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Preface

This third issue of the *Journal of Continuing, Open and Distance Education (JCODE)* contains eight articles covering various themes in the field of continuing, open and distance education and e-Learning. The first article by Yeba Judith Sama Mouokuio Meno seeks to establish whether there is attitudinal gender bias towards girls in the use of computers in selected schools in Central Africa based on the theory of socialization. The author collected quantitative and qualitative data from the PanAf observatory (Indicators 4.4.3, 4.4.4, 4.4.5, and 4.4.6) which is an open knowledge-sharing resource for research on the pedagogical integration of ICTs established by the PanAfrican Research Agenda on the Pedagogical Integration of ICTs. The target population consisted of eleven schools from Cameroon, Central African Republic and Congo. The findings demonstrate that there is an attitudinal gender bias towards girls in computer use due to the female students' perception of themselves, ignorance, public opinion and their parents.

The second article by Angeline Mulwa, Kyalo Ndunge, Omondi Bowa and Guantai Mboroki explores the relationship between ICT infrastructure and readiness to adopt e- learning in secondary schools in Kitui District Kenya. Data was collected from 15 provincial and 36 District schools selected through stratified random sampling. Two way ANOVA at 0.05 and regression analysis results showed that institutional factors such as infrastructure (connectivity, sources of energy and e-equipment) have a significant influence on readiness to adopt e-learning. They recommend that government should address the issue of e-learning infrastructure, human resource capacity and the attitude of secondary school principals, teachers and students towards the adoption of e-learning in secondary schools before embarking on full scale implementation.

The third article is a study by Nkehsera Claire Massano Ndangle who investigated the use of ICTs in selected higher teacher training colleges in Africa. The purpose of the study was to identify the level of ICT knowledge among teacher trainers, find out how they use this ICT Knowledge and establish the challenges ICT usage posed. Data was collected from the Pan African Research Agenda on the Pedagogical Integration of ICTs observatory, (www.observatoiretic.org). The author concludes that there is high need for the teacher trainers to receive at least 50 hours of professional

training that includes ICT integration. She also recommends the inclusion of ICT integration in teacher education curriculum.

The fourth article by Laban Ayiro investigated students' skills and practices of using information and communication technologies (ICT) in ten Kenyan Universities. One hundred and fifty students responded to a self-report questionnaire. From the analysis, three constructs that represented these students' interactions with and perceptions on ICT emerged. These are: computer assisted learning makes the learning process more meaningful and motivates learners towards further learning; competence and intensive use of ICT at home and networking with expert cultures and tutoring other people to improve their ICT skills and intensity of using ICT which is determined by the availability of equipment and the extent to which ICT is used rather than by a student's expertise in ICT.

The fifth article by George Musumba, Robert Oboko and Elisha Opiyo report results from an experimental study where they developed a prototype that implements an adaptive presentation of course content under conditions of intermittent Internet connections. The prototype was tested on two groups of undergraduate students studying a database systems course. One group used it online and a control group used it offline. This study found out that it is possible to have learner models that can adapt to learner characteristics such as learner's level of knowledge and that learners can be able to learn under in both on-line and off-line modes with adaptation working correctly.

The sixth article by Harriet Kidombo, Christopher Gakuu and Anne Ndiritu examines the function of school principals as institutional managers and the role they play in the adoption and integration of Information and Communication Technologies in teaching and learning in ten selected Kenyan schools. The authors analysed quantitative and qualitative data from the PanAf observatory, an open knowledge-sharing resource for researchers on the pedagogical integration of ICTs in education. The research used a mixed methods approach where both qualitative and quantitative data was collected using a variety of tools to achieve the benefits of triangulation. They conclude that the development of ICT skills and knowledge among school principals is slow and may explain the low levels of ICT integration in the selected schools.

Issifu Yidana and Casmir Maazure, in this seventh article, present results of a study on faculty perceptions of their technology professional development needs and how these needs relate to faculty use of instructional technology in two Ghanaian teacher education universities. 132 teacher education faculty members were selected purposively. The study used survey methodology supplemented by interviews. The study found no significant relationship between faculty perceptions of their technology professional development needs and faculty use of technology for teaching and learning. However, the authors explain that this insignificant relationship could be due to limited technology knowledge and skills, limited participation in the technology innovation decision process, and inadequate opportunity for faculty to have hands-on experimentation with technology in instruction because of limited technology resources in classroom settings.

This study by Gerald Kimani, Augustine Kara, Lucy Njagi and Margaret Ruinge, which is the eighth article, examined students' experiences and perceptions of Master of Business Administration offered through distance methods at Kenyatta University. The sample consisted of 40 students enrolled in the programme. They report that majority of the students are adults with social and professional responsibilities and enroll largely because of future career prospects and flexibility of the programme. However, challenges related to irregular and untimely supply of the modules, poor coordination, delayed examination results and poor record keeping were cited. The need to improve on provision of high quality study modules, instructor – student interaction and students' support services are recommended.

Editor

Call for Papers

The School of Continuing and Distance Education, University of Nairobi, Kenya wishes to call for research papers to be published in its Journal of Continuing, Open and Distance Education (JCODE). The vision of JCODE is to become the leading journal on current adult and continuing education, open and distance education discourse. To achieve this vision, the journal will publish high quality peer reviewed papers which meet international standards. Recent empirical studies are encouraged on the following areas:

1. Adult education and community development
2. Open and distance education policy and practice
3. E-learning, online learning and ICT integration in education
4. Cross-cutting issues in open, distance and e-learning - gender and socio-cultural factors

The Journal will be published bi-annually, in January and June of every year.

Deadlines for Submission

a. Deadline for submission of completed papers is on 31st October of every year for the January issue and 30th March for the June issue.

b. The editorial board reserves the right to reject or accept contributions by authors and will communicate the decision to the respective author (s).

c. Email your articles to the addresses below:

	-	*jcode.scde@uonbi.ac.ke* OR
Dr. Harriet J. Kidombo	-	*harrietkidombo@yahoo.co.uk* OR *hkidombo@uonbi.ac.ke*
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Notes to Contributors

The Journal of Continuing, Open and Distance Education accepts articles in English from all over the world especially Africa on issues related to the advancement of the state of knowledge and practice of adult and continuing education, open, distance and e-learning. Below is a summary of the basic information that potential contributors to the Journal must be aware of. These instructions apply to all future contributions of the Journal.

i. Title should be brief (one line is best), and should begin with a word useful in indexing for information retrieval (not Effect or New). After the title, authors' names, institutional affiliation, telephone / fax number and e-mail should be mentioned (corresponding author should be indicated if different from first author).

ii. An abstract not exceeding 250 words and additional 3 to 5 keywords (i.e. key words not mentioned in the title) should be provided on the second line following the abstract.

iii. Articles should not exceed 7000 words.

iv. The article should be typed in Times New Roman, Font size 12, double-spaced and the format should be compatible with Microsoft Word.

v. The submitted full length papers should contain the following: title, names of authors and affiliation, abstract, introduction, context, methods, findings, discussion, recommendations, conclusions and Bibliography or References [Choose one, but for an article, we suggest the former]

vi. Citations should be the American Psychological Association (APA). Footnotes should not be used.

vii. A paper already published or under consideration for publication elsewhere (wholly or substantially) cannot be accepted.

viii. Manuscript should be in British English.

ix. Headings can be used up to a maximum of two levels. Only essential tables, diagrams and illustrations will be published.

x. Tables and figures with their caption should be submitted separately from the text (on a separate page and at the end of the file), but captions must be included in the text at the appropriate place. They

must be numbered in Arabic numbers according to the sequence in the text, i.e. Table 1, Table 2 … avoid large tables: the book size will be 15 × 21 cm (A5), use the tabulator (TAB) only.

xi. Tables should be clear without reading the text. Column heading should be brief and clear. Vertical lines should not be used to separate columns. Any necessary explanation essential for understanding the table should be given as a footnote at the bottom of the table.

xii. Diagrams produced by graphical computer programmes are only acceptable if their quality matches that of handmade diagrams.

xiii. Formulae should be numbered in Arabic numbers serially at the right-hand side in parentheses. They should be type written. Give the meaning of all symbols immediately after the equation in which they are first used.

xiv. All references cited in the text must be listed at the end of the manuscript. In the text, refer to the author's name (without initials) and the year of publication. The APA style of referencing is recommended.

Editorial Policy

1. JCODE is a forum for scholars and practitioners for reflective thinking and the dissemination of results of their research in adult and continuing education, open, distance and e-learning.
2. JCODE publishes articles that contribute to scholarly dialogue and the major criteria for choosing articles for publication will be their scholarly quality.
3. All articles submitted for publication will be peer reviewed by scholars of proven competence. However the final decision regarding publication shall reside with the Editorial Board.
4. Views expressed in articles which appear in JCODE and responsibility for them is solely those of the authors and not those of the Editors.
5. In addition to regular issues of the JCODE, special issues may be devoted to specific themes based on contributions solicited by the editors.
6. Articles submitted, if not published, will not be returned to the authors. However, the editors will acknowledge all contributions.
7. Authors of articles will receive two copies of the journal.

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GENDER BIAS IN ATTITUDE TOWARDS GIRLS IN THE USE OF COMPUTERS IN SELECTED SCHOOLS IN CENTRAL AFRICA

Yeba Judith Sama Mouokuio Meno

Abstract

This paper examines whether there is attitudinal gender bias towards girls in the use of computers in selected schools in Central Africa. Drawing from the theory of socialization, the paper also establishes the causes of the attitudinal gender bias towards girls in the use of computers wherever they are manifest. The aim is to ensure women's access to the benefits of ICTs, making it a central tool in women's empowerment and the promotion of gender equality. Quantitative and qualitative data were collected from the PanAf observatory (Indicators 4.4.3, 4.4.4, 4.4.5, and 4.4.6) which is an open knowledge-sharing resource for research on the pedagogical integration of ICTs established by the PanAfrican Research Agenda on the Pedagogical Integration of ICTs. Questionnaires, interviews schedule, and focus group discussion guide, were developed and validated by the PanAf team. Secondary data were collected from documents and other scientific research in this domain. The target population consisted of eleven schools from Cameroon, Central African Republic and Congo. Data were illustrated on tables and analysed by describing the data and interpretation of meanings of the information supplied by the participants. The findings demonstrate that there is an attitudinal gender bias towards girls in computer use. This is due to the female students' perception of themselves, ignorance, public opinion and their parents. Based on the findings recommendations are being made to encourage female and male students to participate equally and succeed in the use of computers.

Key Words: **Gender, Girls, Socialization**

Introduction

Information and Communication Technologies (ICTs) are understood to include computers, the rapidly changing communications technologies (including radio, television, mobile telephony and Internet), networking and data processing capabilities, and the software for using the technologies (Primo, 2003). Whilst acknowledging that the term ICTs does refer to this range of technologies, this paper focuses discussion on the use of computers. This is partly because the use of radios, audio-cassettes and videos in education is longer standing and more widely researched, and principally because it is computer-related technologies which are opening up dramatic new opportunities and challenges, and which are subject to intense debate as well as to rapid development and change (Debyshire, 2003).

Though there appears to be an increase in awareness of the need for gender equity in ICTs by development actors, there seems to be a continuous gap between the theory of the importance of female participation in ICTs and the practice. Former United Nations Secretary-General, Kofi Annan at the World Summit on the Information Society in Geneva (2003), said that there is a gender divide, with women and girls enjoying less access to information technology than men and boys. This can be true of rich and poor countries alike. This gendered digital divide is more prominent in the developing world and Africa provides a very obvious illustration. The result is an inequitable distribution of benefits that come with the use of ICTs (Nsibirano, 2009).

One of the reasons for this continuous digital divide in Africa is gender bias in attitude about girls and computers. According to Sanders, (2005), gender bias pervades societies throughout the world, thereby influencing girls' choices in many ways. A gender-biased society teaches girls to have gender-stereotyped interests (Makrakis, 1992) as cited by Sanders (2005). Gender bias in this case is seen as a separation of gender in such a way that one sex is preferred over the other in computer use, access, internet use and content (Mbangwana, 2011). Because computer use becomes more and more important in the educational environment, the attitudes of students towards the computer may play an important role in their learning (Fahad, 2000).

Earlier studies by Morahan-Martin, Olinsky & Schumacher (1994) as cited by Lior (1997) reveal that many significant differences are also present when comparing computer attitudes between the genders. "Males have been found to have more positive attitude towards computers than females, while females are more likely to be disinterested in, dislike, or fear computers" (p. 1). In certain aspects, women had a more positive attitude towards computers; females believed, more than males, that computers will assist them more with jobs and with getting jobs. These differences in attitude towards computers are quite significant; each sex perceives computers in its own regards.

One of the most potent forces shaping the 21st century is the new Information and Communication Technologies. ICTs are becoming a vital engine of growth for the world economy (Primo, 2003). It has become a potent force in transforming social, economic and political life globally (Hudson, 2001; Thioune, 2003:1) as cited by Omamo (2011). Even with this potential, issues of social inclusion and exclusion have emerged as a dimension of the range of critical issues, which need more research and debate as we progress into the 21st century (Omamo, 2011). This study will therefore identify whether there is an attitudinal gender bias towards girls in the use of computers in some selected schools in Central Africa (Cameroon, Central African Republic and Republic of Congo). It will also identify the kind of gender bias that exists in attitude about girls and computers in the selected schools. Existing gender bias in attitudes about girls and computers have to be known in order to propose measures aimed at wiping out the gender bias consequently narrowing the gender gap in ICT use. This is because as Liverpool (2002) says though there have been some recorded successes of women in ICTs, a lot still needs to be done to spread out the knowledge about these successes and to ensure gender equality in all facets of this discipline.

Khan, assistant director-general of UNESCO for Communication and Information as cited by Primo (2003) in her report on the world summit on the information society, says improved understanding of the opportunities that ICTs could provide for women, are important steps towards bridging the gender digital divide and towards transforming it into digital opportunity.

The involvement and engagement of women in the Information Society on an equal footing with men will directly contribute to improving the livelihood of people, making it more sustainable and thereby promoting the social and economic advancement of societies. In like manner, a report by Primo (2003), on the world summit on the information society by UNESCO reveals that, given the potential of ICTs in development and social transformation, it is essential that we address the gender digital divide.

Contextual Background

The Beijing Declaration and Platform for Action, adopted by the Fourth World Conference on Women in 1995, is generally regarded as a watershed in understanding of information technology as a powerful tool that women could use for mobilization, information exchange, and empowerment (Primo, 2003). It called for the empowerment of women through enhancing their skills, knowledge, access to and use of information technologies. The role of ICTs as a tool for development has also attracted the sustained attention of the United Nations. In 2000, the Economic and Social Council adopted a Ministerial Communiqué on the role of information technology in the context of a knowledge-based economy. Later that year, the Millennium Declaration underscored the urgency of ensuring that the benefits of new technologies, especially ICTs, are available to all (Expert group meeting in Korea, 2002). This is because as Primo (2003) says, ICTs provide us with the capacity to harness access and apply information and disseminate knowledge in all kinds of human activities, thus giving rise to the information or knowledge-based economies and societies. According to the expert group meeting in Korea the potential of ICT for stimulating economic growth, social development and political participation is recognized, but it is increasingly apparent that the benefits are unevenly distributed between and within countries, to a large extent because of differential access to ICTs, and differences in the knowledge base needed for optimal use of ICTs.

Research in Europe and North America has consistently highlighted gender differences and inequalities in access to computers, attitudes towards and use of computers and on the educational impact of computers. The context for

the European and North American studies is very different in many ways to the African context, including the spread and role of computers in society; education challenges, goals and resources; and the extent and manifestation of gender inequality. In Africa, the introduction of computers into primary and secondary education is recent and as yet, small scale and experimental. On the other hand in many economically developed countries, computers have been a compulsory component of the school curriculum since the late 1980s (Derbyshire, 2003). Whilst there are no figures on African children's subject choices in relation to computing, African women have the lowest enrolment rates in the world in science and technology education at all levels (Hafkin & Taggart, 2001) as cited by Derbyshire (2003).

The World Links case study on gender issues in the use of computers in schools identified that in Africa, boys spent more time than girls in front of computers both during lessons and during free time. More boys had access to a computer at home and they used computers more often in their leisure time. In 2001, a study involving interviews with a total of 380 students and teachers from Uganda, Ghana, Senegal and Mauritania found that whilst in principle girls are given the same opportunity as boys to access computers, gender equity of access does not always exist in practice (Gadio, (2001) as cited by Derbyshire (2003). Similarly, in a school in Zambia, it was found that male students ran faster than their female counterparts to occupy the little space in the window hole computers. In some cases where girls were using a single computer, the male students were mostly the ones operating the computers (Mbangwana, 2011).

Therefore it is necessary to bring out those negative attitudes which block the girls from having interest in computer, in order to propose moves that can culminate in the total eradication of the negative attitudes. And according to the expert group meeting in Korea (2002), it is essential to focus on the gender dimensions of the digital divide, not only to prevent adverse impact of the digital revolution on gender equality and to enhance women's equitable access to the benefits of ICT, but also to ensure that ICT can become a central tool for women's empowerment and the promotion of gender equality.

Theoretical Background: Theory of Socialisation by Shashaani (1993)

Socialization, "the acquisition of culture and ability through participation in group life in order to regulate social interaction" (Shashaani; 1993, p 171) as cited by Lior (1997), attempts to explain the sex differences in attitude towards the computer. According to the theory of socialization, the family is the primary exposure that an individual receives, shaping his beliefs, basic attitude, sex role identity, and self image. This identity is then shaped further by the school system, "an environment that formally transmits society's basic culture to children and provides them with values, feelings, and norms beyond their families" (Shashaani; p 171). The process of socialization clearly has a significant impact on sex differences. It is the main influence on gender differences regarding behaviour. It assigns male and females different role identities, which include different values and tasks. Socialization of gender role may very well be the cause for low self confidence and low expectations among women.

Shashaani, in "Gender Differences in Attitudes towards Computers", examines the male and female attitudes towards computers at a secondary school level. And this is the issue being addressed in this paper. She analyzes computer attitude differences and the research background before presenting the "Socialization Theory". She found many differences among high-school students regarding different perceptions towards computers between the sexes. In this study, generally "boys showed greater enthusiasm for becoming familiar with computers", while girls tended to have a negative attitude towards computers (Shashaani; p 174). She also found out that there are clear signs of gender differences in secondary schools in regards to confidence in using computers and that boys tend to feel confident and comfortable around computers. But girls tend to fear using computers and feel nervous and uncomfortable around computers. "Low confidence in learning and using computers deters an individual from participating in computing" (Shashaani P: 176). By removing the cause for lack of confidence in computer use among girls, improvement in removing the inequality in the computer field can be made. Differences in computer attitudes may be the main causes that separate females from males in regard to computers. Fear of computers, may deter females from further

participation with computers. Negative stereotypes, such as the computer field being a man's field; also reduce female self- confidence in computer use.

These differences in computer attitudes need to be removed in order to increase the female population in the computer field. To remove these differences, the causes and origins of these differences in attitudes must be found first. Shashaani found out that parents, teachers, peers, and school counsellors, have significant influence over the gender roles of students, by reinforcing gender-related beliefs and attitudes. Parents can influence these values by treating their children differently based on their sex; by giving their sons and daughters different opportunities, parents clearly influence the future of their children. Many parents and teachers have different educational expectations of male students and female students. Boys are encouraged to take computer science courses and mathematical courses more than girls. 22% of the parents believed that for their daughters, computer science is important to learn. Girls who believed that their father viewed computers as more suitable for males than females, tended to have significantly lower confidence in their computer abilities. From the study, it is clear that "female students, because of low confidence in their ability and lack of encouragement from their parents, teachers, and counsellors, have lower expectations for success in computing and thus, are deterred from entering this field" (Shashaani, p.178-179).

Shashaani concludes that it is clear that the present differences in computer attitudes between males and females are influenced by gender socialization. Students' decisions and attitudes towards computers are influenced primarily by parents and educators. Instead these parents and educators should support and encourage the female students to use computers in order to decrease gender differences in regard to computer attitudes.

Review of Related Literature

The role of ICTs as a tool for development and social transformation has enjoyed sustained interest in the international arena, and especially in the United Nations. As a contribution to the Beijing conference, the United

Nations Commission on Science and Technology for Development (UNCSTD) carried out a comprehensive set of studies on the relationships between gender, science and technology, and development. This work showed convincingly that there were significant gender differences in levels of access to, control of, and benefits accruing from a wide range of technological developments (UNCSTD-Gender Working Group, 1995).

Generally, women have less access than men to ICT facilities where they exist. Numerous invisible barriers limit women's and girls' participation in the Information Society. One of the more pervasive but intractable problems is "technophobia," or fear of technology. Women often have complex relationships with technology and machines as a result of being socialized over time to believe that machines and technology is a man's domain and not for women and girls, thus generating a gender bias in attitudes towards studying or using information technology. Once girls do enter school, they are discouraged from studying science and technology, either consciously or unconsciously, by parents' and teachers' biases. The steady attrition of girls and women throughout the formal science and technology system, from primary education to decision-making level, has been characterized as a "leaky pipeline' (Huyer, 2002) as cited by Primo (2003) in a UNESCO report on the world summit on the information society.

In the 1980s, the research in Europe and north America which identified boys' greater access to computers in schools also noted boys' dominance in computer related tasks and discussions. This research commonly found boys to be more active in computer-related classroom discussions, to make more spontaneous comments, and to be asked more questions by teachers. Girls, on the other hand, more often lacked confidence in computing, tended to underestimate their computer-related competence, and found boys' greater confidence intimidating and excluding. Initial explanations of these findings in Europe and north America focused on boys far greater hands on experience of computers at home, their greater enthusiasm to use computers, their greater confidence in using computers, and their tendency to rate themselves better than girls (Volman & Van, 2002).

Despite the lack of gender specific quantitative data, project level qualitative data have established that ICTs are not gender neutral. ICTs impact men

and women differentially, and in almost all cases, women have many disadvantages that result in their having less access to the technology and therefore less use of it (Hafkin & Huyer 2007). Estimates in Africa indicate that women comprise 25% or less of internet users (Hafkin & Huyer 2007). In terms of practical implementation of ICT interventions literature suggests that there is an overall gender bias in ICT projects. Hafkin & Taggart (2001), highlight three reasons for this bias, 1) women are rarely involved in the needs assessment of ICTs for development; 2) attitudes that high-end information technology is not for women who are still being treated as passive recipients of information and not as active information users and communicators; and 3) there is considerable delay in addressing the limitations faced by women in accessing supposedly 'public' information spaces.

One cultural aspect of gender and ICTs is gender bias in attitudes towards women studying or using information technology. Throughout the world, there are problems in attracting young women to science and technology studies. The problem is worse in Africa than in any other region. Many (predominantly male) maths and science teachers in Africa hold outmoded views that girls can't think or work scientifically and that science is too mechanical and technical for girls, thus discouraging female students (Quaisie; 1996) as cited by Omamo (2011). Sometimes collateral cultural factors, other cultural attitudes based in gender bias, and not the immediate gender identification of technology use, prevent young girls and women from accessing and using ICT.

Ndidde (2011) reveals from her study of Ugandan institutions that, the school system is the first point of contact for the majority of computer technology users in Uganda yet schools largely exhibit deep seated negative stereotypes against girls' and female teachers' use of technology." She observed that in one of the secondary schools studied, 99.3% of computer users were boys with girls being only 0.7%.

Women's access to ICTs is constrained by factors that go beyond issues of technological infrastructure and socio-economic environment. Poverty, illiteracy, lack of computer literacy and language barriers are among the factors impeding access to the ICT infrastructure, especially in developing

countries, and these problems are particularly acute for women. Socially and culturally constructed gender roles and relationships remain a cross-cutting element in shaping (and in this case, limiting) the capacity of women and men to participate on equal terms in the Information Society (Primo, 2003).

Tchombe (2008) stipulates that women's access to ICTs and their effective use of it are constrained by factors that go beyond issues of technological infrastructure and socio-economic environment. Similarly, Munyua (2005) says socially and culturally constructed gender roles and relationships play a crucial role in shaping and limiting the capacity of women and girls to participate on equal terms in the information society. A study by Durndell, Cameron, et al., (1997) as cited by Sanders (2005) revealed that parents are one source of gender stereotypes with respect to computing. In Romania and Scotland parents had more stereotyped computer attitudes than their children. In the United States parents were found to give less computer-related support to girls than boys (Kekelis, Ancheta, et al., 2005) as cited by Sanders (2005).

Primo (2003), says that information and communication technologies could give a major boost to the economic, political and social empowerment of women, and the promotion of gender equality. But that potential will only be realized if the gender dimensions of the Information Society - in terms of users' needs, conditions of access, policies, applications and regulatory frameworks are properly understood and adequately addressed by all stakeholders.

Objectives of the Study

1) To identify whether there is attitudinal gender bias towards girls in the use of computers in selected schools in Central Africa.

2) To establish the causes of the attitudinal gender bias towards girls in the use of computers wherever they are manifest.

Research Questions

1) Is there an attitudinal gender bias towards girls in the use of computers in selected schools in Central Africa?

2) What is the cause of the attitudinal gender bias towards girls in the use of computers?

Methodology

This concern the description of methods and procedures used for the purpose of the study. The study is qualitative and so the case study research methodology was used.

Research Design

Since this study was to find out whether there is attitudinal gender bias towards girls in the use of computers in selected schools in urban and rural areas in Central Africa, the sample survey design is the most appropriate design because the study involves collecting data on vital facts about people and their performance. It is also appropriate because it involves a relatively small number of people, with the intention of generalizing the findings to the larger population.

Population and Sample

The population of the study consists of PanAf schools in Central Africa, precisely Cameroon (Cam), Central African Republic (CAR) and Republic of Congo. The PanAf project is a multi-institutional partnership project which aims to better understand how the pedagogical integration of ICTs can substantially improve the quality of teaching and learning at all levels and scales of African education system. One of the Project's unique characteristics was its commitment to gender and ICTs and the collection of sex-disaggregated data, as well as the extent to which the analysis brings out differences in results on the basis of gender. In the African countries that were concerned with this translational research; qualitative data was collected from selected schools and training institutions with the view of preparing an observatory for each country of the state of integration of

ICTs in education. One of the parameters for choosing these schools was the acquisition of computers to identify leading practices on the pedagogical integration of ICTs.

The target population was made of 11 schools, five in Cameroon, and four from the Central African Republic (CAR) and two in Congo. These are Lycée PIE X11, Lycée Marie Jeanne CARON, Haute Ecole de Gestion et de Comptabilité, Etablissement Groupe Elite Formation, Lycée technique du 1er Mai, Ecole Notre Dame du Rosaire, Longla Comprehensive College, Bamenda, Lycée Classique et Moderne de MVOMEKA'A, Lycée General Leclerc, Yaounde, Ecole les Champions FCB de Memiam, Lycée Bilingue Essos Yaoundé.

Table 1: Information on the selected schools

Schools	Nature of school	Students' gender	School level	Location
Lycée PIE X11	**Private**	**Girls only**	**Secondary**	**Urban (CAR)**
Lycée Marie Jeanne CARON	**Public**	**Girls only**	**Secondary**	**Urban (CAR)**
Haute Ecole de Gestion et de Comptabilité	**Private**	**Mixed**	**Tertiary**	**Urban (CAR)**
Etablissement Groupe Elite Formation	**Private**	**Mixed**	**Secondary**	**Urban (CAR)**
Lycée technique du 1er Mai	**Public**	**Mixed**	**Secondary**	**Urban (Congo)**
Ecole Notre Dame du Rosaire,	**Private**	**Mixed**	**Secondary**	**Congo (Urban)**
Longla Comprehensive College, Bamenda	**Private**	**Mixed**	**Secondary**	**Cam (Urban)**
Lycee Classique et Moderne de MVOMEKA'A	**Public**	**Mixed**	**Secondary**	**Non-Urban (Cam)**
Lycee General Leclerc, Yaounde	**Public**	**Mixed**	**Secondary**	**Urban(Cam)**
Ecole les Champions FCB de Memiam	**Public**	**Mixed**	**Primary**	**Non-Urban (Cam)**
Lycee Bilingue Essos Yaoundé,	**Public**	**Mixed**	**Secondary**	**Urban(Cam)**

Out of the eleven schools selected for the study, five of them are private while six are public. Nine of them are mixed schools while two are for girls only. Two are located in non-urban areas, and the rest in urban areas. Nine of them are secondary schools; one is a tertiary school, and one a primary school. In choosing the samples the researcher considered the availability of data in the PanAf observatory on gender bias in attitudes towards girls using the computer. The sample of selected respondents consists of male and female learners from the schools selected for the study.

