods of time. However, like any new project, there is a possibility of challenges such as students' attitudes and how to impart knowledge and skills, which may first need to be addressed in order to guarantee full implementation and success of the project in Kenyan secondary schools. In this study the findings are in agreement with Godfrey (2001) who contends that the biggest challenge in the integration of ICT into the curricula lies with the training of teachers.

e) Learners generally have a negative attitude towards Kiswahili and it is due to this among other factors, that performance is low. This is encouraged by the fact that language policies in most schools tend to favour English as a subject and not Kiswahili. Kiswahili in many schools had only two days allocated to its use and the rest of the days were entirely left for English use. As a result many learners opted not to speak on Kiswahili days and they could still survive through the day. The implementation of language policies that do not favour and promote the use of Kiswahili automatically contribute towards poor results in the subject.

f) There is a shortage of Kiswahili teachers in secondary schools. The student population in secondary schools at the moment is far too high compared to the number of teachers teaching Kiswahili in each school. This in turn influences the kind and trend of performance that the schools can register at the end of every year for the national examination. Most of the teachers are overstretched as they handle not only Kiswahili as a subject like their counterparts in English but also teach their second subjects due to understaffing in most secondary schools hence making them have divided attention while handling the two subjects.

g) There is a unanimous view and feeling that the number of lessons accorded to the teaching and learning of Kiswahili is less compared to the content to be taught. There is a lot to be covered yet the time allocated to the subject per week is quite low (6 lessons for Forms 3 & 4 and 5 lessons for Forms 1 & 2). The content is wide, quite tasking and demanding in relation to the three papers sat for at K.C.S.E. making it difficult for the teachers to fully cover the syllabuses in time. Failure to complete the syllabuses in time makes the student move into the examination less confident hence their poor results at the end of it all.

h) Most of the learners in the region are also affected by their mother tongue that impacts negatively on their language proficiency. Three quarters of the learners hail from two major communities; Kalenjin and Luo and this affects the learners' expressive language whereby they make grammatical errors alongside spelling mistakes due to influence of mother tongue. Considering that these aspects are greatly looked into as they get awarded, most learners thereby lose marks because such mistakes are penalized. When this is factored in they end up getting low marks.

i) Many schools do not expose their learners to debates and symposiums to help build their language proficiency and creativity, which is a key requirement in Kiswahili composition and grammar papers. Since most learners lack high level of creativity they end up performing dismally in the subject.

j) Considering that most of the schools in the region are day schools, this has also had an impact in the performance of the subject in the region. Learners in day schools felt that they were disadvantaged compared to their counterparts in boarding schools. This feeling came as a result that the boarders had fellow students who they could converse with using the language while at school yet the day scholars lacked people who were fluent in the language to speak with while at home. Language proficiency is developed through constant practice in language use, the moment this practice is curtailed competency is affected and in turn the performance also gets interfered with.

k) The region within which the study was conducted is greatly affected by the students' entry behaviour in Kiswahili at form one. Most learners get to secondary school level with very low marks in the subject at K.C.P.E making the teachers at secondary school have a lot of work as they try to make the learners attain the basic concepts in the subject alongside teaching them secondary school subject content. Most of the students also confessed that they were literally taught Kiswahili content with much seriousness in form one especially those from the local primary schools. Bearing in mind that there is no allocation for extra time for this remediation process, some teachers ignore the basic concepts and proceed into the next level hence the poor results attained at K.C.S.E by most learners.

l) Majority of the learners have poor reading culture and this had a negative impact in their results especially in paper three. Due to this, the learners were not in a proper position to explicitly explain their facts as most of them depended fully on what they did with the teacher in class as an insight to the set texts. They therefore relied fully on the teacher's short/summarized notes and failed to go through the set texts on their own for more information and detailed facts.

m) Some of the teachers also helped in promoting the poor performance by the fact that they held low opinion over their learners' ability in the subject. This was as a result that majority of them did poorly in national examinations and the attitude that most learners had that Kiswahili was not a language close to or even related to their native language and that majority of their people are not fluent in the language. With this in mind the teachers tended to embrace instructional methods that were more teacher centered and friendly as opposed to learner centered methods.