Research Instruments

In this study, data was drawn mainly from the PanAf project data that has been uploaded on the Observatory www.observatoreitic.org. The observatory is an open knowledge-sharing resource for research on the pedagogical integration of ICTs established by the PanAfrican Research Agenda on the Pedagogical Integration of Information and Communication Technologies. Specifically, data was taken from category 4 indicators relating to equitable ICT use and related barriers and challenges. Three instruments-questionnaires, interviews schedule, and focus group discussion guide, were developed and validated by the PanAf team. Secondary data was also collected from documents and other scientific studies carried out in this domain. The interviews and group discussions were carried out with the female and male learners in the selected schools. This was intended to give freedom and spontaneity.

Method of Data Presentation and analysis

Data were illustrated by using tables and analyzed by describing the data and interpretation of meanings of the information supplied by the participants. Qualitative analysis was presented in narratives guided by the research questions. Before analyzing and interpreting the researcher read through the data to obtain a general sense of the information collected and reflected on its overall meaning.

Presentation of Findings

Objective One

To identify whether there is attitudinal gender bias towards girls in the use of computers in selected schools in Central Africa.

Looking at all the eleven schools that were used for the study, data from the PanAf observatory reveals that in most of the schools there is attitudinal gender bias towards girls in the use of the computer. For instance in Lycee General Leclerc like in most of the selected schools, some of the girls are afraid to work in the cyber cafés. Some of them do not know how to use the computer. Some of them know the computer but cannot use social internet based networks. But in some of the schools like Lycee technique de 1er Mai, Ecole Notre Dame du Rosaire and Lycée PIE X11, gender bias in attitudes towards girls using the computer is less because some of the girls at least know and use the computer. Meanwhile in some of the schools like Ecole les Champions FCB de Memiam the girls know about the computer but do not use it (**Indicators 4.4.2** on the frequency of ICT use by Learners for Academic Purposes; **4.4.3** on female learners' points of access to computers/Internet; **4.4.4** on female learners' participation in Internet- based social networking; **4.4.5** on male learners' point of access to computers/Internet; **4.4.6** on male learners' participation in Internet - based social networking).

The kind of gender bias is attitudes often held by the girls themselves about computers, the parents and the society. In some of the schools that were used for the study like Lycee General Leclerc, even though the girls are aware of the importance of the computer and internet to them, some of them are afraid to work in cyber cafés (**indicator 4.4.3**). The few girls who know and use the computer as well as social internet based networks do not use them for pedagogic reasons but to communicate with relatives abroad (**indicator 4.4.5**).

In Lycee Classique de Mvonmeka, some of the girls think they do not really need the computer or the internet now in secondary school (**indicator 4.4.3**). Some of the girls in this institution communicate with their teachers through some of the internet based social networks like facebook indicating that they know and use the computer. (**Indicator 4.4.5**). Similarly, in Lycee

Bilingue Essos and Longla Comprehensive College the girls say they have heard of internet based social networks but they do not use them. The few who know about these networks use them for social reasons only (**indicator 4.4.5**).

In Lycee Pie X11, some of the girls know how to use the computer and internet because they cited cyber cafés, telephone and the home as their most convenient point of access. They use the computer and internet to do research to strengthen their course contents (**indicator 4.4.3**). In Lycée Marie Jeanne Caron, Etablissement Groupe Elite Formation and Haute Ecole de Gestion et de Comptabilité the girls talk about the computer but do not have interest in learning how to use it talk less of social networks (**indicators 4.4.3, 4.4.4**). In Lycee technique de 1er Mai female learners have a positive attitude towards the computer because they at least know and use the computer and some of them even use social networks and search engines like Yahoo, Twitter and Google (**indicator 4.4.5**). In Ecole Notre Dame du Rosaire female learners know and use the computer for pedagogical reasons because they use search engines like Google and Yahoo, to do research (**Indicator 4.4.5**).

Objective Two

To establish the causes of the attitudinal gender bias towards girls in the use of computers wherever they are manifested.

The study revealed that the attitudinal gender bias towards girls in the use of computers is due partly to ignorance, fear and lack of self confidence by the girls themselves. In some of the schools that were used for the study like Lycee General Leclerc, some of the girls are afraid to work in cyber cafés because they fear to damage either the machines or programmes (**indicator 4.4.3**). Some of the girls do not use the computer, internet as well as social internet based networks because they do not know what it is all about and the few who know about the networks say people have a bad impression about the use of the internet. The boys have greater knowledge of the computer and use social networks more than girls do and this reflects gender bias in attitudes.

In Lycee Pie X11, one of the students interviewed says she is afraid to use the computer and social internet networks for fear of falling in the hands of

delinquents (**indicator 4.4.5**). In Lycée Marie Jeanne Caron, Etablissement Groupe Elite Formation one of the female students says she is interested in learning the computer and ICTs but since in Lycée Marie Jeanne Caron they don't have adequate computer facilities; she has difficulties (**indicator 4.4.5**). In Lycee Classique de Mvonmeka, some of the girls think they do not really need the computer or the internet now in secondary school because according to them, this will be useful in the university (**indicator 4.4.3**). Similarly, in Lycee Bilingue Essos and Longla Comprehensive College the girls say they have problems using the computer and internet because they are not as free as boys are. According to them the boys will feel free and enter whatever site, while the girls choose sites before visiting them (**Indicator 4.4.5**).

The study revealed that the attitudinal gender bias towards girls in the use of computers is also due to the fact that their parents do not encourage them. For instance in Memiam like in most of the selected schools, the girls are not allowed by their parents to visit cyber cafés (**indicator 4.4.3**). Similarly, in Lycee Bilingue Essos and Longla Comprehensive College their parents who use them do not show them how to use it because they do not think it is necessary. In Lycee General Leclerc, some of the girls say their parents think it is risky for them to use the computer and social internet based networks because they will be exposed and can be derailed by men (**indicator 4.4.5**).

The study also reveals that public opinion about the use of computers and the internet by girls is also a main hindrance. In Lycee Bilingue Essos, and Longla Comprehensive College like in most of the selected schools the girls say they have problems using the computer and internet because public opinion holds that boys use the internet for scamming and girls will be seen as scammers if they get to use the social internet networks. The female students who use the computer and internet often are commercial students since most of the subjects they offer require the use of these ICTs. As for the non-commercial students they prefer using the computer and internet at home and mostly in the cyber café.

Discussion of Findings

Finding out why there is gender bias in attitude towards girls in the use of computers, data collected from the PanAf observatory reveal that female students do not know much about the computer and social internet networks as compared to boys, reflecting gender bias in attitude. They feel uncomfortable using the internet because public opinion holds that boys use the internet for scamming and girls will be seen as scammers if they get to use the social internet networks. This ties with the view of CIDA (2000) which reveals that women are often restricted from using technology due to socio-cultural and religious attitudes and practices, manifested in limits, set by society, on the extent to which women and girls can interact with technology.

The girls also say they have problems using the computer and the internet because they are not as free as boys are. According to them the boys will feel free and enter whatever site, while the girls choose sites before visiting them (**Indicator 4.4.5**). The female students who use the computer and internet often are commercial students since most of the subjects they offer require the use of these ICTs. Huyer (2003) supports this view as she argues that women and girls are poorly placed to benefit from the knowledge economy because they have less access to scientific and technical education specifically and to education in general. From the study, the students give reasons like, not having free access to these facilities in school and even when they have, the time is limited and they are not free to get into whichever site they want to. Some of the female students think the subjects they offer do not require the use of the computer and the internet (**Indicator 4.4.3**). The above views also ties with Mani (2008), as cited by Yeba when she says that women continue to shy away from ICTs because of low self esteem and lack of confidence.

From the findings it is clear that the differences in computer attitudes between males and females in the use of computers are influenced by gender socialization. Shaashani (1993) as cited by Sanders (2005), supports this view in his 'theory of socialization' when he says students' decisions and attitudes towards computers are influenced primarily by parents and educators. The study revealed that the parents use the computer but do not show their girl children how to use it because they think it is not necessary. Shashaani's

view ties with this when he says that parents' computer stereotypes in favour of males encouraged their sons' computer involvement and discouraged their daughters'. Instead these parents and educators should support and encourage the female students to use computers. Huyer, (2002) as cited by Primo (2003) in a UNESCO report on the world summit on the information society supports this view when she says that once girls do enter school, they are discouraged from studying science and technology, either consciously or unconsciously, by parents' and teachers' biases.

Computer experience and skills vary and therefore should be viewed as "multidimensional". Since there are present gender differences in regards to experience/skills, these gender differences may influence negatively female students' motivation and accomplishments (Morahan- Martin, Olinsky & Schumacher; 1994:7) as cited by Lior (1997). The issue of females tending to have a negative attitude towards computers could lead to them avoiding computer use when optional (Morahan- Martin, Olinsky & Schumacher; 1994). These differences "suggest that perhaps different kinds of assistance will be necessary in working with male and female students" (Morahan-Martin, Olinsky & Schumacher; 1994).

Conclusion

The main objective of this study was to identify whether there is an attitudinal gender bias towards girls in the use of computers in selected schools in Central Africa, and to establish the causes of the gender bias wherever they are manifest. The researcher concludes from the findings that gender bias exists in attitudes towards girls in the use of computers, and these are attitudes often held by the girls themselves about computers and the internet. This is because of the female students' perception of themselves, lack of self-confidence, ignorance, fear, parents' attitudes towards gender and computers, as well as public opinion about girls who go to the cyber café. From the findings it is clear that the differences in computer attitudes between males and females are influenced by gender socialization. Based on the above conclusion the following recommendations are made for policy and practice.

Recommendations

Female students should be sensitized on the importance of the computer and internet to them as individuals.

Parents should be sensitized on the importance of education in general, and encourage their girl children to go to school because as Huyer (2003) says, women and girls are poorly placed to benefit from the knowledge economy because they have less access to education in general. Parents should also reward daughters for their computer achievements.

Teachers could greatly increase the percentage of women in the computer field by encouraging female students to participate more in class; e.g. give presentations and lead coed groups. Schools should bring in female speakers who are successful in the computer field to motivate female students (Shashaani, 1993) as cited by Sanders (2005).

Finally, as Shaashani (1993), says it would be beneficial to create programs that would increase the job opportunities for females in the computer industry. By changing the computer job market into more gender balanced, the increase in the female population in this job market would change parents and educators perspectives and would motivate them to encourage females and males equally to participate and succeed in the use of computers.

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INFLUENCE OF ICT INFRASTRUCTURE ON READINESS TO ADOPT E-LEARNING IN SECONDARY SCHOOLS IN KITUI DISTRICT, KENYA

Angeline Mulwa, Ndunge Kyalo, Omondi Bowa, Guantai Mboroki

Abstract

This article advocates for speedy provision of Information Communication and Technology (ICT) infrastructure in all secondary schools to make it possible for the teachers and learners to adopt e-learning to accelerate development and economic growth of our Nation. The article explores the relationship between ICT infrastructure and readiness to adopt e- learning in secondary schools. Objectives of the study were to establish the extent to which ICT connectivity influences the readiness to adopt e-learning in secondary schools, the influence of sources of power on readiness to adopt e-learning in secondary schools and the extent to which ICT equipment influences readiness to adopt e- learning in secondary schools. It is based on literature review and field research by employing cross–sectional survey research design to determine the extent to which ICT infrastructure influences readiness to adopt e-learning in secondary schools in Kitui District. A single questionnaire and an observation schedule were used to collect data from 15 provincial and 36 District schools selected through stratified random sampling. Null hypotheses were tested by using two way ANOVA at 0.05 confidence level and regression analysis. The results established that institutional factors such as infrastructure (connectivity, sources of energy and e-equipment) have a significant influence on readiness to adopt e-learning. However, 70% of the schools in Kitui District did not have adequate infrastructure to support the adoption of e-learning. It was recommended that the government should address the issue of e-learning infrastructure by availing e-learning equipment, enhancing connection to reliable sources of power, improving internet connectivity to secondary schools in Kitui District and all other districts before embarking on full scale implementation of e-learning in schools in Kenya.

Key Words = **Connectivity, Power/Energy, Equipment**

Introduction

Information and Communication Technology (ICT) plays a key role in promoting economic development of a country. Many of the economic gains in the developed world economies over the past two decades could be to a great extent attributed to the impact of ICT, (UNESCO 2004

There is no doubt that the advances in information and communication technology have enabled people all over the world to share ideas faster and more effectively at far distances. Many countries both in developed and developing economies have adopted the modern electronic communication technology for different operations in their economies. However, the extent to which a country is able to participate and benefit from the electronic communication technology depends on the country's digital divide as well as availability of e-infrastructure and technical know-how in the country, (UNESCO, 2004).

ICT infrastructure is a basic requirement for adoption of e-learning in learning institutions and indeed any organization. The concept of ICT infrastructure denotes all the facilities necessary for effective e-learning in schools. Such facilities include equipment, connectivity and sources of energy. ICT infrastructure is a basic requirement for adoption of e-learning. The concept of ICT infrastructure denotes all the facilities necessary for effective e-learning in schools. Such facilities include equipment, connectivity and sources of energy. Furthermore, the question of availability of e-infrastructure needs to be dealt with at institutional level in order to give a true picture of the specific operational environment. Such infrastructure includes connectivity to various networks (internet, intranet, and mobile-telephone); sources and reliability of energy (UPS, electricity, standby generators); equipment (computers, radios, videos, television, LCD projectors and software, e-learning laboratories furniture and stores and information storage facilities such as flash disks, CD-ROMs, DVDs.

The Ministry's Policy Framework indicates that there are a number of challenges concerning access to and use of ICT in Kenya. This includes high levels of poverty, limited rural electrification and frequent energy disruptions as well as lack of computers and adequate connectivity, (National ICT policy, 2006).

Successful e-pedagogy depends on effective e-facilitation, which can be made difficult or possible by various factors depending on how prepared the implementers are. Lumumba (2007), in his study on the challenges facing e-learning at public secondary schools, based on the NEPAD pilot project schools in Kenya established that the e-learning project was faced by many challenges. He singled out lack of adequate e-learning facilities (infrastructure), as key obstacles to the success of the e-learning project. He attributed such challenges to lack of preparedness among the institutions and implementers before the implementation process began. The study recommended that, for successful implementation of e-learning in educational institutions to be enhanced, the factors determining the readiness to adopt e-learning be established and dealt with adequately before the implementation process commences. However, the extent to which availability of ICT infrastructure influences readiness to adopt e-learning in Secondary Schools was not addressed.

It is worth noting that studies that have been carried out on the area of e-learning (ICT) adoption and diffusion were based on the developed countries and therefore the findings can be generalized especially in developing country like Kenya with a lot of caution. Literature on e-learning in secondary schools is scanty but they all point out that there is a big gap between policy and practice when it comes to readiness of secondary schools to adopt e-learning. The few studies that have been carried out on use of ICT in curriculum implementation at Secondary schools in Kenya (Lumumba, 2007; Ayere at-el, 2010 and Keiyoro, 2010) were based on NEPAD and CSTS e-schools which were set up as Centres of excellence in e-learning integration, so that other schools could copy their model. For this reason the schools were provided with computers, e-materials, internet appliances and trained personnel. Such studies do not reflect the real situation of readiness to adopt e-learning in normal Kenyan Secondary Schools. This article examines the concept of e-learning, followed by a brief discussion on the influence of ICT infrastructure on readiness to adopt e-learning. The rest of the article describes the methodology used, data analysis, interpretation and discussion of findings and finally outlines the recommendations to improve the speed to which the government and the

secondary schools are moving towards the installation of ICT infrastructure as the basic requirement for sustainable adoption of e- learning in secondary schools. The study was guided by the following objectives: to establish the extend to which ICT connectivity influences the readiness to adopt e-learning in secondary schools, the influence of sources of power on readiness to adopt e-learning in secondary schools, the extend to which ICT equipment influences readiness to adopt e- learning in secondary schools.

The concept of e-readiness

Mcconnel Intl, (2001) describes e-readiness as the measure of the extent to which nations are capable to participate in the networked world. He clarifies that e-readiness measures the capacity of a nation to participate in the digital economy by judging the relative advancement of the key important applications. E-readiness originated with the attempt to provide a unified framework to evaluate the breadth and depth of the digital divide between the less developed and the developed countries (Arce and Hopman, 2002). Today there is no doubt that there is a wide gap between the developed and the developing world in terms of e-readiness. It is therefore agreeable that e-readiness is a critical area that must be assessed and prudently addressed before adoption of e-learning in Kenyan learning institutions and indeed all other developing countries.

Gakuu (2006) observes that information is now viewed as a basic raw material that is being consumed at an enormous scale in the socio-economic processes and thus having competitive importance. Sadly, neither competitive value accrues evenly across countries nor technological diffusion limits the difference in national, political, economic, social and cultural structures. Thus, Carlson,(2004) claims that, it is very likely that digitization of information will only benefit a few countries which have the capacity to harness the required resources. It is also true to say that even within a country only some few well endowed regions will be able to benefit from the digitization of information due to different levels of development.

Various international agencies have focused their attention on the phenomenon of the digital divide; The UN, UNESCO, OECD, UNDP,

the World Bank and many others. In particular, UNESCO was the first international body who focused on the issue of digital divide which it considered as one of the most pressing ethical and social challenges of our time. In a recent document named "Towards the knowledge Society", (UNESCO World Report (2005), it is claimed that bridging the digital divide is a priority of UNESCO mission.

Focus is placed on the need to develop a culture of knowledge enabling not only "formal" but also "effective" access for all to information and communication technologies (ICT). It is pointed out in the UNESCO (2005) that new technologies cannot be implanted from the top in deprived and disadvantaged contexts. In order to be effective; they need to come as specific local needs by means of a "bottom- up" process. It is, therefore, paramount to start from local practices and involve all the actors concerned (at institutional and non-institutional levels) in the specific contexts where such projects and policies are implemented. It is for this reason that the current study focused on specific institutional and human factors that influence readiness to adopt e- learning in secondary schools.

The Influence of ICT Infrastructure on Readiness to Adopt e-Learning

E-learning is new in many developing countries and is somewhat being practiced on a trial and error method as it is actually at infancy stage (Kenya data profile 2006). A number of African countries have just completed the pilot stage with the NEPAD e-schools e-learning project. The experience of these schools in the pilot study indicate that successful implementation of e-learning in secondary schools needs careful planning as there are many challenges that need to be addressed.

The Kenya Internet Usage and Marketing Report (2006) indicated that only people (20%) in Kenya have a computer at home. Radio and television access is much better with 48% while mobile phone are common (76.9%) place and the number of internet users is increasing rapidly due to the number of internet cafes, shops and access centres that are available, particularly in urban areas. However, it is feared that, due to wide use of English in

Kenya usage of Internet may be congested since most of its web sites are in English.

Technology especially electronic media has a place in educational research and delivery. However, Mboroki (2007) warns that the cost and availability of electronic media technology would be a serious limiting factor to the usefulness of the technology to the students and teachers. He points out that students will have to travel long distances and spend a lot of time and money travelling to market places where there are cyber cafes and to pay for the services from personal budgets that are already stretched to the limit. A study on readiness to adopt e-learning in secondary school guards the country from falling into the pitfall of introducing media into educational delivery that is unplanned and unsustainable, warned against by Bates(1986)

Kenya Internet Usage and Marketing Report, 2006 Kenya data profile (2006) indicates that most secondary schools had some computer equipment. However, this could consist of one computer in the office of the Head teacher. The profile also points out that very few secondary schools have sufficient ICT tools for teachers and students. Further, it was observed that even in schools that have computers, the student-computer ratio is 150:1 (Kenya data profile, 2006). Notably, given that the conditions above are described as they were in 2006, it is likely that with the effort made by the government towards preparation for introduction of e-learning in schools, things have improved.

The major problem pointed out by the Data and Statistics (2006) was that Kenya lacked adequate connectivity and network infrastructure. It was pointed out that, although a small number of schools had direct access to high speed connectivity through an internet service provider, generally there was limited penetration of the national physical telecommunication infrastructure into rural and low-income areas. This fact raised a greater need for investigating the role played by ICT infrastructure in determining readiness to adopt e-learning in secondary schools against the ministry's plan to leverage the e-government initiative of networking public institutions countrywide to facilitate the educational sector.

Theoretical Foundation of E-learning

This study was guided by the programmed learning theory which has been popularized through its use of linear program teaching machines. The theory was developed by Skinner (1954) and later modified by Crowder (1960). According to the programmed learning theory, any classroom learning should be treated like any other learning situations in which certain behaviour is to be shaped. The student must be allowed to progress gradually from familiar to unfamiliar material and be given an opportunity to do the necessary discriminations, and the student must be reinforced to progress. This view observes that the classroom situation in the traditional face-to-face learning has many disadvantages to students. What may be too fast for one student may be too slow for another. Each individual's opportunities to make the required responses are limited, and often reinforcement is greatly delayed.

Skinner (1968) states that, a learner's actions which are reinforced, are likely to be repeated and learned, while actions that are not followed by reinforcement will tend to disappear from the learner's repertoire. Skinner (1968) and Lumumba (2007) argued that individual tutoring could solve all these problems but in most cases, this is out of question except for perhaps, supplementary work. He suggests that in order to give students in school the same advantage, the answer would be to use teaching machines, such as computers.

The theory of programmed instruction suggests that effective learning can result from a presentation made to an individual student with a carefully designed sequence of instructional material responses, which can be reinforced in the direction of desired behavioural capabilities. A program is therefore an individual lesson, designed and presented as a sequence of relatively small units of information which lead the students, step by step, to a level of behaviour predetermined by the programmer (Methuens, 1970).

The features of the linear program have been described by Skinner (1968) and Winfred (1977) as follows: First, material is arranged in a carefully ordered sequence of very small, cumulative and coherent steps, so that the learner is not aware of any real difficulty in assimilation. It assumes that,

the whole process of becoming competent in any field must be continuous, upon the accomplishment of each step and that, by making each successive step as small as possible the frequency of reinforcement can be raised to a maximum, while the possible aversive consequences of being wrong are reduced to a minimum (Skinner, 1968; Winfred, 1977 and Lumumba, 2007). Secondly, the learner has to make a constructed response, in an overt manner (such as in writing), to each question arising from the material. Third, in order to help the learner in his or her responses, the material includes clues and responses which guide him or her. Therefore, immediately the response is made, the learner is informed whether he or she is right or wrong. The learner acts as his or her own response comparator.

Finally, the program which has been empirically validated is constructed so that a correct response will be given, at least nine times, out of ten. This produces satisfaction (reinforcement) and continuous progress is made that much more certain. In the case of an incorrect response, the learner notes the error, and moves onto the next unit of information.

Lumumba (2007) further describes another type of programme as suggested by Crowder (1960). This is known as "branching" or "Intrinsic" program. It is constructed so as to utilize the learner's responses in the determination of content and actual presentation of the material. In contrast to the linear programmer, he uses multiple choice quotations. This is meant to test the learners understanding of the materials he or she has studied and allow the presentations of remedial material where, no response is made.

The technique of the branching program differs from that of the linear program in that, it begins with a frame which usually contains much more information than that, presented in a linear-type step. The information is followed by a multiple choice question. A correct response results in the learner being informed that he or she is correct (and why) and in the presentation of a new unit of information. On the other hand, an incorrect response results in the learner being informed that he/she is wrong (and the nature of the error). In this case, the learner may be instructed to return to the original frame to "try again" or may be moved to a 'remedial sub-sequence'.

E-Learning is thus basically based on this theory and concept. The claim of the programmers is that if a subject can be taught, then it can be programmed. There is therefore, according to this claim, no limit to the areas in which programmed instruction can be effective. This is the approach applied in e-learning via the internet. It can be argued that, when a user approaches the computer (Internet), he or she can do one of the following three things: browse pages for information, interact with pages of content or collaborate with other users. During a session, a user may be involved in the tasks of browsing, interacting or collaborating. To browse means that a user uses the technology to gain information. The activity requires the user to read information presented on the screen and take away from the information a degree of knowledge. This activity relies on the learner being able to interpret the information effectively, and draw relevant conclusions.

On the other hand, to interact implies that the information is developed and shaped by the user. The information retrieval process relies on the interaction of the user with the system. Key questions may be asked of the user and choices made or communicated on line forms. This activity involves the user directly in the learning process and requires them to interact with the information, to enable relevant conclusions to be made. Finally, to collaborate means that the learning activity relies on the user collaborating with other users and sharing that information and knowledge. When a user approaches the system, they are actively involved in the activity which can only take place when users interact, and information is provided by other users. This activity, involves the user directly in the learning process.

From the foregoing discussion, it is evident that for learning to take place, there should be e-learning infrastructure: Hard and software, skills and learner's interest. The presence or absence of such essentials to the user, will determine the extent to which, such a user can utilize e-learning. This study was meant to establish the readiness of secondary schools to adopt e-learning, based on the e-learning infrastructure, human resource capacity (skills requirement and acquisition) personal characteristics and interest in using e-learning approach to curriculum implementation, as indicated in the teachers and students attitude. While acknowledging the important

contribution of the two theories, this study advocates for the linear program teaching machines, based on programmed learning theory.

This study was also based on the Diffusion Theory particularly, Rogers' (1995) Innovation Diffusion Process Theory. This theory states that diffusion is a process that occurs overtime and can be seen as having five distinct stages, namely: Knowledge; persuasion; decision; implementation and confirmation. According to this theory, potential users of an innovation must learn about the innovation, be persuaded on the merits of the innovation, decide to adopt and implement the innovation, and confirm (re-affirm or reject) the decision to adopt the innovation. According to Rogers (1995) the rate of adoption is also influenced by three other factors, including the type of innovation decision; Communication channels and the extent of change agent's promotion effort.

Studies by Holloway (1977) and Wyner (1994) indicated relative advantage and compatibility to be more significant perceptions among potential adopters of Instructional Technology in High schools. A study by Eads (1984) established that compatibility was more important attribute among students and schools administrators.

According to Massy and Zemsky (1995), there are three levels of technology adoption. The first level is the personal productivity aids, which involves application which allows teachers and learners to perform familiar tasks faster and more effectively. The second level is the enrichment add-ins which involves injecting into the "old" teaching and learning without changing the basic mode of instruction, that is e-mail, website searches, use of videos, multi-media, simulation to enhance classroom presentation and homework assignment. The third level is the paradigm shift, which involves the Ministry of Education and schools recognizing teaching and teaching activities. To take full advantage of new technology to current instructional methods or attempting to impose a traditional format on a technology-supported learning environment is likely to produce inferior learning outcomes. Therefore, the teacher and the student need to be engaged in active learning where the student takes more responsibility of the learning process while the teacher takes the role of the facilitator.

Methodology

The study adopted a cross-sectional descriptive survey design. The design was chosen due to its ability to ensure minimization of bias and maximization of reliability of evidence collected(Kothari,2002).Furthermore descriptive survey design raises concern for the economical completion of the research study. The method is rigid and focuses on the objectives of the study thus guarding the researcher from collecting irrelevant information. The study used ex-post-facto design, which is a systematic empirical inquiry in which the researcher does not have direct control of independent variables because their manifestation have already occurred or they are inherently not manipulable, (Emory,1985).

The study further adopted a combination of both qualitative and quantitative techniques which according to Emory (1985) and Kothari (2004) supplement each other in that qualitative technique provides the in-depth explanations while quantitative technique provides the hard data needed to meet the requirements of objectives and test of hypotheses. The philosophical foundation of this study is positivism which stresses that the social world exists externally, and that its properties should be measured through objective methods, rather than being inferred subjectively through such approaches as intuition, sensation and reflection, (Easterby-Smith, Thorpe and Lowe, 2002), coupled with constructivism for qualitative data.

The population for this study included 51 out of 80 Public Secondary Schools in Kitui District. The sample was selected through stratified random sampling as indicated in Table1.

Table 1: Sample Selection for the Schools

School category	Total No. of Schools	Selected No. of Schools
Provincial	16	$\frac{16}{80} \times 66 = 13$
District	64	$\frac{64}{80} \times 66 = 53$
Totals	**80**	**66**

The calculations in Table 1 indicate that 13 provincial schools and 53 district schools were selected to participate in this study through the stratified random sampling technique. The sample for the secondary schools was selected using a table of random numbers prepared by Tippet (Kothari, 2004). Tippet's Table of random numbers which is generally used to draw random samples from finite populations when the lists are available and items are already numbered. In this study, the secondary schools were already listed, numbered and categorized into Provincial and District schools in the District Education Officer's (DEO) records, hence the appropriate application of Tippet's Table of random numbers. The approximate sample size for the schools was 66.

Data were collected by means of a questionnaire and an observation schedule. To ensure reliability of the research instrument self-administration approach was applied in data collection and Cronbach's co-efficient Alpha was determined in order to measure internal consistency of the research instruments.

Data analysis was done following the four phases normally used in many research projects, namely, data clean up, data reduction, data differentiation and explanation. Factor analysis was done to identify the most important infrastructure factors in influencing readiness to adopt e-learning by computing factor loadings for each factor. These are the factors that were used in further analysis of the variables. In this study, parametric tests were used since they are more powerful due to their ability to reduce chances of committing type II error, less likely to not reject a null hypothesis which should be rejected. The main approaches used were the Analysis of Variance ANOVA, Pearson's coefficient of correlation and Regression analysis

Operationalization of the dependent and independent variables

Operational definition of the dependent and independent variables is provided here. In this study the dependent variable is readiness to adopt e-learning, while the independent variable is ICT infrastructure whose key indicators include connectivity, sources of power and equipment as indicated in Table 2

Table 2. Summary of Variables and Indicators

VARIABLE	INDICATORS
INDEPENDENT VARIABLES	
Connectivity	• Internet connectivity • mobile network coverage • Intranet connectivity
Sources of power/energy	• Electricity • Standby generators • Uninterruptible Power Supply (UPS)
Equipment	• Computers (hardware) • Radios • Televisions • Mobile phones • LCD projectors • Software • Computer laboratories • Furniture • Equipment stores • Flash disks • CD-ROMs • Diskettes • CDS
DEPENDENT VARIABLE	
Readiness to adopt e-learning	• Reliable sources of energy/power. • Variety of network connections • Sufficient internet connectivity • Sufficient electronic learning equipment • Storage devices such as flash disks, CD- ROMS

	• Relevant skills in handling e-learning • Access to e-learning facilities in school • Readiness to devote extra time for e-learning

Findings and Discussion

The study set out to establish the significance of infrastructure in influencing readiness to adopt e-learning in curriculum implementation. ICT infrastructure was studied under three variables, namely; connectivity, source of power/energy and equipment, from which three hypotheses were formulated to guide the study. Readiness was measured using two key indicators, namely; availability of sufficient electronic-learning equipment and availability of relevant skills in handling e-learning.

Secondary Schools' Readiness to Adopt E-learning

The variable of 'readiness' to adopt e-learning (the dependent variable for this study) was measured by two key factors which were selected using factor analysis from a list of twelve factors. The selected factors included: availability of sufficient electronic e-learning equipment and availability of relevant skills in handling e-learning. The two categories of respondents (Principals and Teachers) were required to respond to the two items used to measure schools' readiness to adopt e-learning. The respondents were requested to indicate a 5 point Likert's scale, ranging from very ready (5), ready (4), undecided (3), moderately ready (2) and not ready at all (1), the extent to which their schools were ready to adopt e-learning. The findings are summarized in Tables 4 and 5.

Readiness to Adopt E-learning Subject to Availability of Sufficient E-learning Equipment

Schools' readiness to adopt e-learning was studied through the Principals' and Teachers' assessment (in a Likert scale) of the extent to which their schools were ready to adopt e-learning based on the availability of sufficient electronic learning equipment. The findings of the schools' readiness to

adopt e-learning subject to availability of sufficient e-learning equipment are summarized in Table 4

Table 4 Schools' Readiness to Adopt E-learning Subject to Availability of Sufficient Electronic Learning Equipment

Level of readiness	**Principals n = 51 %**	**Teachers n = 56 %**
Very ready	17.6	7.1
Ready	15.7	10.7
Undecided	2.0	3.6
Moderately ready	9.8	21.4
Not ready at all	54.9	57.1
Total	**100**	**100**

The information in Table 4 indicates that over half (54.9%) of the principals viewed their schools as absolutely unprepared to adopt e-learning with regard to the availability of the necessary e-learning equipment, while 2.0 percent were undecided on the extent to which their schools were ready with e-learning equipment. Only 33.3 percent felt that their schools were adequately prepared to adopt e-learning while the remaining 9.8 percent reported moderate readiness.

Teachers reported similar information to what had been reported by Principals. For example, 57.1 percent of teachers felt that their schools did not have enough electronic equipment necessary for the adoption of e-learning while 3.6 percent were undecided on the status of the e-equipment in their schools and only 17.9 percent indicated that their schools were ready to adopt e-learning while 21.4 percent were moderately prepared.

It was clear from the results obtained from respondents, that the schools were at the initial stage in readiness to adopt e-learning, hence a lot of preparation needed to be done to improve on readiness. Some respondents disclosed the fact that their schools were unable to purchase the e-learning

equipment on their own, unless, the government intervened. Other respondents envisaged e-learning as a secondary need, clarifying that they had to first address the more basic needs of their schools before thinking of the acquisition of e-learning equipment.

Readiness to Adopt E-learning Based on the Availability of Relevant Skills in Handling E-learning

Schools' readiness to adopt e-learning was studied through a Principals', Teachers' and Students' assessment (in a Likert scale) of the extent to which their schools were ready to adopt e-learning based on availability of relevant skills for handling e-learning. The findings of schools' readiness to adopt e-learning subject to availability of relevant skills are summarized in Table 5.

Table 5 : Schools' Readiness to Adopt E-learning Subject to Availability of Relevant Skills in Handling E-learning

Level of readiness	Principals n= 51 %	Teachers n= 56 %
Very ready	9.8	7.1
Ready	3.9	19.6
Undecided	5.9	10.7
Moderately ready	37.3	35.7
Not ready	43.1	26.8
Total	**100**	**100**

The results indicated in Table 5 on the schools' readiness to adopt e-learning subject to availability of relevant skills reveal that there was lack of adequate skills for handling e-learning. For example 43.1 percent of principals and 26.8 percent of teachers reported total lack of skills, while 37.8 percent of principals and 35.7 percent of teachers indicated moderate availability of skills and only 13.7 percent of the principals and 26.8 percent of teachers reported that their schools had the necessary skills for adoption of e-learning. Further, 19.6 percent of principals and 10.7 percent of teachers'

could not establish whether their schools had the relevant skills for handling e-learning or not.

The general observation on the availability of relevant skills for handling e-learning was that, there was a lack of adequate skills in handling e-learning in most Secondary schools in Kitui district, as reported by 51 percent of Principals and 62.4 percent of teachers. This means that there is need for training teachers and students in ICT, before the adoption of e-learning, in order to provide and improve the skills in e-learning.

Principals' Evaluation of the Schools' Readiness to adopt e-learning based on e-Infrastructure

The principals were requested to indicate the extent to which their schools were ready to adopt e-learning in relation to availability of various facilities essential for e-learning which were listed in the questionnaire. They were required to indicate in a 5 point Likert scale within the range described below.

Very great extent	=	5
Great extent	=	4
Minimal extent	=	3
Very minimal extent	=	2
No extent at all	=	1

The results are summarized in Table 3.

Table 3: Principals' Opinion on the Extent to which their Schools' were ready with e-infrastructure

Facilities	Very great extent	Great extent	No extent at all	Minimal extent	Very minimal extent
CONNECTIVITY	**Percentage (%)**				
Internet connectivity	15.7	33.3	27.5	7.8	15.7
Mobile network coverage	41.2	15.7	21.6	15.7	5.9
Intranet connectivity	25.5	23.5	41.2	2.0	7.8
EQUIPMENT					
Computers	21.6	35.3	19.6	13.7	9.8
Mobile telephones	39.2	11.8	15.7	29.4	3.9
LCD Projectors	7.8	27.5	51.0	3.9	9.8
SOURCES OF POWER/ENERGY					
Electricity supply	60.8	19.6	9.8	7.8	2.0
Uninterruptible Power Supply (UPS)	23.5	25.5	39.2	7.8	3.9
Standby generators	27.5	23.5	31.4	7.8	9.8

The findings shown in Table 3 indicate that over half of the schools enjoyed reliable mobile network coverage as reported by 56.9% of the principals, though some 21.6% complained of total lack of network coverage in their schools while another 21.6% suffered unreliable network coverage. This shows that, though mobile network coverage was spread over many areas in the district, some areas were still either not covered or the network was not reliable. According to the findings, the schools were found to be at varied levels of readiness in relation to internet connectivity. Schools that had very great access to internet constituted 15.7% while those with great access were 33.3%. Twenty seven percent (27%) of the schools had no access to Internet at all, while the extent of access to Internet of the remaining 7.8% and 15.7% of the schools had minimal to very minimal extent of access to internet probably, because they could only access the internet from the cyber cafes in Kitui town. With regard to intranet connectivity, only 49% of the schools were reportedly ready with this facility, while 10% had minimal to very minimal Intranet connectivity. The remaining 41% had no intranet connectivity at all.

Most Principals felt that their schools were ready with electricity supply. For example 60.8% were ready to a very great extent while 19.6%were ready to great extent. Those whose schools were ready to minimal and very minimal extent constituted a combined percentage of 9.8% while those not ready at all were 9.8%. Electricity seemed to have spread out to many schools thanks to government policy of Rural Electrification. The study reveals that almost half of the schools had either Uninterruptible Power Supply (UPS) or standby generators. Some 49% had UPS and 51% had standby generators while 51% and 49% respectively do not have. This indicates that such sources of power/energy were not as widespread as electricity. The availability of electricity could have been made through the implementation of rural electrification programme.

LCD Projectors were rare equipment in many of the schools. For example 51% of the schools were not ready with LCD projectors, 3.9% and 9.8% were ready to a minimal and very minimal extent respectively. However, 27.5% were ready to a great extent and only 7.8% of the schools was ready to very great extent. This could be due to the high cost and skill requirement for the equipment. With regard to availability of computers in schools, 21.6% were ready to adopt e-learning to a very great extent while 35.3% ready to a great extent as they had enough computers. However, 13.7% were ready to a minimal extent while 9.8% were ready to a very minimal extent and only 19.6 were not ready at all. This is an indication that with some government subsidy on computers, the schools could easily attain the required level of readiness to adopt e-learning. Furthermore, the findings indicate that a combined percentage of 51% of the principals felt that their schools had enough mobile phones which could facilitate e-learning, while 33.3% felt that their schools did not have adequate mobile phones to support adoption of e-leaning while 15.7% were not ready at all. This implies that a lot of investment needed to be committed to equipping the schools with e-facilities so as to improve on the school's readiness to adopt e-learning as they were found to be very poorly equipped. The findings of the study were scientifically validated through testing of the following three hypotheses.

The Analysis of Data Collected through Observation

To further corroborate and complement the information provided by Principals concerning the availability of e-learning infrastructure in secondary schools in Kitui District, some infrastructure indicators were directly observed in the schools. This was particularly important in examining the actual existence and/or accessibility of those facilities and services in the schools or within the reach of the schools in order to get a greater insight into the situation and thus increase reliability. Using an observation schedule previously developed, observation was done in 48 schools out of the 51 schools that were involved in this study. A summary of the findings is provided in Table 4.6.

Table 4.6. Availability of Infrastructure for E-learning in Secondary Schools as Observed by the Researcher

Facilities condition	**Present** **%**	**Absent** **%**	**Total** **%**
Electricity supply	60.4	39.6	100
Computer services	43.7	56.3	100
Postal services	43.7	12.5	100
Mobile telephone network coverage	100	-	100
Reliable means of transport	64.6	35.4	100
Telephone services	31.3	68.7	100
Internet connectivity	37.5	62.5	100
ICT Resource Centre	22.9	77.1	100

The findings, indicated in Table 4.6 revealed that, there was a close similarity between what Principals reported and what was observed on the ground in the schools in relation to the availability of specific infrastructure for e-learning. For example, the presence of electricity supply was reported in 60.8 percent while the same was observed in 60.4 percent of the schools. On the other hand, computer services were observed to be unavailable in

56.3 percent of the 48 schools observed, while the report from principals indicated lack of adequate computer services in 56.9 percent of the 51 schools studied. This close similarity between what Principals reported concerning the availability of specific infrastructure for e-learning, and what was observed, adds to the reliability of the research instrument. Some of the facilities however, were only studied through observation.

Through observation it was established that postal services were available in majority (87.5%) of the schools but telephone services were not readily available in the schools. This could be explained by the fact that many schools used personal mobile telephones, either belonging to the Principal, deputy- Principal or Principal's secretary. The reliability of such telephone services therefore, depended on the co-operation of the owner of the phone. Mobile phones are meant for personal and not for public use. Therefore, they could not be used for learning purposes.

Similarly, internet connectivity was lacking in many schools (62.5%) while only 22.9 percent of the schools had access to an ICT Resource Centre. Although a considerable percentage (64.6%) of the schools was found to have some 'reliable' means of transport, most of it was by motor bikes (Boda boda) which were used by teachers to travel to and from their respective schools. This means of transport are very expensive and inappropriate for students as per the Ministry of Education regulations. Hence many schools could not transport their students to a resource centre, which was a major limitation to the readiness to adopt e-learning in secondary schools in Kitui District. The statistical significance of the influence of ICT infrastructure on readiness to adopt e-learning was based on three hypotheses related to objective one. These hypotheses were tested using the Pearson's Correlation Coefficient Technique.

Hypothesis H_{01} Information and Communication Technology (ICT) Connectivity does not have Significant Influence on Readiness to Adopt E-learning in Secondary Schools

The testing of this hypothesis involved an assessment of the extent of availability of Information and Communication Technology (ICT)

connectivity in secondary schools in Kitui District, as reported by principals and teachers. The ICT connectivity was measured by three indicators, as described in the operationalization of variables in Chapter Three. The indicators for ICT connectivity included: internet connectivity, intranet connectivity, and mobile network coverage/connectivity. ICT connectivity was correlated with the composite scores on the readiness to adopt e-learning, (the dependent variable of the study) which was measured by two key indicators. These were selected through factor analysis, from the number of indicators studied, as indicated in the Appendix VI under the title, "Summary of factor analysis". The key indicators of readiness included: availability of sufficient electronic learning equipment, and the availability of relevant skills in handling e-learning. The summary of the findings is indicated in Table 4.7.

Table 4.7. Relationship between Information and Communication Technology (ICT) Connectivity and Readiness to Adopt E-learning

		Schools' readiness to adopt e-learning subject to availability of sufficient electronic learning equipment	**Schools' readiness to adopt e-learning subject to availability of relevant skills in handling e-learning**
Internet connectivity	Pearson Correlation	.330(*)	.313(*)
	Sig. (2-tailed)	.018	.025
	N	51	51
Intranet connectivity	Pearson Correlation	.233	.254
	Sig. (2-tailed)	.100	.072
	N	51	51
Mobile network coverage	Pearson Correlation	.245	.256
	Sig. (2-tailed)	.083	.070
	N	51	51

•Correlation is significant at the 0.05 level (2-tailed).

From the results provided in Table 4.7, it was established that internet connectivity has a significantly positive correlation with electronic learning equipment with **r** = 0.330 and the relevant skills in handling e-learning with **r** = 0.313 both of which are indicators of readiness to adopt e-learning. The correlation was significant at **P** = 0.05. There was also a positive correlation between intranet connectivity and electronic learning equipment with **r** = 0.233 and relevant skills with **r** = 0.254. However, both correlations were not significant. Similarly, a positive correlation was noted between mobile telephone network coverage and the two indicators of e-readiness with a correlation coefficient of **r** = 0.245 and **r** = 0.256 for e-equipment and relevant skills respectively. However, the correlation was not significant in both cases.

Based on the findings in Table 4.7, it could be concluded that ICT connectivity has positive influence on the readiness to adopt e-learning. It is therefore implied that, a school's readiness to adopt e-learning could be determined by the availability of ICT connectivity at the school. The results indicated that connectivity to internet is the most important connectivity factor in determining a school's readiness to adopt e-learning. To further investigate the strength of ICT connectivity on predicting readiness to adopt e-learning in secondary schools, regression analysis was conducted on the indicators of ICT connectivity, and those of readiness to adopt e-learning. As a result, regression prediction models were developed for each variable, found to be correlated to readiness to adopt e-learning. In the description of the regression prediction models, 'Re' is used to denote readiness to adopt e-learning when measured by the availability of sufficient electronic equipment, while 'Rs' is used to denote readiness to adopt e-learning subject to availability of relevant skills in handling e-learning. The results on the regression analysis are indicated in Tables 8 and 9.

Table 8 Regression Prediction Model for Connectivity and Readiness to Adopt E-learning Subject to Availability of Relevant Skills in Handling E-learning

Model summary	**R**	**R^2**	**Adjusted R^2**	**Std. Error of the Estimate**	**Change Statistics**				
					R Square Change	**F Change**	**df**	**df^2**	**Sig. F Change**
	.344 (a)	.118	.062	1.20961	.118	2.103	3	47	.113

Model ANOVA		**Sum of Squares**	**Df Square**	**Mean**	**F**	**Sig.**
	Regression	9.231	3	3.077	2.103	.113(a)
	Residual	68.769	47	1.463		
	Total	78.000	50			

Model Coefficients		**Unstandardized Coefficients**		**Standardized Coefficients**	**T**	**Sig.**	**95% Confidence Interval for B**	
		B	Std. Error	Beta			Lower Bound	Upper Bound
	(Constant)	2.937	.463		6.348	.000	2.006	3.868
	internet connectivity	.198	.170	.202	1.163	.251	-.144	.540
	Mobile network coverage	.109	.152	.115	.718	.477	-.197	.416
	intranet connectivity	.111	.181	.101	.612	.543	-.253	.474

The results indicated in Table 8 revealed that all the three ICT connectivity indicators (internet connectivity, mobile network coverage and intranet connectivity), have a positive influence on the readiness to adopt e-learning when measured by the availability of relevant skills in handling e-learning. Based on the results obtained, the following equation for estimating the availability of relevant skills for handling e-learning on the basis of ICT connectivity was developed:

$$\mathbf{Rs_1 = 2.937 + 0.202\,X_1 + 0.115X_2 + 0.101X_3}$$

Where,

Rs = composite index for e-readiness in terms of relevant skills in handling e-learning.
$\mathbf{X}_1$ = composite index for internet connectivity
$\mathbf{X}_2$ = composite index for mobile network coverage
$\mathbf{X}_3$ = composite index for intranet connectivity

This model has a multiple regression coefficient of **r** = 0.344 and an F value of 2.103 whose critical level is 0.113. This indicated that it is a weak model for predicting a school's readiness to adopt e-learning. However, the value of $\mathbf{r}^2$ is 0.118, which means that ICT connectivity would account for only about 11.8 percent of readiness to adopt e-learning, based on relevant skills in handling e-learning. Hence, the model is moderately weak in estimating the readiness to adopt e-learning subject to availability of relevant skills in handling e-learning. However, it is established here that, out of the total contribution made by ICT connectivity, internet is the most important connectivity factor. It contributed a beta value of 0.202 as compared to 0.115 and 0.101, for mobile network coverage, and intranet connectivity, respectively.

Table 9. Regression Model for Connectivity and Readiness to Adopt E-learning Subject to Availability of Adequate Electronic Learning Equipment

Model Summary	**R**	**R^2**	**Adjusted R^2**		**Std. Error of the Estimate**	
	.347(a)	.120	.064		1.60110	
Model ANOVA		**Sum of Squares**	**Df**	**Mean Square**	**F**	**Sig.**
	Regression	16.495	3	5.498	2.145	.107(a)
	Residual	120.485	47	2.564		
	Total	136.980	50			

Model Coefficients	Unstandardized Coefficients		Standardized Coefficients	T	Sig.
	B	Std. Error	Beta		
(Constant)	2.301	.612		3.757	.000
internet connectivity	.322	.225	.249	1.431	.159
mobile network coverage	.122	.202	.097	.604	.549
intranet connectivity	.091	.239	.062	.380	.705

The results in Table 9 indicate that the three ICT connectivity indicators (internet connectivity, mobile network coverage and intranet connectivity) have a positive influence on the readiness to adopt e-learning, based on the availability of sufficient electronic learning equipment. Based on the results obtained, the following regression equation for estimating readiness to adopt e-learning in terms of the availability of sufficient electronic learning equipment, based on ICT connectivity is derived:

$$\mathbf{Re_1 = 2.301 + 0.249X_1 + 0.097X_2 + 0.062X_3}$$

Where,

$\mathbf{Re_1}$ = composite index for e-readiness in terms of sufficient electronic learning equipment

X_1 = composite index for internet connectivity

X_2 = composite index for mobile network coverage

X_3 = composite index for intranet connectivity.

This regression model has an F value of 2.145, whose critical value is 0.107. If the model is used to estimate the level of a school's readiness to adopt e-learning in terms of the availability of sufficient electronic learning equipment for a given level of internet connectivity, mobile network coverage and intranet connectivity, then the independent variables would only account for 12 percent of the dependent variable. The implication here is that the model is a weak estimator of a school's readiness to adopt e-learning. However, the model indicates a greater beta value for internet connectivity (0.249) compared to the beta values for mobile network

coverage (0.097) and intranet connectivity (0.062). This implies that, out of the three indicators of ICT connectivity, connectivity to internet can predict a school's readiness to adopt e-learning with more accuracy than the other two connectivity indicators.

Hypothesis H_{02} Sources of Energy do not have Significant Influence on Readiness to Adopt E-learning in Secondary Schools.

This hypothesis sought to establish the influence of sources of energy/ power on the readiness to adopt e-learning. This fact was established by computing the correlation coefficient between key energy indicators including: electricity supply, Uninterruptible Power Supply (UPS) and standby generators on one hand, and the key indicators of readiness to adopt e-learning, on the other. The results of the correlation between sources of power/energy and readiness to adopt e-learning are given in Table 10.

Table 10. Correlation between Sources of Energy/Power and Readiness to Adopt E-learning

Schools' readiness to adopt e-learning based on		**Electricity supply**	**Uninterruptible power supply (UPS)**	**Standby generator**
Availability of relevant skills in handling e-learning	Pearson Correlation	.316(*)	.256	.255
	Sig. (2-tailed)	.024	.070	.071
	N	51	51	51
Availability of sufficient electronic learning equipment	Pearson Correlation	.378(*)	.374(*)	.364(*)
	Sig. (2-tailed)	.006	.007	.009
	N	51	51	51

*** Correlation is significant at the 0.05 level (2-tailed).**

The results in Table 10 indicate that there is a significant positive correlation (**r** =0.316) between electricity supply as an indicator of sources of energy and the availability of relevant skills in handling e-learning, as an aspect

of readiness to adopt e-learning. The correlation is significant at **P**=0.05. The findings also indicate a positive correlation (**r** = 0.256) between Uninterruptible Power Supply (UPS) and the availability of relevant skills in handling e-learning, and, between standby generators and the availability of relevant skills to handle e-learning with a correlation coefficient of **r** = 0.256 and **r** = 0.255 respectively. However, the correlation is not significant at **P** = 0.05.

The results indicate that, all the three indicators of sources of power have a significant and positive influence on the readiness to adopt e-learning based on the availability of sufficient electronic learning equipment. The influence was, in each case, significant at **P** = 0.05. The correlation between electricity supply and e-learning equipment was **r** = 0.378 while, the correlation between UPS and the availability of e-learning equipment was **r** = 0.374. The correlation between standby generators and the availability of e-learning equipment was **r** = 0.364. The results therefore, reveal the fact, that the extent to which a school is equipped with electronic learning facilities could, to a significant extent, determine the availability of reliable sources of energy such as; electricity, UPS and standby generators in the school. The reason is that, the electronic equipment cannot be operated without power/energy; hence reliable sources of power/energy are a mandatory pre-requisite to the acquisition of the effective use of electronic learning equipment in schools.

It is therefore clear that, there is a significant relationship between sources of power and the readiness to adopt e-learning. Hence, we reject the null hypothesis which states that sources of power have no significant influence on the readiness to adopt e-learning. Further investigations on the strength of the influence of sources of energy on the readiness to adopt e-learning was done through regression analysis and the results are presented in Tables 11 and 12.

Table 11. Regression Model for Sources of Energy/Power and Readiness to Adopt E-learning Subject to Availability of Relevant Skills in Handling E- learning

Model Summary	**R**		**R^2**		**Adjusted R^2**	**Std. Error of the Estimate**
	.369(a)		.136		.081	1.19745
Model ANOVA		**Sum of Squares**	**Df**	**Mean Square**	**F**	**Sig.**
	Regression	10.607	3	3.536	2.466	.074(a)
	Residual	67.393	47	1.434		
	Total	78.000	50			
Model Coefficients		**Unstandardized Coefficients**		**Standardized Coefficients**	**T**	**Sig.**
		B	**Std. Error**	**Beta**		
	(Constant)	2.924	.462		6.331	.000
	Electricity supply	.295	.175	.251	1.683	.099
	Standby Generators	.157	.163	.158	.968	.338
	Uninterruptible Power Supply (UPS)	.075	.205	.064	.366	.716

The results in Table 11 indicate that, the three indicators of sources of energy/power: electricity, standby generators, and uninterruptible power supply, have a positive effect on readiness to adopt e-learning, when measured by the availability of relevant skills in handling e-learning. Based on the field data results, the following regression equation for estimating the readiness to adopt e-learning in terms of availability of relevant skills in handling e-learning based on sources of energy/power is derived:

$$\mathbf{R_{S2} = 2.924 + 0.251X_1 + 0.158X_2 + 0.064X_3}$$

Where,

$\mathbf{R_{S2}}$ = composite index for e-readiness in terms of relevant skills in handling e-learning.

$\mathbf{X_1}$ = composite index for electricity supply

$\mathbf{X_2}$ = composite index for standby generators

$\mathbf{X_3}$ = composite index for Uninterruptible Power Supply (UPS)

This model has a multiple regression of 0.369 and an F value of 2.466, whose critical level is 0.074. The model has an **r** value of 0.369, and $\mathbf{r^2}$ of 0.136, implying that 13.6 percent of change in school's readiness to adopt e-learning in terms availability of relevant skills in handling e-learning could be accounted for by the availability and reliable sources of power/energy.

Table 12. Regression model for Sources of Energy/Power and Readiness to Adopt E-learning Subject to Availability of Adequate Electronic Learning Equipment

Model Summary	**R**		**R^2**		**Adjusted R^2**	**Std. Error of the Estimate**
	.483(a)		.234		.185	1.49463
Model ANOVA		**Sum of Squares**	**Df**	**Mean Square**	**F**	**Sig.**
	Regression	31.986	3	10.662	4.773	.006(a)
	Residual	104.994	47	2.234		
	Total	136.980	50			
Model Coefficients		**Unstandardized Coefficients**		**Standardized Coefficients**	**T**	**Sig.**
		B	**Std. Error**	**Beta**		
	(Constant)	1.724	.576		2.991	.004
	Electricity supply	.413	.218	.266	1.893	.065
	Standby generators	.291	.203	.221	1.436	.158
	Uninterruptible Power Supply (UPS)	.219	.255	.140	.856	.396

From the results in Table 12, it is realized that, the three indicators of sources of energy/power: electricity, standby generators and uninterruptible power supply, have a positive effect on the readiness to adopt e-learning, when measured by the availability of sufficient electronic learning equipment. On the basis of the results obtained, the following regression equation for estimating the readiness to adopt e-learning in terms of availability of sufficient electronic learning equipment, based on sources of energy/power, is formulated:

$$\mathbf{R_{e2} = 1.724 + 0.266X_1 + 0.221X_2 + 0.140X_3}$$

Where,

$\mathbf{R}_{e2}$ = composite index of e-readiness in terms of sufficient electronic learning equipment
$\mathbf{X}_1$ = composite index for electricity supply
$\mathbf{X}_2$ = composite index for standby generators
$\mathbf{X}_3$ = composite index for uninterruptible power supply (UPS)

This model has an **r** value of 0.483 and an **F** value of 4.773, whose critical level is 0.006. Thus, a school's readiness (in terms of sufficient electronic learning equipment) to adopt e-learning could be estimated well on the basis of the extent to which the school has reliable sources of power. The model has an $\mathbf{r}^2$ value of 0.234, implying that 23.4 percent of change in a school's readiness to adopt e-learning could be accounted for by the availability of reliable source of power/energy. Based on the results indicated in Tables 4.23 and 4.24, respectively, we reject the null hypothesis which states that sources of energy/power have no significant influence on the readiness to adopt e-learning.

Hypothesis H_{03} Availability of ICT Equipment has no Significant Influence on the Readiness to Adopt E-learning in Secondary Schools in Kitui District.

This hypothesis sought to establish whether a school's readiness to adopt e-learning is significantly influenced by the availability of Information and Communication Technology (ICT) equipment. This was computed by applying the correlation coefficient between the key indicators of ICT equipment which included: LCD projectors, mobile telephones and computers, and the readiness to adopt e-learning as indicated by the availability of sufficient electronic learning equipment, and the availability of relevant skills, in handling e-learning. The summary of findings is summarized in Table 13.