n) Most of the programs aired on T.V. tend to use language that can attract the attention of the youth. Some of the programs that entertain the youth like Papa Shirandula tend to use "sheng" and pay less attention to grammar rules and students who watch the program without much guidance end up using the distorted language they hear. When this is carried back into the school system, such learners end up getting low marks in Kiswahili exams.

o) The proficiency of a student in Kiswahili is explicitly shown in his/her performance in any examination. Considering that Kiswahili exam is done through writing skills, learners who have fluency in written and spoken skills end up doing better than those with fluency in spoken skills and lack fluency in written skills. This means that learners with spoken skills who lack written skills get disadvantaged at examination level hence their poor performance.

p) Some of the heads of schools preferred buying teaching and learning aids to support and promote other subjects that did better than Kiswahili at K.C.S.E. and ignored Kiswahili as it was considered wastage of meager resources investing in a subject that performed dismally. The moment the subject got discriminated upon with regard to teaching and learning resources the performance also got maintained at low levels. Resources for teaching Kiswahili affect students' performance in Kiswahili. In schools where learners felt that resources were adequate, performance was also high as compared to those schools where students felt that resources were not adequate.

q) Students kept on doing poorly in the subject due to the fact that most parents only kept track of their children's performance in Mathematics and science subjects making the learners work harder in those subjects at the expense of Kiswahili which is also considered a less important subject in most career choices and the language of the touts. This mind set contributes a great deal in killing the spirit of hard work in the subject hence its poor results. In cases where parents kept track of their children's performance in all subjects, performance was also higher as compared to children whose parents were more concerned with Mathematics and science subjects only.

r) Another key factor in performance was also identified to be motivation both to teachers and learners. Schools where teachers and learners were intrinsically motivated to teach and learn to perform in the subject did better than schools that embraced extrinsic motivation and far much better than those that motivated not their teachers and learners to do better in the subject.

s) The language development of most students in day secondary schools was low, a good number were culprits of speaking mother tongue in their schools. This was also due to the fact that in many of the day schools in the region, parents AGM/PTA days were conducted in the native language of the school with very few translations in Kiswahili. At this rate, the learners in such schools tend to lag behind in language development hence the reason for their poor performance in the subject.

Recommendations

Based on the findings of the study, the following recommendations were made for consideration so as to better the standards of the subject with regard to performance:

a) The attitude of both the learners and teachers need to be changed to enable the students like the subject more. In return, the teachers will also need to change their instructional methods to benefit all learners hence improve on performance of Kiswahili.

b) There is need to avail more teaching and learning resources in schools to promote the teaching and learning of Kiswahili. Teachers too need to make good and effective use of a variety of teaching and learning resources to effectively achieve the goals of education. Heads of schools also need to appreciate the fact that Kiswahili just as other subjects require material support in terms of resources in order to improve. Resources for teaching Kiswahili should be availed to all schools to make teaching of the subject easier for the teacher and pleasant to the learners.

c) It is necessary to make all teachers aware that technology is essential in teaching and learning as it influences the content that is taught and enhances students' learning. It is also essential that professional development experiences equip teachers with professional literacy necessary for meaningful ICT integration in teaching and learning of Kiswahili.

d) Schools need to reconsider and look into their language policies so as to accord Kiswahili equal or more days for exclusive communication so as to boost learners' level of proficiency hence improved results.

e) More teachers need to be recruited to help solve the problem of teacher shortage in several secondary schools in the district so as to better the subject's results.

f) There is need to have the number of lessons per week in teaching of Kiswahili reviewed so as to have more lessons than the currently slated six lessons.

g) Schools need to do all that they can to have their students exposed to regular debates, symposiums and educational trips if need be for improvement to be noticed/realized.

h) Teachers need to be taken for regular refresher courses to better their teaching methods and to remind them of the need to effectively teach the subject especially to the teachers teaching within the local primary schools.