Table 13. Correlation between Availability of ICT Equipment and Readiness to Adopt E-learning

Schools' readiness to adopt e-learning based on;		**LCD projectors availability**	**Mobile telephone availability**	**Computers availability**
Availability of sufficient electronic learning equipment	Pearson Correlation	.385(*)	.347(*)	.287(*)
	Sig. (2-tailed)	.005	.013	.041
	N	51	51	51
Availability of relevant skills in handling e-learning	Pearson Correlation	.256	.303(*)	.243
	Sig. (2-tailed)	.070	.031	.086
	N	51	51	51

** Correlation is significant at the 0.05 level (2-tailed).*

As indicated by the results in Table 13, there was a significant positive correlation of **r = 0.385,** between the availability of LCD projectors in schools, as an indicator of ICT equipment, and the availability of sufficient electronic learning equipment, as an indicator of readiness to adopt e-learning. The correlation was significant at **P = 0.05**. There was also a significant positive correlation of **r = 0.347**, between the availability of mobile phones in schools, as an indicator of ICT equipment, and the availability of sufficient electronic learning equipment, an indicator of readiness to adopt e-learning. The correlation was significant at 0.05. Similarly, there was significant positive correlation **r = 0.287**, between the existence of computers in schools and the availability of relevant skills in handling e-learning, an indicator of the readiness to adopt e-learning.

It was further established that, there was a positive correlation with **r = 0.256**, between the availability of LCD projectors in schools, and the availability of relevant skills, in handling e-learning, as an indicator of the readiness

to adopt e-learning. However, the correlation was not significant at **P = 0.05** levels. Further findings indicated the existence of a significant positive correlation of **r = 0.303**, between the extent to which mobile phones existed in the schools, and the availability of relevant skills in handling e-learning. The correlation was significant at **P = 0.05**. Finally, the results indicated a positive correlation of **r =0.243**, between the existence of computers in schools and the availability of relevant skills in handling e-learning. However, the correlation was not significant. Based on the findings described above, it could be concluded that there exists a significant relationship between the extent to which schools are equipped with ICT equipment and the readiness to adopt e-learning. Hence, the null hypothesis is rejected at **P = 0.05**. This means that e-learning equipment is a crucial requirement for the readiness to adopt e-learning in curriculum delivery. For the schools to be able to utilize this modern technology of e-learning, they must acquire the necessary ICT equipment such as computers, LCD projectors and mobile phones. Mobile phones are particularly useful today, because they enable learners to access internet services.

A further analysis on the relation between ICT equipment and the readiness to adopt e-learning, was done through the regression technique. This was necessary, in order to determine the extent to which a schools' readiness to adopt e-learning could be estimated, on the basis of the availability of ICT equipment. The results of the regression analysis have been provided in Tables 14 and 15 respectively.

Table 14. Regression Model for ICT Equipment and Readiness to Adopt E-learning Subject to the Availability of Relevant Skills in Handling E-learning

Model	**R**	**R^2**		**Adjusted R^2**	**Std. Error of the Estimate**			
	.367(a)	.135		.080	1.19823			
Model ANOVA		**Sum of Squares**	**Df**	**Mean Square**	**F**	**Sig.**		
	Regression	10.520	3	3.507	2.442	.076(a)		
	Residual	67.480	47	1.436				
	Total	78.000	50					
Model Coefficients		**Unstandardized Coefficients**		**Standardized Coefficients**	**T**	**Sig.**	**95% Confidence Interval for B**	
		B	**Std. Error**	**Beta**			**Lower Bound**	**Upper Bound**
	(Constant)	2.672	.557		4.800	.000	1.552	3.792
	Mobile telephone	.239	.129	.263	1.851	.070	-.021	.498
	Computers	.023	.208	.023	.110	.913	-.395	.440
	LCD projectors	.243	.253	.194	.960	.342	-.266	.752

From the results in Table 14, it is evident that, the three indicators of ICT equipment: mobile telephone, computers and LCD projectors have a positive effect on the readiness to adopt e-learning, when measured by the availability of skills in handling e-learning. On the basis of the results obtained, the following regression equation, for estimating the readiness to adopt e-learning in terms of availability of skills in handling e-learning based on ICT equipment is derived:

$$\mathbf{R_{s3} = 2.672 + 0.263X_1 + 0.023X_2 + 0.194X_3}$$

Where,

$\mathbf{R_{S3}}$ = composite index for e-readiness in terms of skills in handling e-learning

$\mathbf{X_1}$ = composite index for mobile telephone

$\mathbf{X_2}$ = composite index for computers

$\mathbf{X_3}$ = composite index for LCD projectors

This model has an **r** value of 0.367 and an **F** value of 2.442, whose critical level is P = 0.076. The model has an $\mathbf{r^2}$ value of 0.135, implying that 13.5 percent of change in a school's readiness, with relevant skills in handling e-learning, could be accounted for by, the availability of ICT equipment. Thus, the extent to which the ICT equipment are available in a school is not a good predictor of the school's readiness to adopt e-learning in terms of availability of skills in handling e-learning.

Table 15. Regression Model for ICT Equipment and Readiness to Adopt E-learning Subject to Availability of Sufficient Electronic Learning Equipment

Model Summary	**R**	**R^2**	**Adjusted R Square**		**Std. Error of the Estimate**		
	.556(a)	.310	.265		1.21918		
Model ANOVA		**Sum of Squares**	**Df**	**Mean Square**	**F**	**Sig**	
	Regression	31.315	3	10.438	7.023	.001(a)	
	Residual	69.861	47	1.486			
	Total	101.176	50				
Model Coefficients			**Unstandardized Coefficients**		**Standardized Coefficients**	**T**	**Sig.**
			B	**Std. Error**	**Beta**		
	(Constant)		.915	.566		1.615	.113
	To which extent in your opinion is your school ready with having LCD projectors		.495	.257	.348	1.925	.060
	To which extent in opinion is your school ready with having mobile telephone		.163	.131	.157	1.240	.221
	To which extent in your opinion is your school ready with having computers		.208	.211	.183	.985	.330

From the results summarized in Table 15, it is evident that, the three indicators of ICT equipment: mobile telephone, computers and LCD projectors have a positive effect on readiness to adopt e-learning, when measured by the

availability of sufficient electronic learning equipment. On the basis of the results obtained, the following regression equation for estimating the readiness to adopt e-learning, in terms of availability of sufficient electronic learning equipment, based on ICT equipment, is derived:

$$\mathbf{R}_{e3} = 0.915 + 0.157X_1 + 0.183X_2 + 0.308X_3$$

Where,

$\mathbf{R}_{e3}$ = composite index for e-readiness in terms of sufficient electronic learning equipment
$\mathbf{X}_1$ = composite index for mobile telephone
$\mathbf{X}_2$ = composite index for computers
$\mathbf{X}_3$ = composite index for LCD projectors

This model has an **r** value of 0.484 and an **F** value of **7.023**, whose critical level is **0.113**. The model has an $\mathbf{r}^2$ value of **0.310**, implying that 31 percent of change in a school's readiness with sufficient electronic learning equipment can be accounted for by the availability of ICT equipment.

Discussion of the study findings

The current study investigated the extent to which information communication technology infrastructure influences the readiness to adopt e-learning in secondary schools in Kitui District. In the study, three specific issues were studied based on three hypotheses. The first hypothesis stated that ICT connectivity has no significant influence on the readiness to adopt e-learning. The indicators for ICT connectivity includes; intranet connectivity, internet connectivity and mobile network coverage.

The study established that, the three ICT connectivity indicators had some influence, on the readiness to adopt e-learning in secondary schools. However, only internet connectivity had a significant influence on the readiness to adopt e-learning. The findings of this study are similar to a study by Lumumba (2007) which established that NEPAD e-schools were facing the challenge of unreliable internet connectivity in some schools due to inadequate preparation, before the commencement of the implementation of e-learning.

Notably, Lumumba (2007) only established that internet connectivity has an influence on the effective use of e-learning but did not show the extent of the influence. The current study went beyond this level and established that internet connectivity has a significant influence on the readiness to adopt e-learning, while Internet and Mobile telephone coverage have an insignificant influence on the readiness to adopt e-learning.

The current study also established the extent to which internet connectivity was available among secondary schools in Kitui District, an issue which Nyaki and Oyeyinka (2002) had failed to establish. It was established in this study that, many secondary schools in Kitui District lacked connectivity to the Internet.

The second hypothesis stated that sources of power have no significant influence on readiness to adopt e-learning in secondary schools. The indicator for sources of energy/power included electricity supply, uninterruptible power supply (UPS) and stand-by generators. The findings of this study revealed that sources of power/energy have a significant influence on the readiness to adopt e-learning in secondary schools. The findings confirm the study done by Shetty (2007) which was based on the NEPAD e-schools. However, the current study covered a bigger population of 51 secondary schools compared to the study by Shetty (2007), which involved fewer secondary schools that were involved in the NEPAD e-learning project. The current study also improves on the findings of Lumumba (2007) and Nyaki, et al (2002) by showing the magnitude of influence exerted by sources of power/energy on readiness to adopt e-learning and by establishing the extent to which reliable sources of power are available in secondary schools in Kitui District. This study established that 80.4 percent of schools in Kitui District were connected to electricity supply which was considered to be a reliable source of energy.

The third hypothesis under objective number one stated that ICT equipment does not have a significant influence on readiness to adopt e-learning in secondary schools. The ICT equipment variable was studied under indicators of computers, LCD projectors and mobile phones which were selected through factor analysis. The findings of this study indicated that ICT equipment has significant positive influence on readiness to adopt

e-learning. The study also revealed that ICT equipment was inadequate in almost half of the schools in Kitui District.

Although a number of studies had demonstrated that ICT equipment has a positive influence on the readiness to adopt e-learning, such studies did not show the magnitude of the influence of ICT equipment on readiness to adopt e-learning in secondary schools. None of the studies had indicated the extent to which ICT equipment was available in secondary schools in Kitui District. This study has addressed the extent to which ICT equipment influences readiness to adopt e-learning in secondary schools, and the level of availability of ICT equipment in secondary schools in Kitui District. Such studies include Lumumba (2007); Shetty (2007); Nyaki, et al (2002) and Keiyoro (2010). The findings of this study on the influence of ICT infrastructure on readiness to adopt e-learning in secondary schools, make an important contribution to the development of distance education and use of advanced technology in distance learning.

Conclusions of the Study

First, it was concluded that internet connectivity is very crucial in determining readiness to adopt e-learning. It should also be noted that intranet connectivity and mobile network coverage will enhance a school's readiness to adopt e-learning especially because internet services could be accessed via mobile phones, hence mobile telephone network connectivity could suffice for internet connectivity particularly in the remotely located schools. We therefore reject the null hypothesis which stated that there ICT connectivity has no significant influence on readiness to adopt e-learning in secondary schools and conclude that readiness to adopt e-learning in secondary school is significantly influenced by the level of ICT connectivity in the schools.

Second it was concluded that availability of e-learning equipment will be a sufficient measure of schools readiness to adopt e-learning only if reliable sources of energy are available. Hence we reject the hypothesis and conclude that sources of energy/power have significant influence on readiness to adopt e-learning.

Third, it could be concluded that ICT equipment are a crucial requirement for readiness to adopt e-learning in curriculum delivery. For the schools to be able to utilize this modern technology meaningfully, they must acquire the necessary ICT equipment, including computers, LCD projectors and mobile telephones among others. Hence the null hypothesis and conclusion that ICT equipment has significant influence on readiness to adopt e-learning in secondary schools. However, lack of adequate ICT equipment was reported in almost half of the schools in Kitui district, meaning that the schools were inadequately prepared to adopt e-learning hence an issue that the government needs to address before implementation of e-learning commences.

As it is evident from the study findings, infrastructure positively and significantly influenced readiness to adopt e-learning. This means that successful adoption of e-learning is determined to a large extent by the extent to which schools have acquired the necessary ICT infrastructure including adequate connectivity, reliable sources of energy and ICT equipment. However, most schools in Kitui District were found to lack adequate ICT infrastructure, hence not adequately ready to adopt e-learning.

Recommendations of the Study

Based on the discussions and findings of this study, the Researcher makes recommendations that could guide other readers, researchers, planners, policy makers and implementers of e-learning.

1. It was established that availability of Information and Communication Technology (ICT) infrastructure is important in determining the readiness to adopt e-learning in secondary schools. It was however realized that secondary schools in Kitui district were poorly equipped with such ICT infrastructure.

(a) It was therefore recommended that, policy makers and education planners should come up with practical strategies of providing the necessary e-learning infrastructure to schools based on the County and Central Government Plans.

(b) Rural schools which are usually marginalized and disadvantaged should be given priority in the allocation of government resources in order to promote equity and quality in education. This will guard against rural schools lagging behind in technology and enable such schools to enjoy the benefits associated with the use of e-learning in education.

(c) The task of equipping schools with e-learning equipment requires huge amounts of resources and therefore cannot be left entirely to the government. This study therefore recommends a combined effort by the Government, Parents, Private organizations, Non-Governmental Organizations and Foreign Governments who are interested in education and modern technology. Such a combined effort will enable Kenya to embrace the modern approaches to distance education in all levels of education as stipulated in vision 2030. Priority should be given to the provision of reliable power supply, through electricity, standby generators and Uninterruptible Power Supply (UPS)units; ICT equipment such as computers, mobile telephones and LCD projectors; and connection to internet services.

(d) Mobile telephones which are cheaper than other e-learning equipment, and could enable access to internet should be availed to schools. In fact, this study recommends that the government should relax its rule on "no phones in schools" and encourage the use of the phone for learning purposes as many students could afford to buy personal mobile phones. However, the use of mobile phones should be regulated so as check on their negative use for cheating in examinations. Since not all the mobile phones have the smart feature that enables access to internet, it is recommended in this study that the government should lower the duty levied on smart phones to be used for educational purposes and where applicable, on social networks.

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Higher Teacher Training Colleges and ICTs in Africa: Usage, Challenges and Impacts on Teacher Training.

by: Nkehsera Claire Massano Ndangle

Abstract

This study sought to investigate the use of ICTs in some higher teacher training colleges in Africa, the challenges faced by teacher trainers and the impacts that the use and challenges bring in the teaching learning process in these institutions. The objectives of the study was to identify teachers of the higher teacher training colleges knowledge of ICTs; find out their use of this ICT Knowledge; identify the challenges ICT usage posed for these teachers and identify the extent to which educators use of ICT impacts the quality of Teacher Training. Data was collected from the PanAfrican research agenda on the pedagogical integration of ICTs observatory, (www.observatoiretic.org). Qualitative data was interpreted on the basis of issues generated from the research objectives and related literature review on previous works in the same domain, while quantitative data was analyzed using a descriptive statistics. The results revealed that only the University of Education Winneba, Ghana has 100% that is, 322 teachers with at least 50 hours of professional training that includes ICT integration. The rest of the colleges follow with less than 50% of their teachers having had at least 50 hours of professional training that includes ICT integration; more than 50% of teachers have email addresses which tell us they are willing to use the knowledge acquired on the use of ICTs. Results also revealed that more than half of the teacher trainers in two out of four of the colleges chosen for this study use ICTs during training while less than 10% of teacher trainers in the other two schools do use ICTs during training. We therefore concluded that for better integration of ICTs in teacher training colleges in Africa, there is high need for the teacher trainers to receive at least 50 hours of professional training that includes ICT integration. The teachers need more than fifty hours pre-service training to be able to stand up to the challenges that come with the use of ICTs. This conclusion led us to recommend as follows: ICT integration should be included in the curriculum of higher teacher training colleges and frequent seminars and training workshops should be organized so that teacher trainers can improve on their knowledge as technology keeps changing.

Introduction

For the Millennium Development Goals (MDGs) for Africa to be achieved by 2015 (UN, 2004) it is essential to have motivated and well trained teachers. Without successful teacher training programmes it will be impossible to ensure that quality education is obtained. Given the very great importance of teacher training, it is surprising that less emphasis is placed on its enhancement by national governments, donors and civil society organisations alike. Teacher training is all too often neglected in the face of more immediately visible educational goals and objectives; it is much easier to build a gleaming new school in an urban community than it is successfully to train quality teachers committed and ready to work in poor, rural areas. The urgency of this issue has frequently been identified. In the EFA Global Monitoring Report for 2002, UNESCO (2002a) emphasised that some 3 million new teachers are required in Africa if the MDGs are to be achieved. Over and above this, there is a pressing need for teachers with a minimal level of training to have opportunities to upgrade their skills and qualifications. Unwin (2004) argues that distance education through the use of ICTs can help a great deal initial training and in-service training of teachers. This is even more important in the Higher Teacher Training Colleges (H.T.T.C) in Africa, as it is one of the determining factor of the quality of teachers we eventually find in the secondary and high schools.

Use of ICT requires different Pedagogic and Evaluation Skills

With the introduction of ICT, the teaching - learning process will change and new skills for the teacher and the learner should be developed. Thus:

- Methodology and content of teaching will change so that the learners will benefit most from the new technology.
- Learners will not be evaluated only according to their knowledge but mainly with respect to their ability to achieve goals with all the technological means available to them.

The situation reminds of writing open-book exams. More specifically:

- The teacher has to organize and arrange all the technological means available in the classroom, to spend time for planning well and scheduling his performance and for choosing carefully the educational material for which the options are dramatically increasing. More structure has to be developed and new ways of interaction/dialogue have to be devised. The teacher will have to act more like a manager/director and not simply as an actor in the simple teaching model.
- From an information point of view, the pupils through ICT applications have certainly more information available to them than what they need. Hence they have to develop the skills to choose. For example, in the past, reading in depth was an important skill for a scientist. Now speed-reading is of great importance too, as students have more than enough material at their disposal, if they are apt in the use of ICTs.

Objectives of the Study

- Identify Teachers of Higher Teacher Training Colleges knowledge of ICTs
- Find out their use of ICT Knowledge
- Identify the challenges ICT usage posed for teachers of Higher Teacher Training Colleges
- Identify the extent to which educators use of ICT impacts the quality of Teacher Training

Theoretical framework

Giving out knowledge is not just pouring and pouring out what the teacher knows to the learner but the teacher making sure that he gives knowledge that can motivate the learner to use what he/she has learnt in the search for more (Karsenti, 2004). The teacher should be able to stimulate the learning process as Bruner's theory puts it.

Constructivist Theory (Bruner, 1966)

Bruner's constructivist theory places emphasis on the development of self learning (student centered). According to Bruner, the instructor should try and encourage students to construct hypotheses, make decisions, and discover principles by themselves (Kearsley 1994). The instructor's task is to "translate information to be learned into a format appropriate to the learner's current state of understanding" and organize it in a spiral manner "so that the student continually builds upon what they have already learned." As far as teaching is concerned, the teacher should try and encourage students to discover principles by themselves. The teacher and student should engage in an active dialog (i.e., socratic learning).

Bruner (1966) states that a theory of teaching should address four major aspects: (1) predisposition towards learning, (2) the ways in which a body of knowledge can be structured so that it can be most readily grasped by the learner, (3) the most effective sequences in which to present material, and (4) the nature and pacing of rewards and punishments. Good methods for structuring knowledge should result in simplifying, generating new propositions, and increasing the manipulation of information. The teaching process today can be made much easier if the teacher is versed with the importance and use of Information and Communication Technologies. When the teacher uses ICTs pedagogically, the class is much more motivated and learners grasp easily (Mbangwana and Tani, 2008). Through this process, learners are motivated to go out for more information which can easily be gotten through ICTs. Bruner's Constructivist theory therefore ties with study as it holds that the teacher is there to stimulate the learning process. What then becomes of the learning process if the teacher cannot stimulate the learners with the most recent ICT tools, during the learning process?

Connectivism Theory (Siemens, 2005)

Connectivism is the integration of principles explored by chaos, network, complexity and self-organization theories. Connectivism is driven by the understanding that decisions are based on rapidly altering foundations. As new information comes up continually so too is it being acquired continually.

The ability to draw distinctions between important and unimportant information is vital. The ability to recognize when new information alters the landscape or our society based on decisions by decision makers made yesterday is also critical, as these decisions fix principles.

Principles of connectivism:

- Learning and knowledge rests in diversity of opinions.
- Learning is a process of connecting specialized information sources.
- Ability to see connections between fields, ideas, and concepts is a core skill.
- Learning may reside in non-human appliances.
- Capacity to know more is more critical than what is currently known
- Nurturing and maintaining connections is needed to facilitate continual learning.
- Decision-making is itself a learning process. Choosing what to learn and the meaning of incoming information is seen through the lens of a shifting reality. While there is a right answer now, it may be wrong tomorrow due to alterations in the information climate affecting the decision.

Review of Related Literature

Information and Communication Technology (ICT)

Information and Communication Technologies (ICT) constitute an assembly of facilities used for the treatment, modification and exchange of information. Their application and areas of implantation are diverse and present in almost all spheres of human activity. Among the different technologies for information and communication, the computer and the internet represent privileged means of learning as they permit wide and rapid exposure to the world as well as enhanced pedagogical practices. These technologies are believed to contribute to the amelioration of the quality of education because they are not only used as tools for the facilitation of cognitive development of learners but also as a means for exposure by their users (Tchombe, 2008). Mbangwana and Ondoua (2008) hold that in this era of globalization, no sector of activity should not be able to benefit from

ICT. Since 1998, ICTs presented themselves globally as a strong mythical aspect; like robots that are capable of doing everything in life. But we ignored the impact of these instruments on our daily and professional lives (Essono and Essono, 2008).

Like many other aspects of life, education is undergoing constant changes under the effect of globalization, which has come as a result of the emergence of the (New) Information and Communication Technologies (ICTs). The introduction and evolution of ICTs are changing the delivery of education, the role of students and teachers and producing a shift in society from industrialization to information – based society. Educational institutions around the world are forced to compete globally by engaging in entrepreneurial activities to sustain themselves in an uncertain and changing world (Mbangwana, 2008). According to Barbara Muller-Ackerman, chairman of the American School Counsellor Association's (ASCA) public relation committee, as quoted by Mbangwana (2008), children cannot be effective in tomorrow's world if trained in yesterday's skills. Globalisation is shaping children, the future citizens of the world into intelligent "global citizens", with a broad range of skills and knowledge to apply to a competitive information – based society.

Toure (2008), argues that ICT on their own will not bring about improvements in educational quality, but when we change our mindsets to use them reflectively and strategically, teaching, learning and administrative processes can be deepened. This includes leaving behind paradigms of teacher as master. Creative and contextualized appropriation of new technologies contributes to more active and interactive pedagogies, increased motivation, updated teaching materials, discovery of self and others, and changed roles and relationships among teachers and students and with knowledge. Learning can become more dynamic as teachers and students become partners in accessing information, constructing relevant knowledge, and representing self and others. However, new technologies such as internet and computer are often introduced and sometimes even parachuted into schools in ways that do not enhance teaching and learning, that promote automated thinking instead of critical thinking, that encourage dependency rather than autonomy and interdependency, and that reinforce existing patterns of exclusion.

Africa needs to integrate ICTs across the curriculum

Tertiary education may improve technological catch-up and, in doing so, help to maximize Africa's potential to achieve its greatest possible economic growth given current constraints. Investing in tertiary education in Africa may accelerate technological diffusion, which would decrease knowledge gaps and help reduce poverty in the region.

Many avenues for further research are evident. If new research points to specific actions that African governments can take to strengthen the ability of higher education, Africa may benefit substantially (Bloom et al., 2006). Among the directions such research could take is curricular reform. Few development strategies mention curricular reform as a necessary area of improvement for increased competitiveness within the globalizing economy. Research on existing curricula and their suitability for serving Africa's needs may shed light on new and useful directions that curricula could take. It appears, but is not clearly established, that African universities have not made large efforts to reform their curricula in response to rapidly expanding scientific knowledge and changing economic opportunities.

The Millennium Declaration adopted in 2000 underscored the urgency of ensuring that the benefits of new technologies, especially ICT, are made available to all (United Nations, 2000). While the potential of ICT for stimulating economic growth, socioeconomic development, effective education and training, and good governance is well recognised, the benefits of ICT have been unevenly distributed within and between countries, regions, sectors, and socioeconomic groups (United Nations, 2005). This uneven distribution is fondly referred to as the "digital divide" to describe the gap existing as a result.

ICT Usage in teacher training colleges in Africa

Accepting ICT usage in teacher training colleges, means that it is crucial for ICTs, including print media, audio, video, computers and the internet, to be integrated throughout the curriculum in a blended way. Unwin (2004) says where computers are set aside in a laboratory, for use only on

special occasions, they remain an object of curiosity, fear, uncertainty, awe or mystery, rather than being seen as the useful, enabling tool that they are. This has been neatly encapsulated in SITE's (2002) first principle on the use of ICT in teacher training: 'Technology should be infused into the entire teacher education program. Throughout their teacher education experience, students should learn about, learn with, and learn to incorporate technology into their own teaching. Restricting technology experiences to a single course, or to a single area of teacher education, such as the methods courses, will not prepare students to be technology-using teachers'. There are issues related to access such as: to have computers in sufficient numbers, concern about security, networking and connectivity. The importance of access and use can never be measured. Lessons learnt from the successful use of computers in education in Europe and North America in recent years, particularly at primary level, illustrate that it is beneficial to have one or two computers in each classroom than to have them in a single laboratory (SITE's, 2002). Computers, internet, video and radio all can become part of the tools that teachers have available, to inspire and educate pupils and students across the curriculum.

Challenges faced by Teacher training institutions

Lewin and Stuart (2003), hold that one of the main challenges facing teacher training in Africa is how best to achieve an appropriate balance between pre-service and in-service training. The education sector as a whole across the continent is under-resourced, and limited budgets have often meant that donor-funded programmes have concentrated on only a part of the teacher training agenda. In recent years, the need to enhance the capabilities and self-esteem of practicing teachers as well as coping with the high costs of running initial teacher training institutions, meant that there have been considerable emphasis on in-service training School-Based Teacher Development programmes, as in Kenya, Uganda and Tanzania. These have provided valuable support to teachers. It is important to note that there are champions of best practices throughout the system who can inspire others touse ICTs in teacher training (see experiences of SchoolNets in Uganda *http://www.schoolnetuganda.sc.ug/homepage.php.*

In a study carried out by Karsenti (2004) on how future teachers and teachers in nine universities in Quebec were being prepared for teaching, he found out that: 46% of the student teachers and teachers did not or rarely used ICTs during their internship; 95% of student teachers and teachers for the secondary said they had never or rarely used ICTs to teach in class; 55% of the student teachers and teachers said they knew nothing about PowerPoint; 42% used ICTs for searching information; 23% used this new technology to supervise the works and projects of their students; 15% used it to search for pedagogic material. These findings only go to support the suggestion of this researcher that teacher trainers face a lot of challenges when it come to the training in Higher Teacher Training Colleges across Africa.

Impact of ICT on Training given to student teachers

Asking the question why teachers should be trained to integrate ICT in their teaching process, Karsenti (2004) holds that: It will help them to teach better by also taking into consideration societal realities; It will facilitate the learning process of the youths they will have to teach; The use of ICTs by their teachers will motivate their educational aspirations.

Kulik's (1994) meta-analysis study revealed that, on average, students who used ICT-based instruction scored higher than students without computers. The students also learned more in less time and liked their classes more when ICT-based instruction was included.

Li et al. (2003) pointed out: "First, web-based instruction presents information in a non-linear style, allowing students to explore new information via browsing and cross-referencing activities. Second, web-based teaching supports active learning processes emphasized by constructivist theory. Third, web-based education enhanced understanding through improved visualization and finally, it is convenient because it can be used any time and in any place".

Fuchs and Woessman (2004) used international data from the Programme for International Student Assessment (PISA). They showed that while the bivariate correlation between the availability of ICT and students' performance is strongly and significantly positive, the correlation becomes

small and insignificant when other student environment characteristics are taken into consideration.

Sosin et al. (2004) constructed a database of 67 sections of introductory economics, enrolling 3,986 students, taught by 30 instructors in 15 institutions in the United States of America during the spring and autumn semesters of 2002. They found significant, but low, positive impact on student performance due to ICT use. But they showed that some ICT seems to be positively correlated to performance while others are not.

From the analysis of the effects of these methodological and technological innovations on the students' attitude towards learning process and their performances seems to be evolving towards a consensus. Such consensus search for which digital technologies used in higher education can have significant positive effects both on students' attitude and their achievement.

Recent research by Youssef and Dahmani (2008) pointed out the importance of transforming teaching in order to integrate ICT effectively. ICT is seen as a catalyst of system, community, school and classroom reform because it provides opportunities to shift from teacher centred to student centred learning. Accordingly, ICT could also increase the pedagogical repertoire of teachers which can also improve the outcomes of disadvantaged students because it attends to individual needs and provides variety of curriculum and assessment strategies to promote student capabilities across a range of learning outcomes. In this sense, good pedagogical practice with the use of ICT to enhance the learning of students who are disadvantaged is good pedagogical practice for all students. ICT may have an impact on teacher quality and characteristics, and so student performance and achievement.

Three complementary effects may be observed (Youssef and Dahmani, 2008). First, teachers' actions may be complemented by the use of learning from the Internet. The process of learning is not only based on teachers' materials. Second, teachers are acting as learners in the new setting of education. Teachers learn from peers and also from students. They are co-constructing the courses and are more sensitive to student participation. ICT is transforming the classrooms and focusing learning more on the process. The third is related to the two first points, because while initial

competence and degrees of teachers remain important, they still need new skills. In particular, there is the held view that students' performance seems dependent on the ability of teachers to develop these new competencies and skills.

Methodology

Research design

The study adopted the descriptive survey design. This design was preferred because it permitted the use of all the data collected through questionnaire, interviews and focus group discussions to describe the knowledge and use of ICTs by lecturers of the selected higher institutions. Data was gotten from the PanAf observatory on the Pedagogical Integration of ICTs in Africa *(www.observatoiretic.org)*.

Research Area

The research was carried out in four selected Teacher Training Colleges from Central, East, South and West Africa. In Central Africa we had the Higher Teachers Training College (E.N.S) Yaounde. This institution admits holders of the General Certificate of Education (GCE), Advanced Level or the Baccalaureat for the first cycle and holders of Bachelor's Degrees for the second cycle. E.N.S Yaounde admits and trains both Anglophones and Francophones of both sexes. It is located in the central region of Cameroon not too far from a good number of Ministries in Yaounde. The Technical Teachers College in Kenya was selected for East Africa. This is a public tertiary level teacher training college located in the capital city Nairobi, Kenya. The college offers diploma level training for secondary school teachers and a higher diploma in education management. The Wits School of Education was used for Southern Africa. The Wits School of Education (part of the University of the Witwatersrand - colloquially known as 'Wits') is located in the economic and demographic hub of South and Southern Africa, and plays a major role in the development of education in the country and the region. It is the outcome of a recent merger of the former Johannesburg College of Education and the previous Faculty of Education of the university. The

merger has enhanced possibilities in the fields of undergraduate teacher qualifications, postgraduate studies and educational research in a wide range of knowledge domains and associated disciplines. Wits Education is committed to making a significant contribution to the transformation of education, the redress of inequities, and the assimilation into theory, policy and application of well-researched educational perspectives, approaches and methods. It has a teaching and research staff of 148, and a student body of 2983.For West Africa, the University of Education Winneba which is a multi-campus institution comprising three in Winneba, one in Kumasi, and one in Ashanti-Manpong, was used.

Population

Lecturers and managers of these institutions made up the sample population used for this study. This was gotten from the target population which was chosen by the PanAfrican research agenda researchers for the various countries selected for this study. One of the parameters for choosing the schools for the PanAf project was the acquisition of computers to identify leading practices on the pedagogical integration of Information and Communication Technologies (ICTs).

Research Instrument

The main objective of PanAf is to collect pertinent data from ten schools in some twelve African Countries with the goal of setting up an ICT PanAfrican observatory (www.observatoiretic.org) which will permit interested persons to understand better how the pedagogical integration of ICTs can ameliorate the quality of teaching and learning in Africa.

Questionnaires and interview schedule developed and validated by the PanAfrican team were used. The researcher also used the observation technique. Secondary data was collected from documents and other scientific research work done in this domain.

Data Analysis

The study uses both qualitative and quantitative strategies and data analysis responds to the nature of data collected. Qualitative data is interpreted on the basis of issues generated from the research objectives and related literature review on previous works in the same domain. Quantitative data is analysed using a descriptive statistics.

Presentation of findings and data analysis

Objective 1: Identify Teachers of H.T.T.C's knowledge of ICTs

Table I: Educator's knowledge of ICTs (3.11.1; 3.11.2; 3.11.3; 3.11.4)

Institution	N° of teacher trainers in institution	N° of educators with 1 to 50 hrs of ICT training	N° of educators with more than 50 hrs of ICT training	% of educators with less than 50 hours of ICT training	% of educators with over 50 hours of ICT training
E.N.S Yaoundé	245	19	9	7,6	3,6
Kenya Tech. Teachers College	870	39	39	33,62	33,62
Wits School of Education	148	30	0	20,27	0
University of Educ., Winneba	322	322	10	100	3,11

When looking at the percentage of teacher trainers who have had more than 50 hours of professional training that includes ICT integration, we realized that though the Kenya Technical Teachers College has less than 50% of teachers who have had more than 50 hours professional development including ICT integration, it is the best of all the four schools selected for this study with 33.62% of the teachers having received more than 50 hours training with ICT integration. This means that it is the same number of teachers (39 out of 870) who received less and more than 50 hours of professional training including ICT integration. The University of Education Winnebia in Ghana comes second with a very low 3.11%,

followed by E.N.S Yaounde having 3.6% of teacher trainers who have had more than 50 hours of professional training with ICT integration. The Wits School of Education comes last with 0% of teacher trainers having received more than 50 hours of professional training with ICTs integrated.

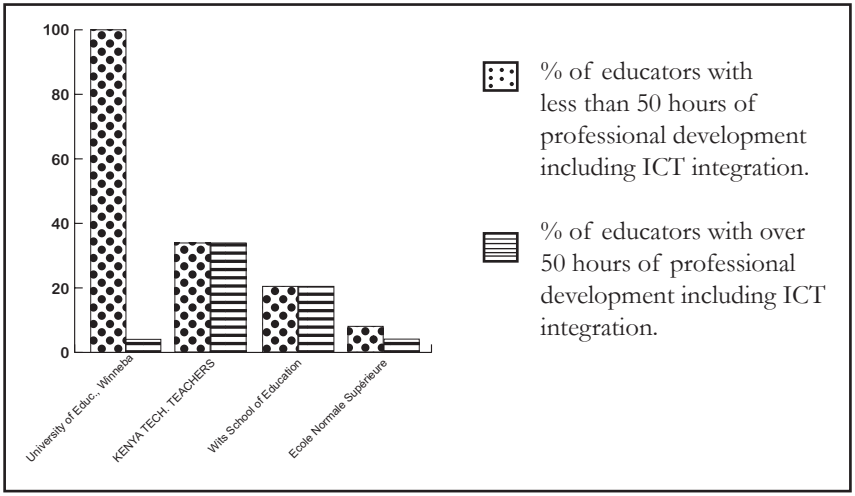

Figure 1: Percentage of educators having received less than 50 hours ICT training

Our findings also showed that all teacher trainers of the University of Education Winnebia have had 1 to 50 hours of proefessional training including ICT integration. 33.62%, 20.27% and just 7.6% of teacher trainers in the Kenya Technical Teachers College, Wits School of Education and Ecole Normale Supérieure Yaounde respectively have had 1 to 50 hours of professional training that included ICT integration.

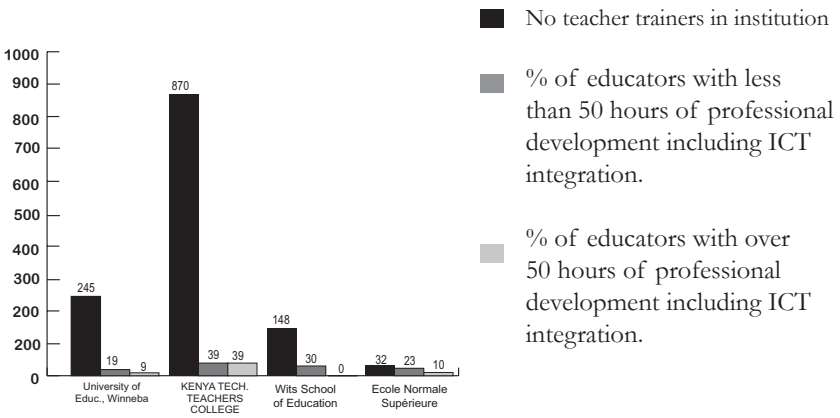

Figure 2: Number of educators having received ICT training

Figure 2, gives us a clear picture of the knowledge that teacher trainers in these higher institutions have. It is very clear that the number of educators who have had 1 to 50 hours of professional training including ICT integration in E.N.S Yaounde, Kenya Technical Teachers College and Wits School of Education Johannesburg is very low, compared to the University of Education Winnebia in Ghana. All 322 teacher trainers in the University of Education Winnebia have had 1 to 50 hours professional training that includes ICT integration, and just 10 of them have had more than 50 hours of training including ICT integration. When we look at the Wits School of Education, we realize that none of the teacher trainers has had more than 50 hours professional training that included ICT integration.

Objective 2: Find out educators use of ICT Knowledge (Indicators: 3.2.1;3.3.1; 3.3.2;3.5.1;3.5.2)

Table 2: Number, percentage and rank of ICTs use by educators of various institutions.

Institution	N° of teacher trainers in institution	N° of educators with email addresses	N° of educators who use ICTs	% of educators with email addresses	Rank of institutions with educators using ICT to train
Wits School of Education	148	148	100	148	1
E. N. S. Yaoundé	245	150	61,22	142	2
Kenya Tech. Teachers College	870	37	4,25	116	3
University of Educ., Winneba	322	322	100	0	4

From table 2 above, we read that Kenya Technical Teachers College has the highest number (870) of teacher trainers but just 37 have email addresses. Out of the 245 teacher trainers in E.N.S Yaounde, 150 have email addresses. All teacher trainers of Wits School of Education (148) and the University of Education Winnebia (322) have email addresses. The number of teacher trainers in Kenya Technical Teachers College who use ICTs (116) is abnormally more than the number of teacher trainers who have email addresses (37). We also realize that while there is a great difference between the number of teacher trainers in Kenya Technical Teachers College (870) and the number who integrate ICTs during training (116), non of the 322 teacher trainers in the University of Education Winnebia Ghana integrates ICTs in their training process.

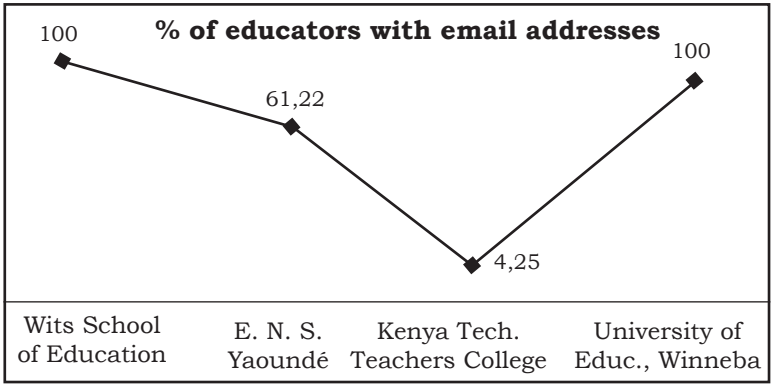

Figure 3 : Percentage of educators with email adresses

Considering that the first thing done after having any training on ICTs is creating an email address, we also found out the percentage of teacher trainers who have email addresses. Only 4.25% of teachers in Kenya Technical Teachers College have an email address. 61.22% of teacher trainers in E.N.S Yaounde have an email address while 100% of the teacher trainers in Wits School of Education Johannesburg and the University of Education Winnebia Ghana have email addresses.

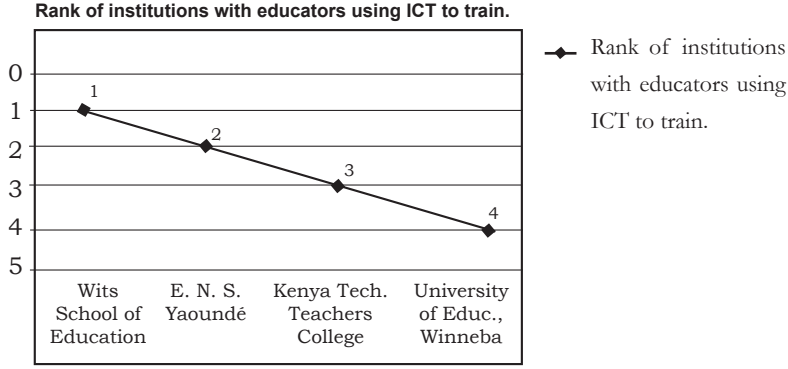

Figure 4: Ranking Institutions that integrate ICTs during training.

In ranking the institutions following the integration of ICTs during training, the figure above clearly indicates, the Wits School of Education comes first

in the pedagogical integration of ICTs, E.N.S Yaounde follows second, Kenya Technical Teachers College third and last we have the University of Education Winnebia Ghana.

Objective 3: Identify the challenges ICT usage posed for H.T.T.Cs Teachers (Indicator 4.7.1)

Institution	Stated factors that are challenges to ICT use by educators
E.N.S Yaounde	The main challenge lies in training of trainers in the use and integration of ICT in their daily activities. Teachers are not well equipped to use these tools, many of them had to do self training in cyber cafés or attend seminars that went on for some few hours. There is also the challenge of ownership of tools by teachers inherent in ICTs. This challenge is further complicated by the fact that very few students have computers. We also have the challenge of providing the institution with a sufficient number of computers for teachers and students. Computers are only found in the computer department laboratory and access is limited to students of this department. There is lack of support from the provincial educational authorities (Provincial Inspector of Education) in the use of ICT.
Kenya Technical Teachers College	The challenges that educators encounter in the use of ICT in teaching are: Lack of enough resources –computers and LCD projectors; Maintenance of the existing machines; Computer illiteracy of both the teachers and students hence not aware of benefits; Techno-phobia - that is the fear of technology; Lack of strong policy on ICT integration in teaching or use of computers; Output and storage devices-they are not always made available by the management, and Internet connectivity that is efficient - currently, the Internet speed is low.

Wits School of Education	There is a view in the School that e-Learning is increasingly important, but there are various obstacles to its realization. The following points emerge from a survey of minutes of staff meetings over the past two years: • Adapting to the use of ICTs in teaching and learning takes time, and staff are already overworked in their current roles. • The design and development of online learning materials is a specialist skill, and staff in general do not have these skills. Note that the tendency in these debates is a view that staff should in the long term be 'empowered' to do carry out these tasks themselves. They should not be entrusted to technocratic instructional designers who themselves have no knowledge of the discipline. • The fact that the School has not yet been able to network computers used in lecture halls with the general system that links office computers to each other is a drawback.
University of Education Winnebia	Faculty are of the view that unreliable power supply, network/internet breakdown/disruptions, down-time of equipment, insufficient access to digital equipment (digital projects, camcorders, cameras, etc) and computers, students' insufficient access time with computers in the various labs, large class sizes (150 – over 3000 in class) adversely affect use of ICT in class. Faculty expressed the need for each member to own a laptop and or office PC to help them plan their lessons more effectively and timely. Educators contend that large classes make group work unreliable and active participation of all students in group projects cannot be guaranteed. Inadequate ready technical support for faculty in their use of ICT is a demoralizing factor. Some are of the opinion that lack of ICT literacy workshops for the older faculty would further discourage such faculty from integrating ICT in their instruction.

	Lack of Internet connectivity, PCs and their accessories (printers, Scanners, etc) in classrooms hinder educators use of ICT in instruction. Faculty explained that the absence of these gargets in classroom settings does not encourage the use of ICT in classrooms. The lack of administrative support and incentives innovative faculty who integrate ICT into their instructional activities and for their students' learning also does not encourage late adopters in the diffusion process to adopt ICT for teaching and learning activities.

Objective 4: Identify the extent to which educators use of ICT impacts the quality of Teacher Training (Indicators 5.1.1; 5.1.2; 5.1.3)

Institution	Impact of ICT on lesson-planning	Impact of ICT on in-class teaching	Impact of ICT on evaluation methods
E.N.S Yaounde	Teachers at the Ecole Normale Supérieure Yaoundé use ICT to prepare their leçons. They use them to prepare material for handling student teachers. They also use ICT to synthesize the work of student teachers and communicate work instructions.	ICT has an impact on classroom work at ENS. The lessons are more attractive and more motivated. Many students are in practice with ICT than the theoretical sessions. The video projectors are often used for demonstrations and presentations .This enables learners to be more involved in classroom work.	Given the large number of students in lecture halls, ICTs permit us to enter the lists of students, evaluations marks and these can be found easily. Certain teachers retrieve copies of evaluations by email. This approach first of all solves transportation problems, storage copies is easier, and it limits complaints of lost copies.
Kenya Technical Teachers College	It has improved preparation of the lessons. The teachers can type and save the lesson plan. This means that they can use the same lesson-plan the following year for the same class and subject with a bit of updating. Time and	Students seem to enjoy the teaching of the lessons.ICT offers opportunity to use multi-media in teaching. The teacher can therefore vary the teaching methods to appeal to the different learning styles of the learners. The teacher	Firstly, the teacher can now type the examinations for themselves unlike before when they had to rely on the school secretary. The quality of examination has improved. There are less errors because the teacher corrects them immediately using the spell-check

Cont.d - Objective 4:

Institution	Impact of ICT on lesson-planning	Impact of ICT on in-class teaching	Impact of ICT on evaluation methods
Kenya Technical Teachers College	money is eventually saved! The teachers become more efficient and effective because the time that could have been spent on lesson planning is used for searching for more information. More interesting presentations to the learners. The teacher can use multi-media in teaching. This improves the quality of the lesson and acquisition of knowledge by learners. Storing and retrieval of information is easier.	enjoys teaching more than when they were not using ICT. The fact that storing and retrieval of information is easy makes the teaching easier and enjoyable. There is more updated information and especially in problem-based learning. The lessons are more interesting. The teachers become more constructive and learning is learner- centered. The role of the teacher has become more of a mentor.	tool. Secondly, the analysis of the marks is easier. Computation of the necessary indices is much easier because they are available in the computer. A lot of time is hence saved and results are released on time enabling quick feedback to the learners. Presentation of the results is better because the teacher can use multi-media to process and present the results to the learners, parents and the management. The teacher indicated that he/she has come to realize that set standards may not work as students have information from different sources

Cont.d - Objective 4:

Institution	Impact of ICT on lesson-planning	Impact of ICT on in-class teaching	Impact of ICT on evaluation methods
Wits School of Education	For the most part in the School there is a resistance on the part of lecturers to engage explicitly with this kind of question. It is obvious from general exchanges with them that the majority use ICTs in their work: however, few see value in explicit reflection on ICT integration. This is reflected in the reluctance on the part of academic staff members to respond to our questionnaire on these issues. Our research team has been struck by this tendency, and believe that it needs more careful reflection and research in order to understand how ICTs impact of	All respondents felt that ICTs allowed them to prepare and to present learning tasks to students more clearly, using data projectors and other technical means. All of them (and this I obviously a general feeling across the School, beyond our respondents) felt that technologies meant that learning materials were more easily prepared, and tended to be neater and more easily understood by students than had been the case in the past. A Maths lecturer was particularly enthusiastic: "Speed of learning has been increased– easier detection of errors in Maths applications and concepts are formulated in shorter periods of time."	The general assessment procedure in the School was summarized by one respondent as follows: "marks are captured and calculated using MSExcel. Ultimately the exam mark and the year marks are inputted into our academic mark system for each course." All lecturers (are required to) use ICTs in these functions. Most of our respondents indicated that they use computer programmes for practical assessment purposes, although this tended to be for administrative rather than for actual educational evaluation purposes. Only one respondent used such a software programme.All respondents used ICTs for the preparation of assignments and exams. One specific advantage of this was indicated as follows: "Feedback

Cont.d - Objective 4:

Institution	Impact of ICT on lesson-planning	Impact of ICT on in-class teaching	Impact of ICT on evaluation methods
Wits School of Education	teaching and learning. The following general points of interest emerged from our respondents: the quality of lecture and tutorial preparation is improved by ICT-enabled access, including research for articles and the designing of materials. However, there was also a feeling that the use of ICTs means that such preparation takes more time. A computer literacy lecturer was very enthusiastic (see attached document): "my lessons are all designed around tasks in Microsoft [Office], e-mail and Internet. …. I demonstrate tasks to students using a data projector."		– quick to have colleagues edit or make comments on assignments and exams before submitting for printing". One reason for this reluctance to explore ICTs in assessment is a general perception that technology can only be used for narrow, one dimensional forms of assessment, such as multiple-choice questioning strategies. There are, however, two lines of exploration in the School emerging that challenge this assumption: i. the exploration of blogging, web-based discussion groups, etc. for assessment purposes, and ii. the development of MCQs designed to assess depth in learning, specifically in relation to the multiple representation possibilities that are made possible in hypertext learning environments.

Cont.d - Objective 4:

Institution	Impact of ICT on lesson-planning	Impact of ICT on in-class teaching	Impact of ICT on evaluation methods
Wits School of Education			One important tendency relates to postgraduate supervision of theses and dissertations. Most supervisors – and we verified this informally by brief interviews with more that just our formal respondents – use the 'track changes' function in MS Word extensively in providing feedback to drafts of students' work.
University of Education, Winneba	Faculty stated that the use of ICT has enhanced the quality of lesson preparation, delivery and assessment. They claimed that the use of the Internet to get new ideas to incorporate in lessons has enriched the content of their instruction. Other also viewed the use of	Faculty members were of the view that ICT use has helped to explain concepts to large group at a time through the use of PowerPoint for instructional delivery. They claimed that PowerPoint makes lesson presentation more systematic, clearer, and less talking. Some were also of the view that ICT use in	Most faculty members were of the view that ICT use makes assessment better and quicker through project-based learning and assessment. One faculty member remarked that "…, practicum assessment includes students producing video taped counseling sessions they are involved on CDs, watching and answering questions based on videos". The biggest

Cont.d - Objective 4:

Institution	Impact of ICT on lesson-planning	Impact of ICT on in-class teaching	Impact of ICT on evaluation methods
University of Education, Winneba	the Internet to conduct their research as having a major impact on their professional development. They also said that ICT use has helped to strategize their instruction to cope with large class sizes at a time, and that the use of multimedia tools to prepare instructional materials has helped contextualized instructional content. Some faculty are also of the view that ICT use has helped them to save time in planning their lessons through access to readily available teaching and learning materials on the Internet and application packages. They also	classroom settings promotes class discussions and extend students' learning. Others contended that ICT enables them to to incorporate multimedia elements in instruction help not only to contextualize learning but also engage learners during the lesson delivery. There is the general feeling among faculty that the use of ICT in classroom settings helps to motivate students' learning and enhance their understanding. They cite the fact that students are more willing to conduct research using the internet to get very current information. Some faculty are also of the view that ICT use allows for a variety of instructional	a impact of ICT use on assessment at the University of Education, Winneba can be felt in students' grade processing. Faculty use of the students' online information management system to enter exam scores online has reduced computational errors in students' results and grades. The various levels of security checks through varying access rights and privileges of various categories of users has helped to eliminate or minimize favouritism among faculty members. The use of ICT makes it easier to evaluate students' work, particularly for large class sizes through email use for assignment delivery. According to some faculty members, the use of spreadsheets or the students' online information system to process students' grades

Cont.d - Objective 4:

Institution	Impact of ICT on lesson-planning	Impact of ICT on in-class teaching	Impact of ICT on evaluation methods
University of Education, Winneba	indicated that ICT use has enhanced quality lesson plans through activity-based activities that engage learners.	strategies and that does not only make teaching easier and more interesting but also meet the diverse learning needs and styles of heterogeneous classes. Yet other educators felt that the use of ICT equipment such as digital projectors eases the tasks of writing on chalkboards and making easier their teaching. Some faculty thought the use of ICT to create hyperlinks to other sources of information both internally and externally has helped to extend learners' access to knowledge and information.	was quicker for such large classes (over 350 in a class).

Objective 4 (con't): Identify the extent to which educators use of ICT impacts the quality of Teacher Training (Indicators 5.1.4; 5.1.5)

Institution	Impact of ICT on educator-learner communication	Impact of ICT on reflection on teaching
E.N.S Yaounde	Teachers communicate with their students through email. These communications are used by even the shy students to ask questions without attracting ridicule from their peers. Teachers may well be closer to their students to understand and to advise them. But the telephone remains the most used.	Teachers use ICT to produce handouts for interested networks and disciplinary think tanks and all these reflections aim to make their teaching more effective.
Kenya Technical Teachers College	The teacher is able to communicate with the learners by email. The students are given assignments which they answer and send by e-mail especially during the holidays hence ensuring that learning takes place asynchronously.	It helps to plan ahead and think of creative ways of presentation. Internet gives unlimited information unlike the textbooks where one is limited to only several books. A teacher is more innovative and creative in lesson preparation. Teaching materials are diverse as the resources are available on the Internet.
Wits School of Education	Most lecturers employ e-mail communication with postgraduate students (i.e. at Masters and PhD levels), but there is little formal communication with students on a one-to-one basis at the undergraduate and Honours	In general, respondents felt that the advent of digital ICTs in teaching and learning has made them think much more about the way they present knowledge to their students. The much easier use of multimedia teaching and learning

Objective 4 (con't): Identify the extent to which educators use of ICT impacts the quality of Teacher Training (Indicators 5.1.4; 5.1.5)

Institution	Impact of ICT on educator-learner communication	Impact of ICT on reflection on teaching
Wits School of Education	levels. Two respondents indicated that they sent messages to their undergraduate students using e-mails, and four indicated that they allowed students to submit It is interesting to note that, of all the lecturers who use the WebCT to deliver their courses, only one seems to sue the 'chatroom' facility for active communication with her students.	strategies seems to be the main reason for this. One respondent in extended this even further: "the main thing that the use of computer technology has made me think about is how knowledge is represented. While formal written text must, in my view, remain the core of the academic enterprise, teaching students to arrive at an understanding of the knowledge systems that give rise to academic knowledge and debate in the first place can certainly rely on the non-linear representation of knowledge that ICTs – in particular, hypertext – makes possible." There was also a strong sense that ICTs enhanced the ability of the lecturer to evaluate his or her own teaching. One respondent spoke of how she "thinks much more about the medium" that she did in the past, and another indicated that ICT usage "helps me to evaluate my teaching. As a result I have retaught sections in Maths, due to misconceptions that I could pick up from diagnostic testing."

Objective 4 (con't): Identify the extent to which educators use of ICT impacts the quality of Teacher Training (Indicators 5.1.4; 5.1.5)		
Institution	**Impact of ICT on educator-learner communication**	**Impact of ICT on reflection on teaching**
University of Education, Winneba	According to some faculty members, students are encouraged to submit assignments through email, as one faculty member remarked "…, [I do] not use ICT to communicate between me and my students but students are free to do so". Most students do not use email but instructors share information with the few that have email accounts and colleagues. At a high cost at the public Internet cafes, students' use of email, Skype, and yahoo messenger to communicate with colleague learners regularly. But their use of cellphones/ mobile phones is the dominant medium of communication between instructors and students, since most students do not have internet access.	Some educators think of the impact of particular lessons have on learners and how best to present the next lesson, and how innovative they can be without indicating how ICT helps in all these issues; the use of pictures and videos from the local environment motivates students to learn and to relate better with what is being taught, ICT also helps me to modify my methods of teaching (how?); using MS Excel to perform trends analysis helps me to determine learners' performance over a period.

Discussion

The discussion draws on the findings of field research, on the literature review and also on the researcher's knowledge of the use of ICTs in higher institutions.

Certainly, the use of ICTs in higher teacher training colleges is to be very welcomed, but when looking at the percentage of teacher trainers who have had more than 50 hours of professional training that includes ICT integration, we realized that all four institutions chosen for this study are barely coping with this. We would therefore agree with SITE's (2002) by saying that technology should be infused into the entire teacher education program. Computers, internet, video and radio all can become part of the tools that teachers have available, to inspire and educate pupils and students across the curriculum, but this will not be realized if teacher training institutions fail to use ICTs during training, taking the example of the Wits School of Education Johannesburg where none of teacher trainers has had more than fifty hours training that included ICT integration. Nevertheless, the other three teacher training institutions can copy from the University of Education Winnebia that clearly stands out with all teacher trainers having received at least fifty hours of professional training including ICT integration. This will be in line with SITE's (2002) saying restricting technology experiences will not prepare students to be technology-using teachers.

Also we considered that the teacher trainers like every other person starts putting the ICTs knowledge acquired by creating an email address. It was realized that the number of teacher trainers who were interested in putting the ICT elementary knowledge (having an email address) into use for better student performance was encouraging as about 50% of the teachers in all four schools owned an email address. This ties with Youssef and Dahmani (2008) who hold the view that students' performance seems dependent on the ability of teachers to develop these new competencies and skills. From interviews with these teacher trainers we gathered that the use of ICTs should be part and parcel of every trainer's program. May be this accounts for the abnormal data collected in Kenya Technical Teachers College where the number of teacher trainers using ICTs during training is alarmingly

higher than the number of teachers who have email addresses. This may be due to the fact that the teacher trainers want to give a good image of their institutions concerning the pedagogical integration of ICTs.