i) The students should be subjected to constant testing with regard to basic aspects of the set texts so as to make them read the books and have points at their finger tips. This will eventually change their reading culture and make them have confidence in responding to questions from any of the set texts.

j) Learners should be well guided to enable them understand that the language used by some of the actors in various programmes is meant for entertainment purposes but in school setup; only correct language use should be factored in at all times.

k) Motivation being a key aspect in performance, it needs to be inculcated in an individual's life to better performance; teachers and students alike require to be motivated.

l) Parents too need to be made aware that their attitude towards and concern about their children's performance play a key role in their performance per subject. They therefore need to be more vigilant and ensure that they accord all subjects the necessary worth and importance in determining their children's final performance.

Conclusion

One of the aims of teaching Kiswahili as a subject is to improve the students' mastery of oral, reading and writing skills. However, it is evident that students make certain mistakes while communicating in this language both linguistically and non-linguistically. Some students make linguistic errors due to the fact that they fail to appreciate the basis of differences between spoken and written language in effective communication. Majority of them tend to write as they speak without realizing that spoken language has cues, which are realized differently in written language. They fail to realize that orderliness in the use of language in speaking is important, but it is much more so in writing.

In addition, they also make nonlinguistic errors pertaining to logical thinking and flow of thoughts. Many of them do have poor organization of work, lack facts and techniques in presentation of facts and arguments systematically, fail to distinguish between main and subsidiary points (relevant and irrelevant materials), make ambiguous statements and presentation of answers in an inappropriate manner. Also, they lack self-drive to learn the subject, have limited teaching and learning resources (material and human) and some too are disadvantaged by their previous language proficiency skills at primary school.

In order to address these challenges fully it is necessary to engage students in frequent practice in the form of dialogue through debate and symposiums to better their oral skills, short drills and make the teaching and learning process learner centered. It is necessary to appreciate that it calls for joint effort among teachers, students, parents and school administrators to better the performance of Kiswahili within the entire district. The Ministry of Education needs to review the current trend of education with the purpose of improving it and the Teachers' Service Commission in liaison with the Government need to employ more teachers to solve the current shortage. For effective teaching and learning of Kiswahili to take place, there is a dire need to embrace learner-centered teaching methods and also use integration of language skills during teaching. It is only with these strategies put in place that remarkable improvement and eventually good performance in Kiswahili can be achieved or realized in the district.

References

Adafu, O.I. (1996). Study of the factors Affecting the Training and Learning of Kiswahili in selected secondary schools in Lamu District''. Kenyatta University-Unpublished P.G.D.E project.

Bingimlas, K. A. (2009). Barriers to the Successful Integration of ICT in Teaching and Learning Environments: A Review of the Literature. Eurasia Journal of Mathematics, Science & Technology Education, 5 (3), 235-245.

Gaible, E., & Burns, M. (2005). Using Technology to Train Teachers: Appropriate Uses of ICT for Teacher Professional Development in Developing Countries. Washington, DC: infoDev / World Bank [Online]. Retrieved June 19, 2013, from: http://www.infodev.org/en/Publication.13.html

Kimui, W.V. (1988).” A study of Availability and use of the Learning and Teaching Resources in primary Teachers’ Colleges in Kenya’’. Kenyatta University-Unpublished PhD Thesis.

Miller, G.R. (1983). Between People. A new analysis of interpersonal Communication. Chicago:
SAR.

Mogeni, J.M. (2005).”Factors influencing Utilization of Resources in Kiswahili in selected public secondary schools in Transmara District, Kenya.’’Kenyatta University-Unplished M.Ed Thesis.

Msei, I. (1985).”A survey of Resources for Teaching and Learning of Kiswahili in some selected primary schools of Central Division, Iveti South, Machakos District.” University of Nairobi-Unpublished M.Ed. Project.

Newby, T.J.; Stepich, D.A.; Lehman, D.J. & Russell, J.D.(2006).Educational Technology for Teaching and Learning. Third Edition. Prentice Hall, Upper Saddle River, New Jersey.