Understandably, in line with Lewin and Stuart (2003), who hold that one of the main challenges facing teacher training in Africa is how best to achieve an appropriate balance between pre-service and in-service training, all four chosen schools for this study, were facing the problem of pre-service and in-service professional training that included ICT integration. The education sector in the schools and as a whole across the continent is under-resourced. There is need to enhance the capabilities and self-esteem of practicing teachers as well as coping with the high costs of running initial teacher training institutions.

The results of this study show that the use of ICTs in higher teacher training colleges in each of the institutions chosen from Central, East, Southern and West Africa, has brought in a lot in the teaching learning process. It brought us to the same answer to the question with Karsenti asked in 2004, why teachers should be trained to integrate ICT in their teaching process. It helps them to teach better by also taking into consideration common societal realities (for all four schools) like having to use email addresses in sending and receiving assignments using email addresses where other developed countries use online courses. It facilitates the learning process of the youths they have to teach as these student teachers become more interactive in ICTs pedagogically integrated lecture halls.

Conclusion

This study can claim no more than that what it has attempted to do is an examination of the question of how higher teacher training colleges in Africa use ICTs, the challenges that teacher trainers face and the impact that the use of these ICTs has brought in the training of student teachers. From this perspective, the conclusion is that there is high need for better pre-service and in-service training for teachers of higher teacher training colleges in Africa. It is not just enough to give teacher trainers some elementary fifty hours training that includes ICT integration as the results of this study have

shown. The teachers need more than fifty hours pre-service training and more of in-service training to be able to stand up to the challenges that come with the use of ICTs, not to mention its use in the training process. During the few hours of training given to teacher trainers, they should be encouraged to create email addresses given that these addresses can be used to send and receive assignments since online courses are still a major problem in African higher teacher training colleges as shown in our data analysis. Also, the importance of access and use can never be measured as SITE's (2002) says, lessons learnt from the successful use of computers in education in Europe and North America in recent years, illustrate that it is beneficial to have one or two computers in each classroom than to have them in a single laboratory. If the challenge of limited number of computers in laboratories and teacher trainers and students not being able to afford personal lap tops and PCs could be dealt with, then the impact of the use of ICTs will be better felt in Africa.

Recommendations

The study gives the following recommendations to:

African Governments

By government we mean the ministry that is concerned with teacher training and every other partner ministry like Telecommunications, Transport, Finance, Defence etc. Information and Communication Technology integration should be included in all curricula especially of higher teacher training colleges, since more than a majority of the teachers in the educational chain from basic to higher education are trained in these colleges. Education being the backbone of every society, teacher trainers who are apt in the pedagogical integration of ICTs will only produce an information and communication technology society.

Frequent seminars and training workshops should be organized by governments so that teacher trainers can improve on their knowledge as technology keeps changing. The above mentioned ministries can work in partnership in this training process. Putting their financial and human resources (locally) together to organize training workshops will greatly

reduce workshop organization cost which is usually too high as a result of experts from out of the country. This is very possible as the results of this study has shown that some teacher trainers have already received good professional training that includes ICT integration and so can be used to train the rest.

Higher Teacher Training Institutions

In copying the example of other countries that have advanced in this pedagogical integration of ICTs, individual countries should not forget to take into consideration th needs and realities of their countries. While restricting or reducing physical movement from one country to another to learn from countries that have advanced in the pedagogical integration of ICTs through the use of ICTs, Cameroon or Kenya for example can learn from South Africa through scientific publications and why not through experiences gotten from interviews with college managers on the PanAf observatory (www.observatoiretic.org).

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Acquisition and utilization of ICT skills among University Students in Sub-Saharan Africa: A Case of Universities in Kenya.

Dr. Laban P. Ayiro,ss.

Abstract

The purpose of the study was to investigate Kenyan university students' skills and practices of using information and communication technologies (ICT). Views about the importance of ICT were also evaluated. One hundred and fifty students responded to a self-report questionnaire. The students were from 10 universities that use ICT in various forms and represented both public and private universities in Kenya. From the analysis, there emerged three constructs that represented these students' interactions with and perceptions on ICT. The first construct entailed the view that computer assisted learning makes the learning process more meaningful and motivates one towards further learning. Competence in using ICT emerged as the second construct, along with intensive use of ICT at home in addition to networking with expert cultures and tutoring other people to improve their ICT skills. The third construct was the intensity of using ICT and this seemed to be determined by the availability of equipment and the extent to which ICT is used rather than by a student's expertise in ICT.

Keywords: Computer skills; Students' ICT skills; Educational use of ICT; Student experts; ICT support for learning

Introduction

Information and communication technology (ICT) is a major foundation of the economy in both poor and wealthy nations (Colle & Roman, 2003; Etta & Elder, 2005; Law, Pelgrum, & Plomp, 2008). Consequently, ICT can be seen as the main facilitator of the knowledge society, and ICT can also play an important role in development and in education (Unwin, 2009). Both of the United Nations' targets of education for all and millennium development goals are affected by increased ICT access and use. However, the implementation of ICT is also highly influenced by local circumstances and by "social processes that determine the outcomes and often have political ramifications" (Qureshi, 2009, p. 235). Kessy, Kaemba, and Gachoka, (2006) and Ford (2007) discuss several reasons for under use of ICT in education in the African context. The cost of adopting ICT including acquiring hardware and software, setting up telecommunication networks, and the maintenance and repair of facilities is often prohibitive for developing nations. Kessy, Kaemba and Gachoka (2006) recommend privatization as a means to enhance competition and reduce cost of ICT utilization in Sub-Saharan Africa. In general, African countries have poor infrastructure including unreliable transportation, limited electricity supply, broadcast and telecommunication facilities. This presents a challenge for institutions to maintain Internet connections coupled with the fact that in Kenya electricity is relatively expensive going, at an average cost US$ 0.08/ KWh compared to the USA rate of $0.02/KWh.

Developments about and widespread use of Communication and Information Technologies (ICT) have a substantial impact on many spheres of life, education included. Countries recognize ICT as a potential tool for change and innovation in education (Eurydice, 2001) and therefore desire to make substantial investments in ICT infrustracture and capacity development. According to the ICT Sector Strategy Paper of the World Bank Group, ICT essentially consists of hardware, software, networks, and media for collection, storage, processing, transmission, and presentation of information (Batchelor and Nocrish, 2005). E-learning which is an outlay of ICT and a strategy for increased access, on the other hand, refers to the purposeful use of electronic systems or computers in support

of the learning process (Allen, 2003). Therefore, the presence of ICT infrastructure in a learning institution is a pointer to an enabling environment for e-learning. The import of the above is 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 are critical to promoting the economic development of Kenya (MOEST, 2005). The government recognizes that an ICT literate workforce is the foundation on which Kenya can acquire the status of a knowledge economy. As a strategic imperative therefore, the government has placed education at the nexus of the pathways that will see Kenyans equipped with ICT skills for sustainable economic growth of the country. In response to issues raised in Sessional Paper No. 1 of 2005, a national ICT policy was developed in 2006 and is designed to assist the nation achieve aspects of the Millennium Development Goals (MOE 2006). The global imperatives of the MDG's are to ensure sustainable economic growth and development as well as poverty eradication through productive and effective technologies. It further aims at pursuing progress towards full socio-economic inclusion of citizens through universal access to education through modalities such as e-learning.

Literature Review/Related Literature

One of the basic requirements of education for the future is to prepare learners for participation in an information society in which knowledge is the most critical resource for social and economic development and where distributed expertise and networked activities characterize the emerging types of work. Educational institutions are therefore required to adopt appropriate pedagogical methods to align and cope with these new expectations. In this regard, acquiring appropriate ICT knowledge is a critical tool for the rebirth of the learning-instruction processes, facilitating the enhancement of students' skills of collaborating and working productively with knowledge. Such skills will have a universal impact across all disciplines of endeavour at university. Essentially these ICT skills are necessary in our emerging knowledge society and encapsulate the ability to solve increasingly complex problems in a variety of established knowledge-rich domains, participate in knowledge work as well as engage in various networked activities.

ICT, however, can only be able to promote educational change if students and lecturers have both access and intensively use ICT as a tool for learning in various subject domains. It is also expected that the learner and the instructor will have sufficient skills so as to productively engage with the ever changing technology. It has been established empirically that intensive use of ICT fosters the students' socio-cognitive development subject to the design and pedagogical usage of applications of ICT being based on well-grounded cognitive principles and sound innovative pedagogy (Scardamalia & Bereiter, 2006; Sinko & Lehtinen, 1999).

Many education researchers have argued that the fundamentals of schooling have shifted and schools should be remodeled to fit the knowledge society (Bereiter & Scardamalia, 2006; Greenhow, Robelia, & Hughes, 2009; Jonassen, Howland, Marra, & Crismond, 2008; Sawyer, 2006). While the calls from these researchers have informed policy makers in many countries to equip schools with ICT and to provide teachers and learners with requisite skills, the shift towards constructivist-oriented pedagogies is still not a salient feature in school (Laurillard, 2008; Lim & Chai, 2008; Selwyn, 2008). This is a challenge that runs from Early Childhood schooling, through primary and high school and up to the tertiary institutions.

Consider the following; the speed and the ease of computation with spreadsheet applications such as Excel have made the manipulation of data accessible to learners. Digital recording media such as video camera, sound recorder and data loggers have made data collection easier and more reliable. Privileged information that was once hard to access is now becoming easily available over the Internet. Abstract concepts and phenomenon are made more accessible to learners through visualization and animation. Learners may even be taught to create interactive models of natural/social phenomenon. These and many other affordances of ICT may be employed to support independent, flexible, collaborative, iterative and meaningful learning (Jonassen et al., 2008). These changes have also prompted many educators to reconsider key epistemological and pedagogical questions such as what knowledge is, what it means to know, how knowing may be measured/captured and how it should be nurtured. These questions have serious implications for the types of key competencies that both teachers

(in this case lecturers) and learners need (Kirschner & Selinger, 2003; Lock, 2007).

Among the technological advancement, the Internet has been regarded as one of the most influential and transformative technology for teaching and learning (Leu, O'Byrne, Zawlinski, McVerry, & Everett-Cacopardo, 2009; Lee & Tsai, 2010). The continuous evolution of Internet-based technology and its accompanying effects on all aspects of modern life has changed what students should learn, how learning should happen, where and when learning can happen. For example, the emergence of Web 2.0 technology has altered the notion of authorship and the relations between readers and writers in a fundamental way. Literacy has to be redefined to accommodate digital literacy (Leu et al., 2009; Mills, 2008; Myers, 2006). An assessment of the pedagogical value of ICT therefore requires a careful examination of the current practices of using ICT in learning institutions such as schools and universities.

The goal of the present study is to investigate Kenyan university students' skills and practices of using ICT. Kenya represents a typical developing country, in Sub-Saharan Africa that globally rates low in terms of computer usage, internet access as well as information technology. The present study focuses on assessing what students actually know about ICT, how they are using ICT and what they think about ICT. These questions are of general interest because all developing countries are facing similar challenges. Kenya's number 41 position in terms of internet connectivity however, is an impetus that irrespective of the economic status of a country, digitalization can be a universal equalizer towards the knowledge based economy. Given the decision to employ self-report measures from university students who are more active in the use of ICT, the purpose of the study is therefore to:

1. Analyze university students' ICT skills
2. Examine how students use ICT for educational and recreational purposes
3. Identify students' attitudes towards ICT
4. Determine to what extent the students, actively using ICT, have adopted the role of ICT expert.

Method

Participants

The researcher designed a self-report questionnaire to measure students' skills (acquired) and level of utilization of ICT. The questionnaire was also intended to examine the students' views about ICT's importance in learning and in their own future lives. The self-report questionnaire was sent to 10 public and private universities. 8 Schools of Information Science Faculty agreed to participate. They designated, within each school, a cohort of students who use ICT more intensively than the others. The questionnaire was administered to the students at school and returned by the lecturers. Altogether 150 students answered the questionnaire and the mean number of students per University that answered the questionnaire was 12 (SD = 2).The percentage of students answering the questionnaire was about 86% of the intended student population. Table 1 presents the year of study and gender distribution of the participating students.

Table 1 : Year of study and gender distribution of the participants

	Gender					
	Female		**Male**		**Total**	
Year of study	**n**	**%**	**n**	**%**	**n**	**%**
1st	15	33.3	30	66.6	45	100
2nd	13	30.2	30	69.8	43	100
3rd	22	42.3	30	57.7	52	100
Total	50	35.7	90	64.3	140	100

Assessment instrument

The self-report questionnaire consisted of Likert-type questions, on a five-point scale; in total there were 68 items concerning skills, usage and opinions on information technology. A limitation of the study was that

the students' utilization practices and ICT skills were measured using their self-assessments. It could therefore be argued that the results of the study perhaps do not necessarily represent their actual competence or practices of using ICT. In order to underplay the possibility of some students overestimating or underestimating their competences, the researchers included a multiple-choice test in the questionnaire, designed to measure (i) the students' knowledge of some basic concepts of ICT (e.g., operating systems, computer memory, file formats, www publishing) and (ii) ability to perform some simple permutations on paper that could be indicative of possession of specific computer skills.

During the preparation of the assessment instrument, 20 students were asked to fill an early version of the self-report questionnaire, and an item analysis was carried out. Items that appeared to be unclear or that did not discriminate between the students were eliminated. The questionnaire was intended to assess students' skills and practices of using ICT and their general beliefs about the importance of ICT in their studies and in real life. The contents of statements presented in the questionnaire were derived from cognitive research on computer- supported learning and cognitive theory. On the basis of these measures, the researcher designed scales for assessing certain important phenomena connected with ICT skills, practices of using ICT, and the nature of students' expertise in ICT.

Table 2 presents a summary of scales related to development of the self-report questionnaire. The scale of technical ICT skills consisted of items that were designed to measure the subjects' general assessment of their mastery of the ICT as well as their competence in different domains of ICT such as text processing, spreadsheet, desktop publishing, SPSS, and www. Another scale consisted of items that focused on examining how intensively students use different applications of ICT for recreational purposes. This scale was labeled intensity of recreational use. Further, the researcher analyzed how intensively students' use of ICT and applications as a tool of their own learning. This scale was labeled as intensity of educational use.

Table 2: Scales for measuring student's skills and practices of using ICT

Scale	Description
Technical ICT skills	How well a student masters applications of ICT from file management and text processing to authoring tools and programming?
Intensity of recreational use of ICT	How often and how many different ways a student uses ICT at home?
Intensity of educational use of ICT	How often a student uses ICT as a tool for learning at school?
Attitude towards ICT	What do students think about ICT; is mastery of ICT a very important aspect of answering to challenges of one's own life?
Inclination towards learning with ICT	Do the students think that they are allowed to use ICT sufficiently in their university work or would they like to greatly increase its use there?
Attitude towards using ICT tools	What are the students' attitudes towards using computers as tools of writing and visualization?
ICT support for learning	Do the students think that the use of ICT improves their learning outcomes and encourages them to study harder?
Progressive problem solving	Are the students ready to put a lot of effort and continuously take challenges in order to learn ICT?
Adopting the experts' role	To what extent have the students adopted the role of an expert; coaching their fellow students, lecturers and other people in learning ICT? Are they doing ICT work outside college?

Scale	Description
Networking	What kinds of connections are there between students interested in ICT and the expert culture in the domain? How deeply are student experts in ICT networked with each other?
Collaborative use of ICT	Do the students think that ICT socially isolates people from each other, or do they think that the use of ICT strongly involves collaborative activity?

Adopted from Scardamalia & Bereiter, 2006.

A further group of scales consisted of items that focused on determining students' attitude to ICT. The students were asked to assess a set of items related to their beliefs about the significance of ICT in answering the challenges of the future. This scale was labeled as attitude towards ICT. Another group of items was intended to assess whether the students think that they are allowed to use ICT sufficiently in their schoolwork or whether they would like to use ICT more intensively. This scale was labeled as inclination towards learning with ICT.

In addition, the researchers assessed, in the questionnaire, what the students thought about ICT as a tool. This scale was labeled as attitude towards using ICT tools. Finally, the researchers assessed the students' beliefs about the effects of ICT on their own learning and motivation. This scale was labeled as ICT support for learning. Based on the knowledge from the fields of psychology and education, the researchers defined learning as a process of developing expertise (Bruer, 1992; Hatano & Inagaki, 1992; Olson & Bruner, 1996). The researchers generally considered a student as ``expert'' in-so-far as he or she has a rich body of accessible and usable domain knowledge (Chi, Glaser, & Ress, 1982). The metaphor of student-as-expert is based on the assumption that an ordinary student can, to a significant extent, adopt some essential features of an expert role, specifically, taking on challenging knowledge-building goals and adopting practices that facilitate high educational achievement and cognitive development (Scardamalia & Bereiter, 1994).

In the present study, several scales were designed to assess the nature of students' expertise in ICT. The researcher analyzed students' expertise in ICT in detail by examining whether they reported a readiness to take on challenging problems to solve in order to learn ICT (Bereiter & Scardamalia,1993). This scale was labeled as progressive problem solving. Further, the researchers aimed to assess to what extent the students using ICT intensively had, according to their report, adopted the role of an ICT expert. This scale was labeled as adopting the expert's role.

An essential aspect of the development of expertise is to function as a part of an expert culture and in support of a network that promotes development of expertise (Brown, Collins, & Duguid, 1989; Ericsson & Lehmann, 1996). Therefore, the questionnaire contained a scale for assessing the students' degree of ICT-related networking. This scale was labeled as networking. Finally, researchers assess to the extent to which ICT was interpreted as a tool of common activity. This scale was labeled as collaborative use of ICT. Prior to analysis, the data were examined for missing values. A small number of participants (5-10%) left some parts of the questionnaire empty, perhaps interpreting those parts as not relating to them. Considering that this percentage of missing values was low and those values appeared to be randomly distributed throughout the data, the missing values were ignored.

The reliabilities of individual scales

Means and Cronbach alphas for different scales are presented in Table 3. The table also contains numbers of items for each scale as well as their means and minimum and maximum values. The internal consistency of the scales varied from 0.57 to 0.93. The reliability analysis revealed that the scales were satisfactory and provided a good basis for further analyses. To analyze relationships between the measures, the researchers calculated a sum variable for each scale (a sum of all individual items in a scale). Examination of the reliabilities of the scales indicated that the sum variable represents the phenomenon being investigated in a rather reliable way. Result analysis was based on these sum scores as well as principal component scores in addition to distributions of individual variables.

Table 3 : Reliability of the scales

Scale	Number of item	Cronbach alpha	Item mean	Minimum/ maximum
Technical ICT skills	15	0.93	2.58	1.68/3.97
Intensity of recreational use of ICT	7	0.85	1.83	1.31/2.76
Intensity of educational use of ICT	4	0.84	1.64	1.28/2.94
Attitude towards ICT	6	0.79	3.69	2.91/4.15
Inclination towards learning with ICT	5	0.79	3.43	3.00/4.03
Attitude towards using ICT tools	4	0.68	3.56	3.23/3.78
ICT support for learning	4	0.85	3.46	3.0/4.0
Progressive problem solving	8	0.84	3.24	2.44/4.07
Adopting experts' role	5	0.65	3.80	3.5/4.4
Networking	5	0.78	2.03	1.52/2.61
Collaborative use of ICT	5	0.57	3.2	2.69/3.7

Findings

Relationships between the scales

Factor analysis was employed to extract principal factors using SPSS on 11 sum scores that represented students' skills and practices with respect to ICT, as measured by the self-report questionnaire. A screen plot was used to estimate the number of factors. In the analysis, the researchers arrived at a three-factor Varimax-solution that explains 71.4% of variance of the variables. In Table 4 results are presented of a principal-component analysis based on sum scores derived from the above-described scales.

The first factor (F1) had high loadings on positive attitude towards ICT and inclination to use ICT as a tool of learning. The factor was characterized by a view according to which the use of information technology both improves motivation and learning achievements. In addition, on the factor were loaded positive attitudes towards ICT and using of ICT tools, progressive problem solving, as well as using ICT collaboratively. This factor that appeared to represent a view that ICT helps students to learn was labeled ICT Facilitation for Learning. The second factor (F2) was characterized by high loadings on technical ICT skills and intensive use of multiple applications of ICT for recreational purposes. On the same factor was loaded, also, functioning in an expert's role; i.e., participation in coaching one's fellow students and other people in ICT skills. Further, networking with expert cultures of ICT characterized this factor. The factor was labeled Expertise in ICT.

Characteristic of the third factor (F3) were high loadings on intensity of self-reported use of ICT at school. This factor was somewhat associated also with skills of using ICT indicating, on one hand, that intensive use of ICT at school may support development of ICT skills and, on other hand, that students interested in ICT are actively searching for opportunities to use ICT in their work. Existence of the third factor indicates that the students' opportunity to use ICT at university depended on available and accessible technical resources as well as a curricular support for ICT usage, more than their expertise in ICT. The factor was labeled Intensity of Using ICT at School.

Table 4 : How students representing different study year and gender groups used ICT

Factor loading of the scales used on the study[a]

Scale	Factor 1[b]	Factor 2[b]	Factor 3[b]
Technical ICT skills		0.701	0.400
Intensity of recreational use of ICT		0.810	
Intensity of educational use of ICT			0.887
Attitude towards ICT	0.784		
Inclination towards learning with ICT	0.780		
Attitude towards using ICT tools	0.733		
ICT support for learning	0.847		
Progressive problem solving	0.716	0.465	
Adopting experts' role		0.610	0.468
Networking	0.388	0.616	
Collaborative use of ICT	0.761		
Percentage of variance	33.6	26.1	11.7

a Principal component analysis, three-factor solution.

b The three factors explain 71.4% of variance. In the table loadings under 0.30 are not represented.

Relationships between students' academic year and gender and the principal component scores obtained through the factor analysis are presented in Table 5. The analysis revealed that the male students emphasized ICT Facilitation for Learning (F1) more than the females. However, in comparison to the huge gender difference in ICT skills (see below), the difference between male and female students' enthusiasm about ICT was not very big. Group comparisons revealed that the principal-component

score of ICT Facilitation for Learning (F1) of all groups of male students was higher than that of 1st year or 3rd year- female students. Further, the analysis indicated that both 3rd year male and female students emphasized the role of ICT for learning more strongly than other year groups of students. The data, as earlier stated, do not permit the assessment of a connection between the pattern of enthusiasm and the self-selection of respondents from among students actively involved in ICT.

The analysis indicated that female students scored significantly lower on scales associated with Expertise in ICT (F2) than male students. Male students' F2 scores were higher in all year groups than female students' corresponding scores; self-reported expertise in and intensive use of ICT is currently typical for the young males. The results may be affected by the male students' tendency to overestimate their own competence in ICT (see below). Further, the results indicated that 1st year male students' ICT skills appeared to be at a lower level than those of the other year groups. A corresponding phenomenon was not present for the female students.

An analysis concerning the third factor (F3) indicated that the intensity of using ICT at school was lowest for the 3rd year old female students; they appeared to use ICT significantly less than the other academic year groups in their school work. Correspondingly, it was found that 3rd year male students used ICT at school less than 1st year males. To conclude, in our cross-sectional perspective, and based on our sample of more actively involved students, the intensity of reported use of ICT at school appeared to monotonically decrease over educational levels from 1st year to 3rd years.

Table 5 : Intensity of use of ICT at university

Mean Factor scores of F1, F2, and F3 as a function of students' academic year and gender. Mean/Standard Deviation and F- value[a]

Age	**Gender**				**ANOVA**	
F1: ICT Facilitation for Learning						
	Female		**Male**		**Effect**	**F**
	M	**SD**	**M**	**SD**		
1st year	-0.26	1.1	0.11	1.1	Year	6.4**
2nd year	0.05	1.0	0.34	0.93	Gender	10.9**
3rd year	-0.27	0.98	-0.02	0.87	Year x Gender	0.86

F2 : Competence of using ICT

	Female		**Male**		**Effect**	**F**
	M	**SD**	**M**	**SD**		
1st year	-0.46	0.76	0.05	1.2	Year	2.9
2nd year	-0.42	0.94	0.47	1.0	Gender	71.9***
3rd year	-0.34	0.72	0.44	0.94	Year x Gender	1.4

F3 : Intensity of using ICT at school

	Female		**Male**		**Effect**	**F**
	M	**SD**	**M**	**SD**		
1st year	0.18	0.88	0.50	1.1	Year	20.2***
2nd year	0.05	0.90	0.36	0.99	Gender	32.0***
3rd year	-0.69	0.80	-0.15	0.90	Year x Gender	0.94

a Degrees of freedom: Year (800), Gender (420). Academic year x Gender (800).
*p 0.05, **p ***p .

The analysis revealed that 42.5% (n = 64) of the students had a computer at home and all the students had, in principle, access to computers at school. Further, the analysis indicated that more than a half of the students had access to the Internet both from home and from school. Intensity of using ICT was examined by asking the students to assess how often they use information technology for educational and recreational purposes. Usage of ICT was examined by performing a paired-sample t test; i.e., we compared each student's (n=150) assessment of his or her intensity of recreational and educational use of ICT to each other student. As expected, the analysis indicated that the students used ICT significantly more intensively for recreational than educational purposes ($t = 16.5$ (150), $p < 0.0001$). Further, the results revealed that the male students used ICT for recreational purposes much more intensively than female students ($F(450)=38.0$, $p<0.0001$) regardless of year of study group. In addition, we observed a statistically significant interaction effect between year of study and gender ($F(802)=2.9$, $p < 0.05$). This reflects the fact that, within the cross-sectional perspective, intensity of using ICT for recreational purposes decreased as a function of year of study in the case of female students, but increased in the case of male students. Although there was a significant gender difference when recreational use of ICT was examined, a corresponding difference was not found for educational use of ICT. Intensity of reported use of ICT for learning and studying is apparently determined by variables other than recreational use of ICT; it is hypothesized that it is determined by access to computers and the role of ICT in the curriculum (Sinko & Lehtinen, 1999).

It was encouraging that, regardless of the differences concerning recreational use of ICT, over 20% of these female students reported that they used ICT daily. For the selected universities, 70% of females reported that they used ICT at least weekly. Many of the students used computers for several hours a week. A small group of students (n=11) used ICT more than 6h per day. Concerning the school subjects in which the students used ICT, our analysis indicated that the students were employing ICT relatively little as a general-use tool in science or humanities.

ICT was used in special courses on information technology as often as all the other school subjects together. The study also examined how the students used the Internet. A little less than 20% of the students used electronic mail

(email) daily, 35% weekly. "Surfing" on the net or searching for information from the Internet were relatively frequent activities: approximately 40% of the students reported engaging in these activities at least once a week.

Attitudes towards ICT

Results of the principal component factor analysis indicated that gender differences concerning F1 (ICT Facilitation of Learning) were significant, but less drastic, than differences in skills of using ICT. The analysis of the sum score representing attitudes towards ICT indicated that the male students' (M = 3.9, SD=0.82) attitudes towards ICT were more positive than those of the female students (M = 3.4, SD=0.77) ($F(413)=38.8$, $p > 0.0001$). Regardless of the gender differences, however, only a small proportion of students had a very negative attitude toward ICT. For instance, only 22 fully disagreed with a statement that "Computers will be very important in human life". It was also encouraging that only a small proportion of the students had a negative attitude towards using ICT as a tool for learning. In such an assessment of negativity, however, it is important to re-state that the selection of students using ICT intensively may have had the effect of reducing negative responses. The students were asked also to assess whether ICT promotes better learning outcomes. The analysis indicated that the male students (M = 3.7, SD=0.94) believed in ICT facilitation of learning more strongly than did the female students (M=3.2, SD=0.92) ($F(413)=34.8$, $p< 0.0001$). For instance, when asked to assess a statement, "I put more effort into studying when I am allowed to use information technology", approximately 60% (n=54) of male and 30% of female (n = 15) students fully or partially agreed with the statement. In accordance with these findings, both male and female students expressed their interest in using ICT more intensively in their studies. There was a gender effect; male students emphasized this idea more strongly than female students did. Yet almost half of the female students partially or fully agreed with a statement, "I would like to use ICT more in my school work".

Expertise in ICT

The students' skills in using ICT were examined by asking them to assess how well they had mastered certain applications of ICT. Because the students' skills were evaluated using self-report, the questionnaire included a multiple-choice section designed to assess the students' knowledge of some basic concepts related to ICT. The responses to the test were scored so that for a correct answer, a student got +1; wrong answer, - 1; and "I do not know" answer, 0 points.

The findings show that the male students self-assessed skills of ICT ($M = 0.44$, $SD=1.0$) were higher than those of the female students ($M = -0.51$, $SD=0.71$) ($F(402)=110.1$, $p<0.0001$). The academic year of the students did not, however, affect self-assessed ICT skills. The results reveal that 1st-year males overestimated their competence in ICT. The self-reported ICT skills of the 1st year females corresponded quite well to their real performance. The 2nd year male and female students' self-assessments, in contrast, appeared to be somewhat lower than their actual competence. It should be noticed, however, that the test did not consider all aspects of ICT skills, only familiarity of some basic concepts. Nevertheless, the assessment provides partial evidence supporting the reliability of the students' self-assessment, in the context of the selection of the schools, and the self-selection of the participants, which may have had the effect of producing a higher level in reported skills.