Newton, L., & Rogers, L. (2003). Thinking frameworks for planning ICT in science lessons. School Science Review, 84 (309), 113-119.

Osborne, J., & Collins, S. (2000). Pupils’ and parents’ views of the school science curriculum. London: King's College London.

Orina, W. M. (2001). “Availability, Acquisition and Utilization of Instructional Resources for Teaching Geography in selected secondary schools in Central Kisii District.” Kenyatta University-Unpublished M.Ed. Thesis.

IS KENYA'S EDUCATION SYSTEM READY FOR ICT INTEGRATION? LESSONS LEARNED FROM ECONOMIC STIMULUS PROGRAMME

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REPUBLIC OF KENYA

Contents of Presentation

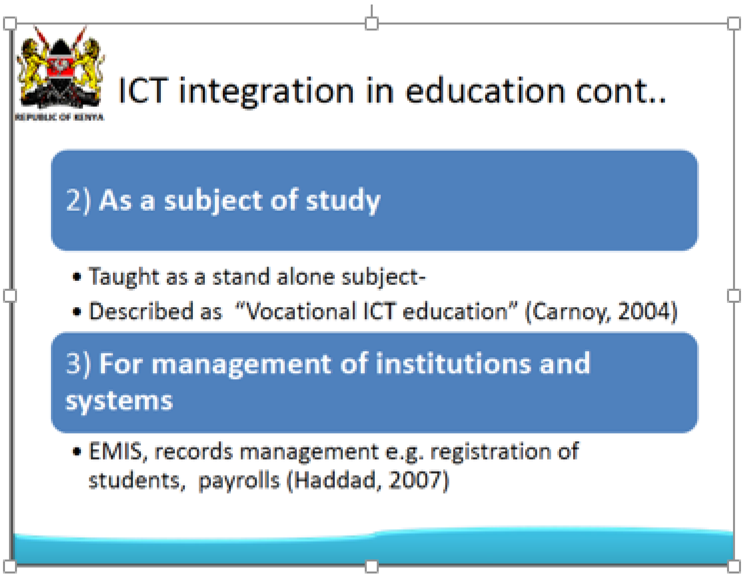
- Debate about ICT Integration-Is it a reality or myth?
- Why the clamour for ICTs in education?
- Model of ICT integration at Ministry of Education, science and technology?
- Lessons from ICT initiatives

REPUBLIC OF KENYA

ICT Integration in Education-What is it?

- Several schools of thought
  1) **As an enabler and facilitator- used by the teacher to enhance his /her teaching and learning**

❖ "ICT integration is broadly defined as a process of using any ICT (including information resources on the web, multimedia programs in CD-ROMs, learning objects, or other tools) to enhance student learning" (Williams, 2003).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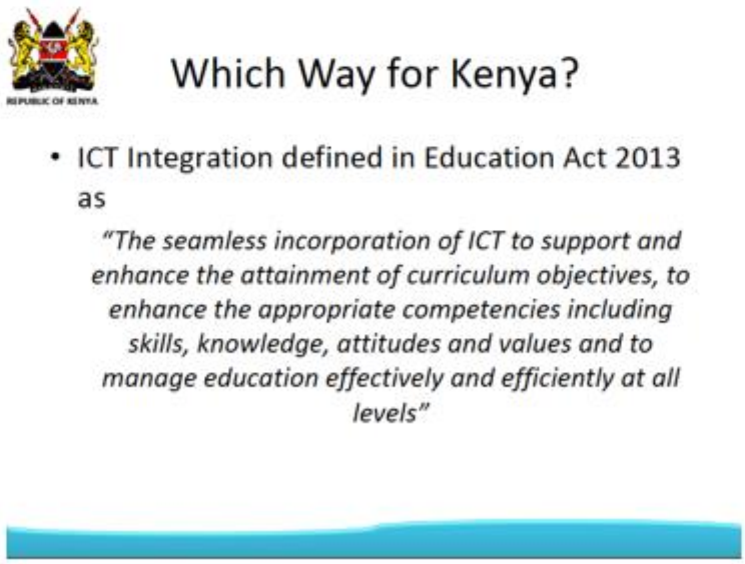
ICT integration in education cont..
2) As a subject of study
• Taught as a stand alone subject-
• Described as "Vocational ICT education" (Carnoy, 2004)
3) For management of institutions and systems
• EMIS, records management e.g. registration of students, payrolls (Haddad, 2007)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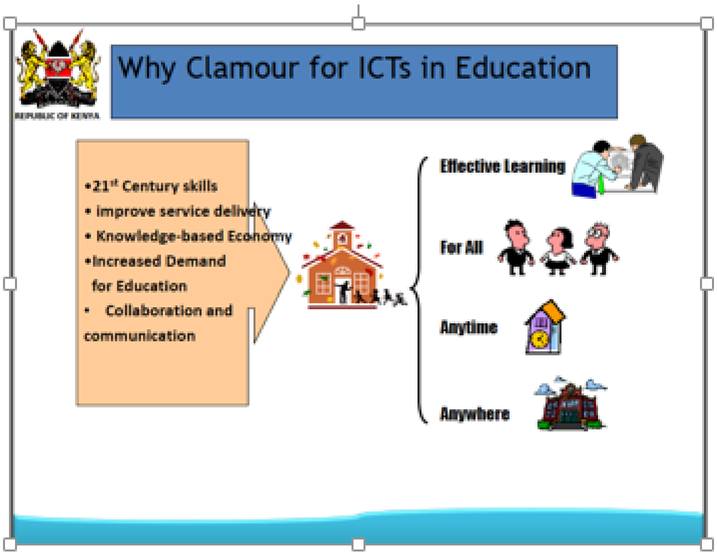
Which Way for Kenya?
• ICT Integration defined in Education Act 2013 as
"The seamless incorporation of ICT to support and enhance the attainment of curriculum objectives, to enhance the appropriate competencies including skills, knowledge, attitudes and values and to manage education effectively and efficiently at all levels"


Why Clamour for ICTs in Education
•21st Century skills
• improve service delivery
• Knowledge-based Economy
•Increased Demand for Education
• Collaboration and communication
Effective Learning
For All
Anytime
Anywhere
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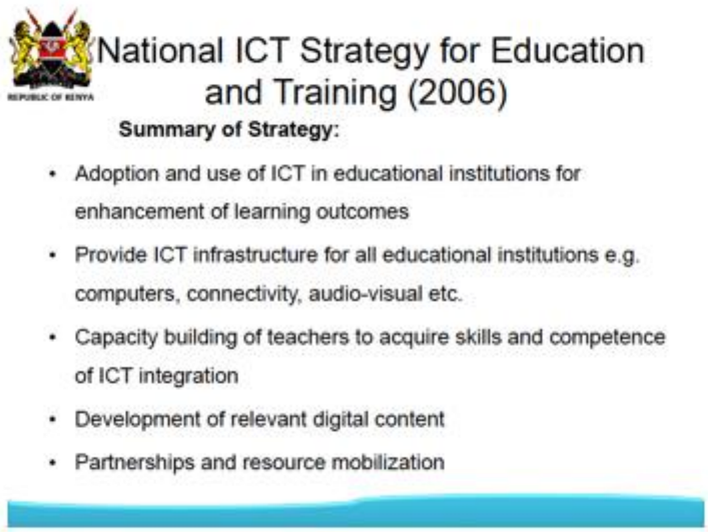
National ICT Strategy for Education and Training (2006)
Summary of Strategy:
• Adoption and use of ICT in educational institutions for enhancement of learning outcomes
• Provide ICT infrastructure for all educational institutions e.g. computers, connectivity, audio-visual etc.
• Capacity building of teachers to acquire skills and competence of ICT integration
• Development of relevant digital content
• Partnerships and resource mobilization
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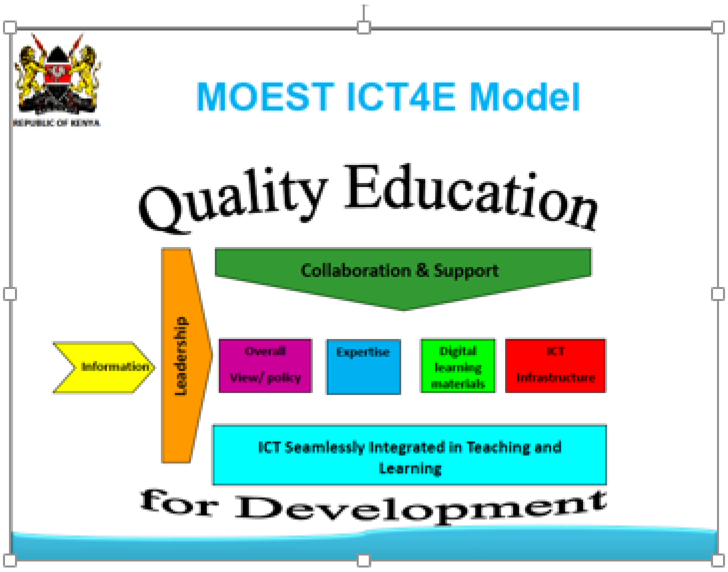
MOEST ICT4E Model
Quality Education
Collaboration & Support
Information
Leadership
Overall View/ policy
Expertise
Digital learning materials
ICT Infrastructure
ICT Seamlessly Integrated in Teaching and Learning
for Development
REPUBLIC OF KENYA