An assessment of the students' ICT skills revealed that they had mastered text processing, graphical processing, information networks, and file management. However, they were not so proficient in SPSS, desktop publishing, programming or computer hardware. One of the aims of the present study was to examine the nature of students' ICT expertise. Important characteristics of experts are to function in the role of a mentor or a coach, networking with other persons interested in the domain, being in contact with professionals of the domain in question, searching for challenging problems and solving them collaboratively. In the following, the researchers will analyze various ways in which ICT expertise of the participants manifested itself. One of the basic characteristics of experts is that other persons working in one's environment repeatedly ask for advice in

solving of complex problems that they cannot solve on their own. An actor may achieve a position of an expert in his or her local community even if his or her qualifications are very limited in comparison to professionals. Thus, expertise may be considered as a relative phenomenon. Approximately 32% (n = 29) of the male students and 14% (n = 7) of the female students estimated that they were more competent in some area of ICT than their classmates. This estimate did not vary according to year level. About 28.1% (n = 25) of male and 9.3% (n = 5) of female students reported that they have been asked for advice in ICT-related matters daily or at least once a week. It also appeared to be very common for the students to provide ICT support for their parents and siblings.

Experts commonly provide pieces of advice and support other people in acquiring new skills in a given domain of knowledge. In order to assess the nature of the students' expertise, the researchers assessed relations between the ICT support the subjects had been receiving and providing. In this data, the lecturers appeared to have a central role in facilitating students' ICT skills; on the whole the students estimated that they receive support more than provide it. However, 17 students, one of them female, provided pieces of advice to lecturers at least once a week. Therefore, students acting as lecturers' coaches in ICT appeared to be an emerging practice at the schools studied, although it was not yet very widely distributed. These students reported that, in addition to lecturers, fellow students also provided significant support.

An analysis of relations between received and provided ICT support indicated that the female students' estimate of the amount of support they had received was substantially lower than the estimate of the male students regarding support the males received ($F(402)=59.9$, $p < 0.0001$). The estimated degree of ICT support was also associated with academic year ($F(802)=5.46$, $p < 0.004$); 3rd year students' estimate of the amount of received support was lower than that of the 1st year students. It was also intriguing that female students' assessment of the support they had themselves given was higher than that of the male students' ($F(402)=7.7$, $p < 0.006$). It is possible that while starting to learn ICT skills, the female students were very motivated to share their emerging skills with their fellow

female students who might not have any experience of ICT; therefore, they tended to remember many situations in which they were able to share their emerging competence.

With respect to the students' expertise in ICT, it is encouraging that 10% (n = 9) of male and 4.2% (n = 2) of female students reported that they were participating daily or weekly in maintenance of ICT in their schools. In addition, 17.5% (n = 26) of students, 6 of them females, reported that they were doing ICT related work outside of school weekly. Altogether 15 students (three females) had received financial compensation from relatives or other adults for helping to solve ICT related problems. Further, approximately 32% (n = 29) of male students and 7% (n = 4) of female students were certainly or almost certainly planning to seek an ICT related profession.

Examination of the data revealed that a majority of the students experienced ICT as a tool for collaborative learning. About 60% (n = 90) of the students reported that it is much more fun to use ICT with others than alone. Further, 40% (n = 60) of them proposed that better learning results are achieved when ICT is used collaboratively. The emphasis on collaboration was not associated with the gender of the students, and there was only a weak association with year of study (1st year students emphasized collaboration slightly more than 3rd year students).

Discussion

Our evidence from this cohort of students, who were highly involved in ICT, was that they were frequently developing prerequisites for productive participation in a knowledge society, in particular, a positive disposition toward collaboration in thinking and working. Yet the evidence for gender differences in ICT skills raises potential concerns for equality. It is very encouraging that the gender difference in ICT facilitation for learning was not so strong as that of ICT skills. Female students, especially younger ones (1st years), appeared to have a rather positive attitude towards ICT in general and the use of ICT as a tool for learning in particular.

Yet further investigation is required to determine the degree to which the attitudes of these highly involved female students are typical of other

young female students. In establishing new resources for learning and development to support the female students' learning, it is essential to integrate educational use of ICT with various subject domains and subsume the use of ICT, thoroughly, under overall pedagogical goals (Lipponen, 1999; Lipponen & Hakkarainen, 1997; Sinko & Lehtinen, 1999). Thus far, however, ICT is mainly studied as a separate subject instead of being used as a tool for solving subject-domain problems. Further research is needed to determine the prevalence, generally, of this problem in Kenyan universities. The study, given the limitation of self-report, indicates that a large number of the students, most of them males, mastered ICT very well and were able to take responsibility for many kinds of expert tasks, such as maintenance of ICT at university or coaching their fellow students or lecturers. Adoption of an expert's role was closely connected with networking - being in contact with other persons interested in the domain or with professionals. Considering the pedagogical goals of the university, this expert functioning is very positive, and may also significantly facilitate development of other academic skills. The fact that many students who were not experts in ICT were reportedly ready to take on challenging problems indicates that educational use of ICT may encourage a larger numbers of students to set themselves more ambitious learning goals.

Limitations of the data should be taken into consideration when assessing the import of the findings as reported above. First, the 10 universities selected were a small sample of all the universities and colleges all of whom are involved in ICT acquisition and utilization in one form or another. Further evidence is required to determine the extent to which the selected university' programs, and students' activities and attitudes might differ systematically from the programs and student characteristics of the other, less involved students in ICT usage in universities. Second, even for these 150 students, the self-report data do not necessarily provide a basis for a reliable estimation of these young persons' actual skills or use of ICT. Evidence from the study suggests that 1st year male students tended to overestimate their competence in ICT (on the basis of the measures applied in the study), and the study has incomplete evidence about other possible areas of students' overestimation or underestimation. Although the self-reported level of competence in using ICT would not be a completely

reliable measure (e.g., because increased understanding may produce more strict criteria for competence), the findings of the study makes it possible to submit that it is a reasonable hypothesis that the measures, taken together, provided reliable information concerning these students' attitudes and activities regarding ICT. As the study is among the first to address, in detail, particular aspects of ICT in the universities in Kenya, especially those connected with enhancement of the learning process itself, there is a need to address the limitations of the data through larger-scale studies based on random and stratified sampling, especially balanced for ICT interest (i.e., controlling for the volunteer variable), social class, rural setting, and parents' background, particularly in relation to computer availability. It is essential that there be rigorous follow-up based on approaches that give a comprehensive, overall picture of Kenyan University students in relation to ICT, including those who may be put off by ICT or deterred by the way it is situated or presented.

Conclusion and Recommendations

It is surprising that the students representing faculties/ universities that are known to use ICT intensively, were still not using ICT as an integrated part of their university study life, and yet Kenya is one of the most ICT survy countries in Africa. An important reason for the low intensity of ICT usage appears to be that computers were usually located in separate computer laboratories instead of being universally available where learning and instruction actually occurs. Consequently, students and lecturers, in many cases, had access to ICT only during special ICT courses. In order to facilitate intensive and pedagogically meaningful use of ICT, it is necessary to increase computer access points and integrate ICT very strongly with studies in various subject domains. The full integration of ICT in all areas of curriculum instruction is something students need to experience in preparing themselves for the information society they will inherit.

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AGENT- BASED ADAPTIVE LEARNING MODEL FOR INTERMITTENT INTERNET CONNECTION CONDITIONS

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Abstract

Many scholars are interested in and are determined to improve the e-learning learning mode and provide easy access to learning information for various groups and individuals. There is need to incorporate into learning systems the ability to dynamically classify learners as they go on with the learning process. Learner classification is used to adaptively provide relevant information for the various categories of learners. There is also need to allow learners to learn while they are either on-line or off-line. In many parts of the world, especially in the developing world, most people do not have reliable continuous Internet connections. This paper reports a prototype that implements an adaptive presentation of course content under conditions of intermittent Internet connections. This prototype was tested in February 2011 by two groups of undergraduate students studying a database systems course. One group used it online and a control group used it offline. This study found out that it is possible to have learner models that can adapt to learner characteristics such as learner's level of knowledge and that learners can be able to learn under in both on-line and off-line modes with adaptation working correctly.

Keywords: Application programming interface (API), K-nearest neighbor (KNN), Learner model, Adaptive learning, Intermittent Internet connection, agent-based e-learning.

Introduction

E-learning systems are introduced in education to enhance learning by making available suitable learning materials to learners. There are various systems that have been developed and implemented for learners. However, most of these systems are static and inflexible. These traditional systems are developed on the basis of "One-size-fits -all" (Blochl, Rumetshofer and Wob, 2003). They have (generally) been designed and developed to cater for and /or to serve all categories of learners. They do not take care of individual learning abilities, needs and performances. As a result, they do not therefore present to learners only relevant information but instead all information (learning materials) from the basic to advanced concepts is availed at the same time. This wholesome information given to learners without considering their specific requirements makes them experience difficulties in perceiving and applying the information when answering quizzes and solving problems. These systems are also developed to work under constant Internet connections (web applications that must be online to function). In these instances, the learners can only learn when online. These concepts are found in all e-learning systems which have been deployed by learning institutions and even organizations that train their staff and clients using Learning Management Systems (LMS).

In the modern world, although Internet accessibility has increased significantly, still many areas do not have access reliable internet connection, if at all they have it. This is especially witnessed in rural areas of the developing world where most Internet Service Providers (ISPs) have not invested adequately in infrastructure to facilitate Internet connectivity. This limitation locks out many people who would otherwise have wanted to participate in this learning process since they do not have access to the Internet. This disadvantaged category of people can only learn by being present at a learning centre. Moreover, even in areas where Internet is available, the connection does not always have 100% uptime. During the Internet downtime, learning does not take place unless there is a physical instructor and a learner at the same venue (face to face) or the learner has to wait for Internet connection to be re-established.

Furthermore, the LMSs that have been developed and distributed for use are installed as applications and the whole package must be in place for implementation and subsequent usage by the target groups. It is necessary to have some modules which can be plugged into a system to provide additional functionalities as may be necessary, such as synchronization of course content after loss of connection.

This paper outlines how to overcome the above challenges by developing an agent based personalized adaptive learning model. This model is deployed as a service using agent technology and not just as an application as is the case with all other available Learning Management Systems (LMS). The service or agent is packaged as a Dynamic-Link Library (DLL).

The service developed in this research can integrate with any LMS and has the advantage of being deployed both online and offline learning (under intermittent Internet connection conditions). A framework is designed in the form of an API (Pai., Wang and Jiang, 2000) that can be integrated into any LMS and can be used to dynamically classify learners in various categories as defined by information in the learner model.

The K-Nearest neighbor algorithm (KNN) was used to classify new learners (Mitchell, 1997). KNN is part of supervised learning that has been used in many applications in the field of data mining. KNN is a method for classifying objects based on closest training examples in the feature space. An object is classified by a majority vote of its K neighbors and K is always an integer. The neighbours are taken from a set of already existing training examples for which the correct classification is known (Srihivok & Intrapairote, 2003).

Related work

Adaptive e-learning systems

An adaptive e-learning system was proposed by Blochl et al (2003). This system applied the user-centric approach to improve its usability and acceptance by users. E-learner requirements were introduced into the system including user skills, learning styles, learning strategy and other user profile

information (Blochl et al, 2003). In this system, the user's learning activities are observed and are used to update the user's profile. The e-learning system is adjusted according to the dynamic user profile.

Component technologies and artificial intelligence are used to deliver e-learning. These components include: pedagogy agents, interactivity level, quality of feedback, control strategies, tutorial remediation and student models.

Pedagogy agents are used for integrating the behavior of users and e-learning components of the system. Pedagogy agents can be used to check student participation, track student progress through task procedures and address students' errors. Other agents can be used as tools for feedback. User performance during instruction should be analyzed to monitor learning. Control strategies, planning for content and delivery strategies should be based on learner knowledge and concept structure such as curriculum. Tutorial remediation is the component responsible for selecting appropriate actions to be performed by the learner in order to accomplish a pedagogy task. A student model can be used to render individualized instruction in the system. Students instructional activities can be filtered, analyzed and sorted based on the individual's learner model. This kind of system adapts to changing knowledge requirements of the learner, is interactive and provides regular access to resource materials (Atolagbe, 2002).

Agent technology

A software agent is a computer program that is capable of autonomous (or at least semi-autonomous) actions in pursuit of a specific goal (Krupansky, 2003). The autonomy characteristic of a software agent distinguishes it from general software programs. Autonomy in agents implies that the software agent has the ability to perform its tasks without direct control, or at least with minimum supervision, in which case it will be a semi-autonomous software agent. Software agents can be grouped, according to specific characteristics, into different software agent classes (d'Inverno & Luck, 2001). There is no consensus in literature on the different types or classes of software agents. As software agents are commonly classified

according to a set of characteristics, different classes of software agents often overlap, implying that a software agent might belong to more than one class at a time. For the purpose of this research, we distinguish between two simple classes of software agents, namely stationary agents and mobile agents. Agents in both these classes might, or might not have, any or a combination of the following characteristics: a user interface, intelligence, adaptivity, flexibility and collaborative properties (Pacheco & Carmo, 2003).

Whether or not an agent has a user interface depends on whether it collaborates with humans, other agents or hosts. User interfaces are commonly found where agents interact with humans. According to Wooldridge (2001), intelligence implies the inclusion of at least three distinct properties, namely reactivity, pro-activeness and social ability. Reactivity refers to the agent's ability to perceive its environment and respond to changes that occur in order to achieve its design goals. Pro-activeness is the agent's ability to take the initiative in its environment in order to achieve its design goals. *Social ability* alludes to the collaborative nature of the agent.

There are different definitions of the collaborative nature of software agents. For the purpose of this paper we use Croft's (1997) definition in which the collaborative nature of a software agent refers to the agent's ability to share information or barter for specialized services to cause a deliberate synergism amongst agents. It is expected of most agents to have a strong collaborative nature without necessarily implying other intelligence properties. Adaptivity is a characteristic that can also be regarded as an intelligence property, although it is not counted as a prerequisite for identifying an agent as intelligent. Adaptivity refers to an agent's ability to customize itself on the basis of previous experiences. An agent is considered flexible when it can dynamically choose which actions to invoke, and in what sequence, in response to the state of its external environment (Pai et al. 2000).

A *stationary agent* can be seen as a piece of autonomous (or semi-autonomous) software that permanently resides on a particular host. An example of such an agent is one that performs tasks on its host machine such as accepting mobile agents, allocating resources, performing specific computing tasks and enforcing security policies.

A *mobile agent* is a software agent that has the ability to transport itself from one host to another in a network. The ability to travel allows a mobile agent to move to a host that contains an object with which the agent wants to interact, and then to take advantage of the computing resources of the object's host in order to interact with that object. An example of a system using mobile agents is a flight booking system where a logged request is transferred to a mobile agent that on its part traverses the web seeking suitable flight information quotations as well as itineraries.

Agent-based e-learning systems

Web mining techniques have been used to build recommender agent-based e-learning systems. An agent recommends activities to a learner based on his access history. The recommendation should be an on-line activity including doing an exercise, providing messages on conferencing systems, running an on-line simulation, or specific web resources to use. The agent is said to improve course material navigation and assist the on-line learning process (Zaiane, 2002). By observing user typing events, behaviors while studying lessons on web browser, tasks and examples, errors made by users, and debugging events on the editor, the agent understands user behavior (Mungunsukh, and Cheng, 2002).

Machine Learning Algorithms

Supervised machine learning algorithms, such as KNN (Mitchell, 1997), are used in the process of personalization of an e-learning course. A function (f) representing the relationship between the inputs (X) and desired outputs(Y) in the training examples (D) is deduced. The value of function f is gotten from a certain fraction of training data d by finding hypothesis which agrees with f from members of d. There is also consideration of the inductive biases in arriving at the deduced hypothesis representing the relationship between inputs and outputs.

Research Design and Methodology

The model was set up in a computer laboratory and 30 students were allowed to use it for 6 hours a day for 5 days. An instructor introduced the system to the students. An explanation was made to students on the objectives of the model, how it works and the expected outcomes of the experiment.

The instructor demonstrated to learners how to use the system: how to register, answer questions, the user interface changes as a result of adaptation, subsequent processes and finally how to fill in a questionnaire about the system. They (students) were shown how to learn when online and also when offline, they were given an explanation of similarities of individual profile status in both remote and local models, how to make a change on a local model while offline, connecting to remote model and how to check the similarities of the profiles locally and remotely.

Two sets of learners were used. One group connected to intranet and internet, downloaded the information to the database in the local module and used it offline to learn. The other group did the learning online. The two groups were interchanged after studying half the course and the process was repeated. The results of the test i.e., test scores were investigated to find out if there was a resemblance between the experiments i.e., learning online and learning under intermittent conditions but supported by the DLL developed.

As a second part of the evaluation, the learners were required to assess the system. A questionnaire was provided to be answered by students after the learning process. The system provided the questionnaires online upon satisfying all the requirements. The questions were designed to capture data related to the research objectives. Aspects considered include model usability, challenges in using the system and recommendations for improving the system.

The learning process

The following is a detailed description of the learning process as designed in this research:

Step 1: Registration of new learners

This is the first step where details of a new learner were captured and the user name and password were created for subsequent logins and use of the system. An existing learner could also login and continue with the learning process. The learner's updated profile would determine the information that would be availed to him.

Step 2: Prerequisite questions

These questions were designed to be able to test if the new learner meets the pre-requisite conditions so that he can be allowed to study the course. A combination of a number of the questions showed whether the new learner qualified to proceed with learning the course or not.

Step 3: Initial classification questions

At this stage, questions were designed that covered all sections of the course, beginning with the basic level or section through to the expert level. Basic level contained the introductory concepts of the course and the expert level had the most advanced concepts of the course. Questions were designed in such a way that those presented at the beginning tested the basics of the course while the questions presented at the end tested the complex concepts of the course. Each question was given a weight. The weights also reflected the level of the course being tested by the question, hence weights increased from first question to the last question. If a learner failed the first questions he would be classified as a basic learner. The way a learner performed in this section, together with other learning attributes, was used to classify him into an appropriate class level.

Step 4: Pointer to the appropriate level of notes and questions

Once a learner's class level was determined, the relevant learning information and the subsequent section's questions were highlighted. Section notes'

reading time was calculated. The learner had an option either to read the section notes or choose to answer questions only. In the former case, the learner was provided with one set of the section's quiz at the beginning (pre-test) and classification attributes such as quiz time and scores were determined. For the latter case, two sets of the section's quizzes were provided where the second quiz (quiz after the pre-test) was detailed.

Step 5: Determine new class level

Subsequent classification was done to determine the new class level for the learner and relevant information was relayed to the learner.

Step 6

Steps 4 and 5 were repeated until expert level was reached, as long as the learner continued making progress in level of acquired knowledge, among others.

Step 7 : Course evaluation

Upon fulfilling all the requirements for the expert level, both soft and hard copies of evaluation questionnaires were provided and the learners' assessment of the system was captured.

System Architecture

The model had four modules namely learner module, classifier agent module, synchronizer agent module and data storage module. All the modules were linked to work as one module. The modules could also function independently as long as the database (data store) was available. The architecture of the system is shown in Figure 1.

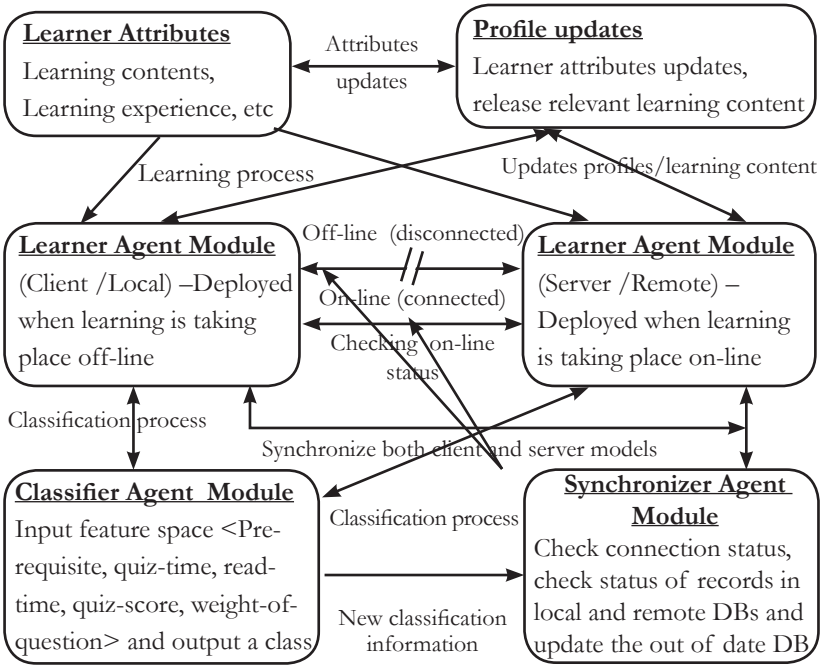

Figure 1: Architecture of the e-learning system

1. Learner agent module

The main function of the learner module was to facilitate the learning process both offline and online. This module made possible the interaction between the learner and the system. This is where the learner could register or login, access his profile details, get learning materials, read the notes, answer section quizzes and view all changes as they occur. This module was connected to the data store and displayed information from the data store to the learner and instructor.

There were two versions of learner model namely client model and server model. Client model was installed on the client machine (local machine) which was used while the learning was offline. The server model was installed in the server machine (remote) and was used to do online learning. It also facilitated learner model updates.

2. The classifier agent module

- *The classifier*

The classifier module or classifier DLL was a stationery agent that used KNN algorithm to classify new learners who entered the system for the first time and to do all other subsequent classifications for existing learners. K is an integer parameter representing the number of nearest neighbours to a new learner. The most common class among the K nearest neighbours becomes the new learner's class. The default value of K can be fixed to an odd number such as 3. However, a low value of K restricts the classification of the new learner to classes of only a few neighbours. The best choice of K depends on the data and generally, larger values of K reduce the effect of noise on classification but make boundaries between the classes less distinct. A good K is chosen using heuristic techniques such as cross validation.

K should also be an odd integer number so that majority vote is always attained. Even numbers for K can result in a tying vote that can hamper correct classification. In this research k was 9. This figure was arrived at after considering that learners would be increasing with time and also to avoid restricting classification to a few training examples.

Feature selection

In *selecting features* (attributes) for the learner model which represents learners, the training data was designed to have features whose values could be combined to determine the class of the learner. If the attributes are too many, say more than 20 but where only 2 of these are relevant in the determination of the class of a particular query instance (the new instance which is to be classified), the problem called curse of dimensionality is experienced (Mitchell, 1997). The distance between training examples and the query instance are dominated by a large number of irrelevant attributes. To avoid this scenario, this research used 5 attributes namely, score, quiz time, reading time, pre requisite score, and weight of questions.

Presented next is a brief explanation of how the features were determined.

Score: Normally students' performances are determined by their scores in the examinations. All learning institutions use the scores as a major factor in grading their students. The higher the score a student attains, the higher the grade the student is awarded.

In this research, we designed score ranges for all the classes, guided by the grading system used for undergraduate computing courses in the university where the study took place. The ranges and their classes are shown in Table 1.

Table 1: Student Classes and their Corresponding Score Ranges

Score Range	Class
0-39	Beginner
40-59	Intermediate
60-79	Advanced
80-100	Expert

Quiz Time: This refers to the time the learner uses while taking a test. Normal practice is that examinations have specific time allocated for them. When the allocated time is over, the learner sitting for the examination stops or is timed out in case of online examination.

In this research, the system did not time out a learner if the set time was exceeded. Instead, the more the time spent after the set time, the lower the performance for the learner and the lower the class assigned. On the other hand, if the learner takes less than the set time to sit for the examination, a higher the level of classification was assigned. A combination of both performance and time or other resources spent in achieving the learning is called learning efficiency (Van Marrienboer & Sweller, 2005). It is a measure of a learner's expertise. Expertise is higher for students who achieve some score with minimum effort compared to those who achieve the same score after spending more resources.

Reading time: This is the time taken by the learner to read the learning material for the level or section. Normally, there is no limit in time for

reading notes in preparation for an examination. A learner can take as long as possible to read the notes. In this research, a reasonable time threshold was set for reading the notes to enable both slow readers and fast readers to complete a topic. It was adjusted during testing of the course to make it appropriate.

In considering this attribute, it was assumed that fast readers also perform better than slow readers hence the less time a learner takes to read the notes, the better the performance that is achieved and therefore, the higher the class assigned. A learner who takes so much time beyond the threshold is assumed to be a slow learner hence was assigned a basic/lower class level.

Pre-requisites: These are the conditions that a learner must satisfy before being allowed to proceed with the learning process. They include interest in studying the course. While considering this attribute, the learner may either meet or may not meet the conditions. This attribute cannot be used independently to classify a learner but it must be combined with other defined attributes for proper classification.

Weight of question: The questions were weighted in an increasing manner from the first question to the last question. In addition, the questions were designed such that basic questions come first and complex ones came towards the end. Considering the design of questions, it was prudent that basic questions were assigned less weight compared to complex questions. If a learner failed to correctly answer basic questions then it was assumed that he was still a beginner hence was assigned to the beginner level class.

- *Choice of the model training data*

The training data had two sections: the feature values and the target function values (i.e., the associated class). A record in the training dataset was represented as a vector of the form $<a_1, a_2, a_3,\ldots n>$ $<T_a>$ where $<a_1, a_2, a_3,\ldots,a_n>$ was the feature vector and $<T_a>$ represented the target function value.

In this research, the training example vectors were defined as <prerequisite, score, readTime, quizTime, weight> <course level>. Table 2 has sample training examples to demonstrate how the 2 vectors were populated.

Table 2: Sample Training Data Based on the Feature Vector Format

Prerequisite	Score	ReadTime	QuizTime	Weight	Course Level
1	91	40	15	8	Expert
1	75	47	10	9	Advanced
1	30	65	35	4	Beginner
1	50	50	20	7	Intermediate

Given the training data, when a new learner joins with feature vector values such as <1, 45, 43, 10, 9> <?>, the KNN algorithm takes the new instance (also called query instance) and compares it with the training data. The distances between the new instance attributes and the training data attributes are calculated.

The total distance of each new training example from the query instance was determined by summing all the attribute distances for the query instance. The closest 9 neighbours were identified and the most popular class among these examples was assigned to the new instance. The assigned class was used to point to the relevant notes in the notes index. Then, the notes were then displayed to the learner.

It is important to note that after classification of the new instance was done, the instance became part of the training data. The classifier agent received data from the environment and after applying the KNN algorithm, classified the learner and dynamically updated his learner model. This agent was autonomous as it did not require any supervision and made decisions depending on the prevailing information. This agent trained the model so that based on the experience the model had with existing training data, it could correctly classify new instances.

3. The synchronizer agent module

The synchronizer agent or synchronizer DLL was also a static autonomous agent that synchronized the learner model contents for both local and remote database. It collaborated with classifier agent and learner module so that after the classifier agent had made changes with regard to the learner status, it made sure that learner's model both locally and remotely matched.

The connection status of the models (client and server) was checked by the agent. The agent tried to establish a connection to the URL of the online system by using the public internet protocol (IP) address. If the application was accessible, then internet connection establishment was confirmed, otherwise it was not confirmed. If connection establishment was confirmed, then the remote version was used otherwise local version was used. The connection of the model to the local and remote databases was checked. After establishing the connection status the contents statuses were compared. The status was determined by examining which database had more records and/or latest records. If the local copy was the latest, then the remote copy was updated and vice versa.

The module also displayed a message to a learner if there was no connection to the remote server, but allowed the learner to continue learning with local copy which was later synchronized with remote copy when connection was reestablished. For synchronization of both databases to take place, the synchronizer agent in the client machine was required to locate the domain address for the remote server and then connect to the database in the remote server. All records were compared. The records of the side with more or latest records were copied to the side with the missing (or less) data. This update was made per profile so that only the affected profile(s) were updated.

4. The data storage module

This module consisted of data stores for the various types of data collected and stored in the system.

Results

The results of the research are explained in terms of the research objectives.

a) The first objective was to design a learner model that would use KNN learning algorithm to get trained and classify new learners.

Table 3 has 10 out of 30 new query data records that were classified using KNN.