ESP Computer Project

2009 -2013 – over **1500 Secondary schools under ESP computer Project** facilitated to integrate ICT in teaching and learning.

Computers, projector and printers	Local Area Network (LAN) Internet	Capacity building for teachers and principals ICT championship programme	Help desk and support

Accelerating 21st Century Education

- Collaboration between MOEST and Consortia of USAID, Microsoft, Intel and CISCO
- 20 primary and 3 secondary schools, 3 TTCs in Mombasa, Kilifi, Garrisa and Nyeri counties
- ICT mobile Lab model-use of charging trolley
- Teacher training in ICT integration the strength of the programme

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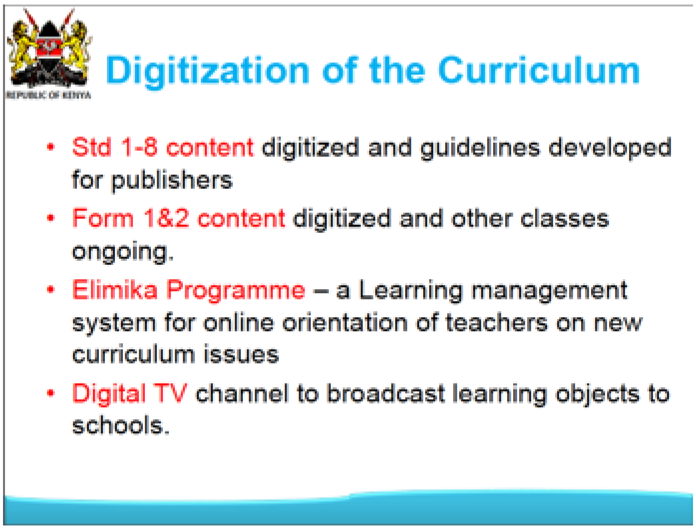
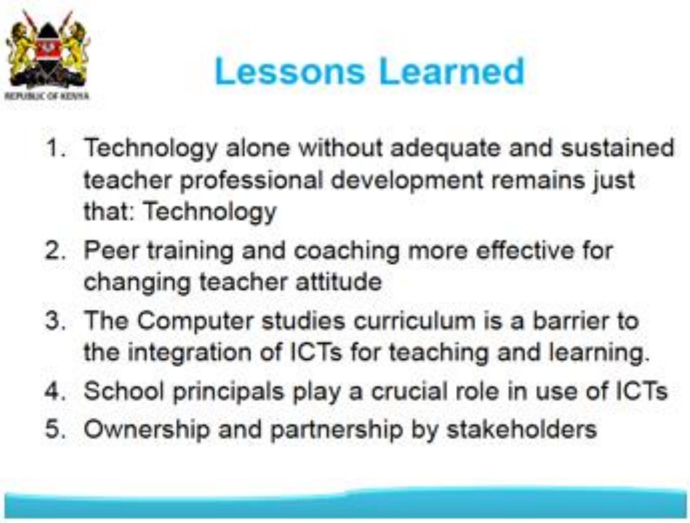
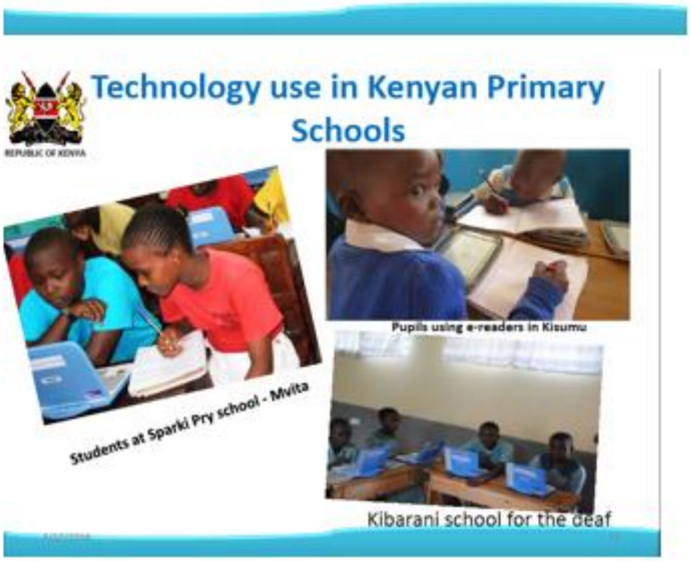
National ICT innovation and Integration Centre (NI3C)

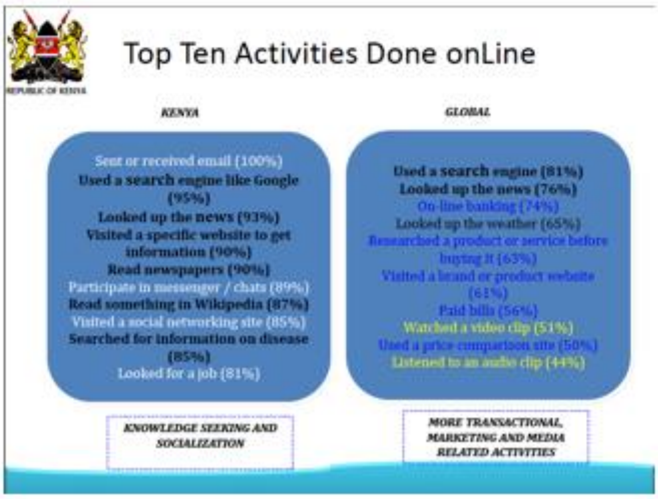
- Show-casing and testing new technological solutions to be deployed to schools (www.ni3c.net)
- Hosts the National Teachers portal (www.elimuportal.net)
- Hosts the National Helpdesk to offer support to schools.
- Offer specialized training in Innovations and Teacher professional Development

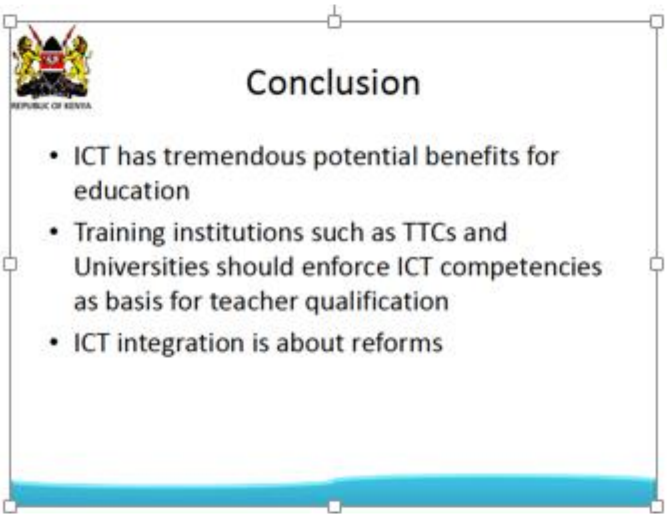

REPUBLIC OF KENYA
Digitization of the Curriculum
• Std 1-8 content digitized and guidelines developed for publishers
• Form 1&2 content digitized and other classes ongoing.
• Elimika Programme – a Learning management system for online orientation of teachers on new curriculum issues
• Digital TV channel to broadcast learning objects to schools.


The e-readiness System……
REPUBLIC OF KENYA
MINISTRY OF EDUCATION
E-READINESS SYSTEM


REPUBLIC OF KENYA
Lessons Learned
1. Technology alone without adequate and sustained teacher professional development remains just that: Technology
2. Peer training and coaching more effective for changing teacher attitude
3. The Computer studies curriculum is a barrier to the integration of ICTs for teaching and learning.
4. School principals play a crucial role in use of ICTs
5. Ownership and partnership by stakeholders


Technology use in Kenyan Primary Schools
REPUBLIC OF KENYA
Students at Sparki Pry school - Mvita
Pupils using e-readers in Kisumu
Kibarani school for the deaf


Top Ten Activities Done onLine
REPUBLIC OF KENYA
KENYA
Sent or received email (100%)
Used a search engine like Google (95%)
Looked up the news (93%)
Visited a specific website to get information (90%)
Read newspapers (90%)
Participate in messenger / chats (89%)
Read something in Wikipedia (87%)
Visited a social networking site (85%)
Searched for information on disease (85%)
Looked for a job (81%)
KNOWLEDGE SEEKING AND SOCIALIZATION
GLOBAL
Used a search engine (81%)
Looked up the news (76%)
On-line banking (74%)
Looked up the weather (65%)
Researched a product or service before buying it (63%)
Visited a brand or product website (61%)
Paid bills (56%)
Watched a video clip (51%)
Used a price comparison site (50%)
Listened to an audio clip (44%)
MORE TRANSACTIONAL, MARKETING AND MEDIA RELATED ACTIVITIES


Conclusion
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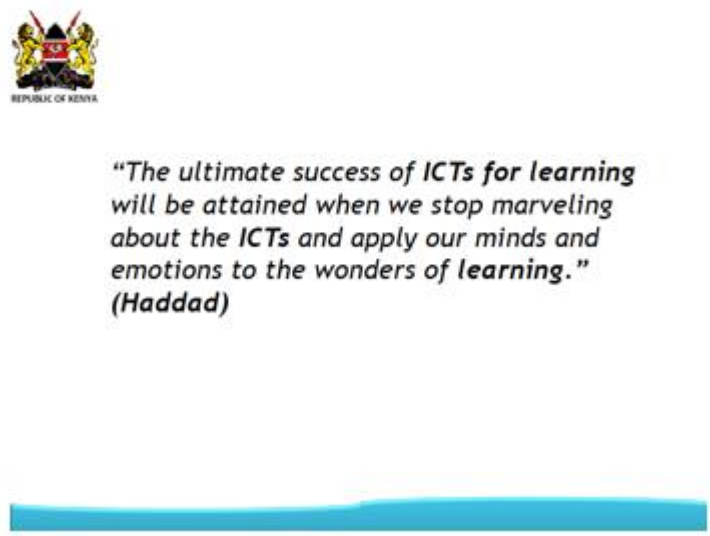
• ICT has tremendous potential benefits for education
• Training institutions such as TTCs and Universities should enforce ICT competencies as basis for teacher qualification
• ICT integration is about reforms


REPUBLIC OF KENYA
*"The ultimate success of **ICTs for learning** will be attained when we stop marveling about the **ICTs** and apply our minds and emotions to the wonders of **learning**."*
(Haddad)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And finally.........
Thank you for your most kind attention!