Table 3: Sample Results Showing Learners were Classified

StudID	Pre-requisite	Read Time	Quiz Time	Weight	Class	Correctly Classified
10011	10	50	31	3	Beginner	1
10020	40	60	30	4	Beginner	1
10031	90	43	19	9	Expert	1
10040	47	65	28	5	Beginner	0
10051	39	54	26	7	Intermediate	1
10061	65	45	15	9	Advanced	1
10071	100	30	8	8	Expert	1
10081	90	32	10	10	Advanced	0
10091	95	40	20	8	Expert	1
10100	100	29	6	9	Expert	1

Note: *The column "correctly classfied" has value 0 for NO and 1 for YES*

Zero (0) was used to indicate a query data that was incorrectly classified while one (1) was used to show query data that was correctly classified. Among the 30 learners studied, only 5 learners were incorrectly classified while 25 were classified correctly. The percentage accuracy was

$$25/30 \times 100 = 83.3\%$$

b) Another objective was to make sure that learner models were updated as the learners continued with the learning process and relevant learning information was displayed to them, based on their profiles.

After the experiment was carried out, the learners were given hard copy questionnaires. Table 4 shows a summary of the answers provided by the learners. The survey collected information related to objectives (a) and (b) to double check results from the logs of learner activities.

The result shows that a majority of the students indicated that they were able to learn online (100%) and offline (73%). A great majority of the students also indicated that it was easy to learn with the system (93%), they were able to get appropriate learning materials (93 %) and that they were classified fairly (90%). The questions and pre-requisite

questions were also well designed (87 %, 100%) . The students also indicated that their profiles were updated (83%) and that the timings for the course were appropriate (60%). The highest percentage of agreement was 100% and the lowest affirmative percentage was 60%.

Table 4: Summary of Responses to Questionnaires after the Learning Process

Question	Question content	Yes	No
1	Would you recommend this learning model to someone?	27	3
2	Is this learning model easy to use?	28	2
3	Were you able to learn online?	30	0
4	Were you able to learn offline?	22	8
5	Do you think you were classified fairly?	27	3
6	Were you able to get appropriate notes?	28	2
7	Were the questions well designed?	26	4
8	Were the prerequisite questions appropriate?	30	0
9	Were the timings (time allocated) appropriate for all questions?	18	12
10	Did your profile get updated?	25	5
11	Did you face any challenges that relate to the system?	3	27
12	Do you have recommendations for the system	6	24

Discussions and Conclusions

In considering the research objectives and other issues that the research was about, together with the results from the study, a number of conclusions were made.

The first objective was about developing the classifier module to classify learners appropriately. From the percentages of the learners that were

classified correctly, it could be concluded that the model was accurate in classifying learners, with an accuracy of 83.3%. Likewise, from the survey results, 27out of 30 (90%) learners said that they were classified as per their expectations.

In this model, attributes were defined that were used to train the classifier so that when the classifier was presented with a new learner represented by a vector of attribute values, the classifier intelligently classified him. In most existing LMSs, learners just read the learning materials at their own pace. There are no systems put in place to determine if the reading is taking place or not. In this model, however, a record of reading time for notes and time taken by the learner to do the quiz was kept and these times contributed towards the classification and subsequent learner model updates.

The second objective was to facilitate the updates of learner models. From the questionnaires' results, learner model's update was achieved since 25 out of 30 (83%) learners stated that their profiles were updated. This is also seen from the log of updates of the learner class from 100 (beginner class) through 200 (intermediate class) to 300 (advanced class) and 400 (expert class). A sample of the logs showing learner class updates is shown in Table 5.

Table 5: Learners History Report for One Course Unit

Student ID: 8888 is Classified to: 100 On Wed Jan 19 13:28:52 EAT 2011
Student ID: 8899 is Classified to: 400 On Wed Jan 19 13:28:52 EAT 2011
Student ID: 8877 is Classified to: 400 On Wed Jan 19 13:28:52 EAT 2011
Student ID: 8866 is Classified to: 100 On Wed Jan 19 13:28:52 EAT 2011
Student ID: 8855 is Classified to: 300 On Wed Jan 19 13:28:53 EAT 2011
Student ID: 8833 is Classified to: 300 On Wed Jan 19 13:28:53 EAT 2011
Student ID: 8822 is Classified to: 100 On Wed Jan 19 13:28:53 EAT 2011
Student ID: 8811 is Classified to: 200 On Wed Jan 19 13:28:53 EAT 2011

The final objective of the research was to enable the learning process to take place both online and offline. From what other scholars have done, it is evident that learning systems and / or models are developed as applications which are deployed to be used online by end users hence requiring the end users to be always online to do the learning.

In this research, a model was developed which can be used as a service by other LMS developers and users. It can be used either independently or integrated with other LMS. A master API was developed which was installed in a server to be accessed by clients' APIs located remotely.

The model used for this research had a functionality that could detect Internet connection and then connect to the server version of the model. The user first logged into the model on the client machine. He was able to continue learning even if there was no Internet connection. A replication of the database took place whenever there was Internet connection. Either of the databases that had more updated information was replicated in the database with an older version of information. This property enabled the learners to be able to do their learning seamlessly whether Internet connection was established or not. This has been shown in the summary of their responses to the post experimental survey.

Learner models were also updated and thus at any one time when the Internet connection was timed out, both databases (local and remote) were at par in terms of learning activities and learner information. Thus, the learners could go on learning offline but with the most up to date version of the learner model and learning information. Thus the learners continued learning even under conditions of intermittent Internet connection.

Future work

As it is, this model is installed both on the server and client machine as separate entities after which the client version accesses the server version for updates. In case the learner does not have the application he will only be able to use the online version. An online downloadable version should be available for installation by any interested learner from anywhere in the world. This way, the learner can download the system and continue learning from any machine, especially in case of travelling from one place to another. This is because whenever there is Internet connection, updates to the learner profile and learning activities are logged into the online server and therefore, the server contains the most up to date information about the student's learning.

The model was developed using Java programming language which is resource intensive requiring higher specifications computers for efficient running. This however may not be possible with everyone who might be interested in learning in this mode. Therefore, it is recommended that research should be done to enable the development of the application with lighter programming languages.

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INSTITUTIONAL MANAGEMENT AND INTEGRATION OF INFORMATION AND COMMUNICATION TECHNOLOGY IN TEACHING AND LEARNING IN SELECTED KENYAN SCHOOLS

Harriet J. Kidombo; Christopher M. Gakuu; Anne Ndiritu

Abstract

A number of studies have identified the school principal as a critical and pivotal person for establishing and maintaining learning environments driven by technology. This paper examines the function of school principals as institutional managers and the role they play in the adoption and integration of Information and Communication Technologies in the process of teaching and learning. It was conceptualized that presence of ICT integration plans, maintenance and renewal plans, extent of community access to ICTs and proficiency in ICTs of school managers have an influence on extent of ICT integration in teaching and learning . Ten principals of selected schools and one teachers' training college from Nairobi and its environs were interviewed. To obtain a detailed and clear picture of the use of ICT, the mixed methods approach was used. Semi directed interviews, focus group discussions audiotapes of discussions, videotaped classroom observations and photographs of school environments, review of school documents on ICT and teacher and student productions were used to collect data. Out of the ten schools studied, five schools had ICT integration and maintenance and renewal plans, while only two schools shared their computers with the community and eight head teachers reported that they had the ability to use ICT skills. From the findings, it appears the development of ICT skills and knowledge among school principals is slow and may explain the low levels of ICT integration in the selected schools. It seems the success or failure of integration of ICT in teaching and learning rests largely on institutional managers and school managers need to take professional responsibility and accountability to ensure that they are well trained in ICT and that their institutions have management strategies to enable them achieve appropriate ICT integration in teaching and learning.

Keywords: School leadership; School managers; Institutional management; ICT integration in education; ICT in Kenyan schools

Introduction

The importance of pedagogical integration of ICT in Kenya and globally cannot be overemphasized. It is becoming increasingly apparent that all aspects of people's lives including the way education is taught and delivered are greatly influenced by developments in Information and Communication Technologies (ICTs). In an effort to keep up with these new developments, the Kenyan Government, through its key ministries of Education, Science and Technology and Information and Communication Technology, has developed several policy and strategy documents to guide the integration of ICT in education (National ICT Policy, 2006; Sessional Paper No. 1 of 2005 and Kenya Education Sector Support Programme, 2005-2010). These efforts are also out of the realisation that there are many initiatives being championed by various government agencies, private sector, non-government organizations and even individuals, that are not well coordinated, are disjointed, lack focus and sometimes duplicate each other. In the last decade, the Government of Kenya has invested numerous resources in ICT infrastructure including the digitization of educational materials through the Kenya Institute of Educaton (KIE) and The National ICT Integration and Innovation Centre (NI3C). The e-content being developed for schools at primary and secondary levels is expected to increase access and improve the quality of education in the country. While this is a laudable initiative, the required penetration in schools both in breadth and depth is yet to be realized.

The existing literature on ICT integration in education in Kenya appears to indicate limited knowledge on the quantity and quality of research in the area of pedagogical integration of ICT. Many scholars and practitioners have raised this as a major research need (Omwenga, 2003, Keiyoro, 2011; Gikonyo 2012). Recent studies have attempted to fill this gap especially in the African context, which for a long time, was assumed to have insignificant adoption of ICTs in education. For example, Karsenti et al (2011) and Farrel and Issacs, (2007) report that African countries have the least integration of ICT in education relative to other countries globally.

Among the various studies carried out to establish the status of ICT integration and the variables influencing it, some have focused on the role of the School Manager, in the adoption and use of ICT in education. Many scholars and policy makers seem to agree that School Principals as institutional managers have a key role to play in the facilitation of educational change (Schiller, 2003; Gronow, 2007 and Tondeur et al. 2007) especially in this decade when Information and Communication Technologies are increasingly finding application in teaching and learning. It appears that ICTs and especially the computer, has moved from being the object of study to a learning tool in the classroom and teachers are increasingly being expected to have basic ICT skills and able to apply them in their teaching. By playing an active role in the adoption of ICT as an educational tool, principals can create an environment that will benefit their teachers and students.

A number of studies have identified the school principal as a critical and pivotal person for 'establishing and maintaining learning environments compatible with student-centred approaches to teaching and learning with ICT' (Afshari et al. 2008). They are also seen as curriculum and pedagogy leaders and are considered by stakeholders as central figures in leading processes for creating the conditions to teach and learn with ICT. From these arguments, it appears school leadership plays a key role in ICT integration in education. The competence of the School Manager in the use of ICT and a broad understanding of the technical, curricular, administrative, financial, and social dimensions of ICT use in education is important to the effectiveness and sustainability of ICT integration programmes.

The integration of ICT in school management in Kenyan schools has been driven to a large extent by the corporate social responsibility efforts of organizations that initially made donations of old refurbished computers to schools and diffusion of ICT skills in the labour market. In addition, access to electricity and internet connectivity, introduction of other technologies such as the mobile phone, Nepad e-schools project, Computers For Schools, Kenya (CFSK), popularization of computers by government through removal of duty, thus, making them affordable, and more recently, the entrenchment of ICT integration in education through the launch of the National ICT Strategy in Education (2006) and the launch of the National

ICT Integration and Innovation Centre at the Kenya Science Campus in Nairobi have created awareness of the place of ICT in education .

Acquisition of a limited number of computers initially by schools for management purposes appears, to have created the conditions necessary to introduce, albeit gradually, integration of ICT in teaching and learning. It could be argued, therefore, that once management adopts ICT in its practices, it diffuses and spreads to other institutional members and they become interested in its use. As such, even without a plan or designed way of integration, some teachers with the inclination and interest in ICT end up finding innovative ways of using it to enhance their teaching capacities. Initially it may be used for recording and analyzing marks, typing lesson plans and eventually actual teaching and learning by searching for information and displaying learning content. Learners, equally, given the opportunity and access, are able to use ICT to enhance their learning.

This paper seeks to address this aspect of pedagogical integration of ICT in teaching and learning by examining the role of school managers in the use of ICT in teaching and learning in Kenyan schools. The findings reported in this paper are based on a research carried out in ten selected Kenyan educational institutions under the Pedagogical Research Agenda on the Pedagogical Integration of ICT in Education in Africa. The data is drawn from the ICT observatory (www.observatoiretic.org).

This article is guided by four main objectives:

a) To identify the influence of ICT integration plans on ICT integration in teaching and learning.

b) To establish the influence of ICT maintenance and renewal plans on ICT integration in teaching and learning.

c) To assess the extent to which community access to ICTs influences the integration of ICTs in teaching and learning.

d) To examine how the proficiency in ICTs of school managers influences ICT integration in teaching and learning

Literature Review

This literature review looks at the theoretical underpinnings of ICT adoption and empirical findings on use of ICT by school managers.

Theoretical perspectives of ICT adoption

Information and Communication Technology (ICT) is pervasive within organizations. It is brought into organizations by people and is put to work by people. The ways in which technology is used and the purposes for which it is used, is a result of the decisions taken by members of the organization especially its leaders. It is essential, therefore, that managers have an understanding of the nature of new technology, the organizational needs and objectives. From an organizational context, several approaches to conceptualizing technology in general have been advanced. Burnes (2003) observes that the outcomes of technological change are socially chosen and negotiated within organizations by organizational actors. Pettigrew (1990) examined organizational politics and decision-making associated with the development and structuring of computer applications and found that managers are able to influence decisions in the computerization domain through taking up a 'gatekeeper' role, which allows them to shape the information reaching key managerial decision-makers. Political behavior associated with organizational and human resource issues arising out of technological change, demonstrates a range of choices available with respect to work organization and control of jobs. It appears, therefore, that the outcomes of technological change within organizations are dependent on the way workers respond, adapt and try to influence the outcome.

From a theoretical point of view, scholars such as Rogers (2003) argue that potential adopters of a technology progress over time through five stages in the diffusion process. First, they must learn about the innovation (knowledge); second, they must be persuaded of the value of the innovation (persuasion); thirdly, they must decide to adopt it (decision); fourthly, the innovation must be implemented (implementation); and finally, the decision must be reaffirmed or rejected (confirmation). In this model, the user or adopter is critical in the whole process. Another perspective advanced to address ICT adoption and usage, is the Technology Acceptance Model

(TAM) advocated by Davis (1989) and **Chuttur (2009)**. In general, this theory states that a behavior is determined by intention to perform the behavior. Actual behavior and intention have been found to be highly correlated (Fishbein and Ajzen 1980). Intention, itself, is determined by attitude towards behavior. Davis' research, in essence, examines the external variables that determine or influence attitude towards ICT use. The TAM identifies perceived ease of use and perceived usefulness as key independent variables (Davis 1989). Perceived ease of use also influences perceived usefulness. The Technology Acceptance Model assumes that behavior is voluntary or at the discretion of the user.

Most of the existing technology acceptance theories focus on the cognitive aspects of human beings, presuming that users must discard their affective selves to work efficiently and rationally with ICTs. The dominant paradigm is rooted in Davis's Technology Acceptance Model (TAM) (Davis 1989). TAM, along with its extensions and elaborations focus on workplace settings and how mandatory systems, designated to increase users' efficiency at work, are accepted in these contexts. Thus, technology acceptance models are restricted in their specified context, resulting in lack of generic applicability, especially on non-utilitarian or work-related systems. Unlike most preceding technologies which were thrust upon the user communities, ICT technology is individually available to diverse users who can use their own systems to serve their own purposes. The impetus for the innovation frequently grows from individual users of the technology, and as their communication and influence moves laterally through their contacts, a body of support can grow and exert "pressure" on the institutional administration to commit to adoption of the technology. There is, therefore, a high potential for a "bottom-up" or "grass roots" adoption process to succeed. From this argument, the importance of participation by school leaders in the adoption of ICT in teaching and learning processes in schools is important. .

The pace of change confronting organizations today has resulted in calls for more adaptive, flexible leadership. Adaptive leaders work more effectively in rapidly changing environments by helping to make sense of the challenges confronted by both leaders and followers and then appropriately responding to those challenges (Bass et al.,2003). In other words, such leaders are

influential in approving or disapproving new ideas.. Adaptive leaders work with their followers to generate creative solutions to complex problems, while also developing them to handle a broader range of leadership responsibilities (Bennis, 2001). Bass (1985 Principals should be eager to model the transformational components of charisma (idealized influence), inspirational motivation, intellectual stimulation and individualized consideration in their schools. As charismatic leaders, principals must talk about values and beliefs, emphasize the sense of mission and promote the good of the group (Bass & Avolio, 2000). As a part of inspirational motivation, principals must create a vision and enlist others to share this vision by making them feel a part of something bigger than themselves. Principals should provide intellectual stimulation by challenging teachers to reconsider and rethink assumptions about their work (Leithwood, 1994). According to Bass and Avolio (2000), transformational leaders were not born; rather, transformational leadership could be taught. Hence, principals must develop and display transformational leadership behaviors through training to improve creativity and innovativeness in their schools.

ICT integration and school leadership

Many studies have shown that school leadership plays an increasingly important role in leading change, providing vision and objectives, as well as professional development initiatives in using ICT to bring about pedagogical changes; Schiller, 2002). While technology infrastructure is important, ICT leadership is even more necessary for effective ICT implementation. While effective leadership is one of the key variables that determine the success of an educational institution, strategic leadership is needed for long-term sustainability of school improvements (Davis, 2003).

According to Brannigan (2010) leadership is one of several critical components in the successful integration of ICTs in Education. The locus of leadership influences the degree to which ICT integration can become embedded in educational institutions as well as the role of leadership in championing ICT. The failure by educational institutions to integrate ICT in education and imprint it on the minds of teachers has been attributed to lack of leadership capacity (Moyle, 2006). As a result, today's school

principals must not only manage the day to day routine activities of a school but also focus on how students learn, performance standards, evidence based decision making and continuous improvement efforts. Ability to plan, implement and sustain changes, including ICT in a school, therefore, depends on the leadership qualities of the school manager. In line with this idea Fullan, (2003), stated that administrators should understand the elements and characteristics of long-range planning for the use of current and emerging technology; demonstrate an ability to analyze and react to technology issues, concepts and proposals; possess a " big-picture" vision of technology in education and schools; use technology to communicate efficiently with staff, parents and the community; use technology directly to collect and analyze data and other information that can improve decision-making and other management functions; understand how current and available technologies can be integrated effectively into all aspects of the teaching and learning process; understand the legal and ethical issues related to technology licensing and usage; and use technology appropriately in leading and communicating about school programs and activities.

Although school heads generally support ICT use, they do not seem to have a particular vision and strategy of ICT integration in education (Gakuu and Kidombo, 2010). Some literature has delved into the crucial role of school leadership in ICT integration in education, and shows how school leadership can hinder or facilitate schools adoption of ICT Fullan, 1999; Fullan, 2003 and Elmore, 2000). For example, when the ICT integration tasks are given to one teacher or a small team of teachers who focus more on infrastructural management rather than technology innovation in teaching, staff development and ICT research are more likely to suffer. According to Fullan (2001), the reasons why this role is not played effectively is still not clear, hence need for more studies. Fullan (2003) and Yuen, et al. (2003) also stress the importance of relationships in an organization and emphasize the need for the School Principal to build a team learning environment in which teachers can communicate with each other on ICT experience and reinforce each other's effective practice, thus paving the way for knowledge sharing, especially for tacit knowledge, which refers to skills, beliefs, and understanding below the level of awareness.

As transformational leaders, principals should show that they also live the values they advocate. This consistency between words and deeds is believed by transformational leaders to build their credibility (Starcher 2006). The principal as a learning leader, specifically, can impact multiple areas of the school setting such as ICT integration (Elmore, 2000). Effective leadership is essential when implementing school improvement initiatives (Rutledge, 2009). A study by Rutledge (2009),on the implementation of New American Schools (NAS) designs found that schools reporting strong principal leaders had implementation levels over half a standard deviation above schools at the sample average (Nataraj-Kirby et al., 2001). Findings suggested that effective and supportive leaders were most likely to both increase and deepen ICT implementation in a school. Principals are, therefore, likely to make the dream of ICT integration in teaching and learning possible in leading through modeling and taking an active role towards this effort.

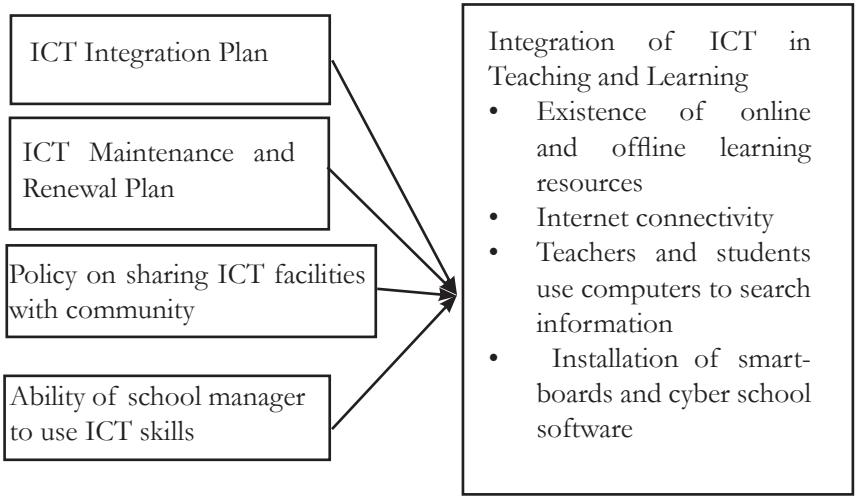
Other studies such as Keiyoro et al. (2010) show that only 9.5% of teachers from both NEPAD and Cyber e-Schools in Kenya indicated that the school principals were supportive of ICT integration and the support was linked to principals' belief in the usefulness of ICT. Forty percent 40.0% indicated that the level of support ranged between 50%-70%. Forty seven percent (47%) indicated that the support was luke-warm while 2.4% felt that there was no support. Teachers felt that the integration of ICT in teaching and learning was still slow among the principals themselves evident in their failure to use the Internet. Other reasons include administrative ignorance of the role of ICT in learning and teaching, lack of resources, both funds and technical equipment and principals' negative attitude towards ICT usage in teaching and learning science curriculum.

Conceptual Framework

From the literature review, certain actions that must be carried out by the school manager as part of providing leadership in the adoption and use of ICT in teaching and learning include creating teams to implement use of ICT, supporting professional development of teachers and harnessing resources required to install ICT infrastructure, It has also emerged from

the literature that working with an ICT integration plan, having an ICT maintenance and renewal plan, having a policy on sharing ICT facilities with the school community and school leader's proficiency in the use of ICT are important factors in the ICT integration equation. It is envisaged that all these factors will have an influence on the extent to which a school integrates ICT in teaching and learning. These relationships are illustrated in Figure 1.

Figure1: Conceptual Framework showing integration of ICT in teaching and learning



Research Methodology

To determine the extent to which institutional managers integrate ICT in education in their schools, 10 principals of schools and one teachers' training college from Nairobi and its environs were interviewed. This study is part of a larger study involving 12 countries in Africa under the Panafrican Research Agenda (Panaf) on the Pedagogical Integration of ICT in Education. The objective of the research was to better understand how the pedagogical integration of ICT can improve quality of teaching and learning in Africa. The mixed methods approach, which is a mix of both the traditional quantitative and qualitative methods, was used. This approach

borrows from diverse methodologies and facilitated the triangulation of data. A multi-case approach was used as opposed to a single case study. This meant selecting ten institutions where similar procedures were applied, thus enabling comparison between the cases.

For every indicator, triangulation was employed; hence views were sought from the managers, educators and learners on the same indicator. The ten educational institutions selected for the study was not based on a statistical model, but on the significance of the case for the objectives of the study, which in this case was the presence of computers in the institution. Diversity factors taken into consideration for the selection of schools included gender, type of institution, geographical location and ownership. To benefit from the advantages of triangulation in data collection, three different survey questionnaires were administered to the school manager or head of the school, the ICT advisor, technician and a subject teacher or educator. The data collection instruments used were: semi directed interviews with school directors, teachers, administrators and pedagogical and ICT advisors; focus group discussions with teachers; audiotapes of discussions, videotaped classroom observations and photographs of school environments; review of school documents on ICT and teacher and student productions. This design was chosen to obtain a detailed and clear picture of the use and impact of ICT in educational institutions. The data is cross-sectional and descriptive. The data collected was fed into the Observatory developed by the Pan African Research Agenda on the Pedagogical Integration of ICT in Education in Africa (PanAf). Hence, the findings reported in this article are based on data drawn from the observatory

From the school managers, the questionnaires sought to find out, for example, the kind of ICT training and skills possessed, the ways in which ICT has been integrated in teaching and learning and its impact, the impact of ICT on professional development and on educational management practices, whether the institution has a plan for ICT integration and one for maintenance of equipment, if the community outside the school has access to the school's ICT facilities. The questionnaire also sought to gather further information on the barriers hindering the achievement of the school's ICT goals.

A questionnaire was also administered to the ICT advisors who are also subject teachers with ICT knowledge in the ten schools. The type of information sought was the impact of ICT on lesson planning, classroom teaching, evaluation methods and communication with learners. They were also asked to explain how ICT may have improved their own access to knowledge and information and if it helps them in producing teaching material. The respondents were guided through the questionnaires by the researchers. The quantitative data is presented in percentages and frequencies and qualitative data is arranged and presented thematically based on the key variables of the study.

Measures

The concept of ICT integration into teaching and learning processes was defined as a situation where the school management has put in place online and offline learning softwares; where at least one computer is connected to the internet; where the teachers and students actively use the computers to search for information; where teaching equipment such as smart boards are available and where learning software such as cyber school solutions have been installed and are used.

The indicator for ICT integration plan and that on plan for renewal and maintenance was measured by asking if the school had a written document that was used to guide the acquisition, use and maintenance of ICT equipment in the school. Regarding the policy for sharing their ICT equipment with the community, the indicator was if they had a practice in place. The variable on the school principal's ability to use ICT was measured by asking them to report their perceived competence in the use of word processing, spreadsheet, email and internet browsing.

Research Findings

The findings of the study were analyzed thematically and presented according to the objectives of the study. The data is drawn from survey questionnaires, interviews, observations and documentary analysis. The respondents, were also asked to give the general status of ICT use and connectivity and the responses are described in the next section.

Profiles of Participating Institutions

Ten institutions participated in this study: These were four primary schools, five secondary schools and one teachers' training college. Aga Khan High School is an urban, co-educational and multicultural day secondary school. It has 350 students, 100 female and 250 male and 23 teachers, 12 female and 11 male. It has 31 computers, 25 of which are connected to the internet. It has computer software called Cyber School which is used in the teaching of science subjects. Enna School is a semi-urban, private girl's secondary school with 100 students and 30 functional computers. It has 6 male and 4 female teachers. It has no internet connectivity. Kenya Technical Teachers College is a public, urban, tertiary level college, which trains Diploma Teachers to teach technical subjects at secondary school. It has 116 lecturers, 45 female and 71 male. It has 870 teacher trainees, 388 female and 482 male. There are 120 computers, 90 of which are connected to the internet. Musa Gitau Primary School is a public, high cost, government assisted day and boarding mixed school located in a semi-urban area. It has 31 female teachers and 9 male. It has 1500 pupils of which 775 are female and 725 are male. It has 50 functional computers and only one is connected to the internet.

Musa Gitau Secondary School is a public, government assisted, mixed day school. It is located in a semi-urban area and has 405 students, 140 male and 265 female. It has 21 teachers, 11 female and 10 male. It has 20 functional computers and has no internet connectivity. Ruaraka Academy is a private, mixed primary school located in a semi-urban location. It has 298 female and 304 male pupils. It has 30 teachers, 13 of whom are male and 17 female. It has 15 functional computers, 4 of which are connected to the internet. St Joseph's, Githunguri is a public, boy's secondary school located in a rural area. It has 800 male students with 32 teachers, 25 female and 5 male. It has 14 functional computers and no internet connectivity. The Green Garden School is a privately owned mixed primary school located in a semi-urban area. It has 350 pupils, 163 male and 187 female. It has 21 teachers, 14 female and 7 male. It has 19 functional computers, 9 of which are connected to the internet. Tigoni Primary School is a mixed public primary school located in a rural area. It has 1345 pupils, 684 female and 661 male. It has 25 teachers, 20 female and 5 male. It has an arrangement with a private organization

to provide computer services. There are 12 functional computers and no internet connectivity. Uthiru Girls is a girl's public secondary school located in an urban area. It has 500 female students and 35 teachers, 10 male and 25 female. It has 23 computers and internet connectivity and all are networked.

Institutional Management and ICT Integration

The study sought to investigate the extent to which the following four variables: the presence of ICT integration plans; maintenance and renewal plans; policy to share computers with the community and ability of school managers to use ICT influenced the integration of ICT in teaching and learning. Figure 1 shows that out of the ten schools studied, five schools had ICT integration and maintenance and renewal plans, while only two schools shared their computers with the community and eight head teachers reported that they had the ability to use ICT skills.

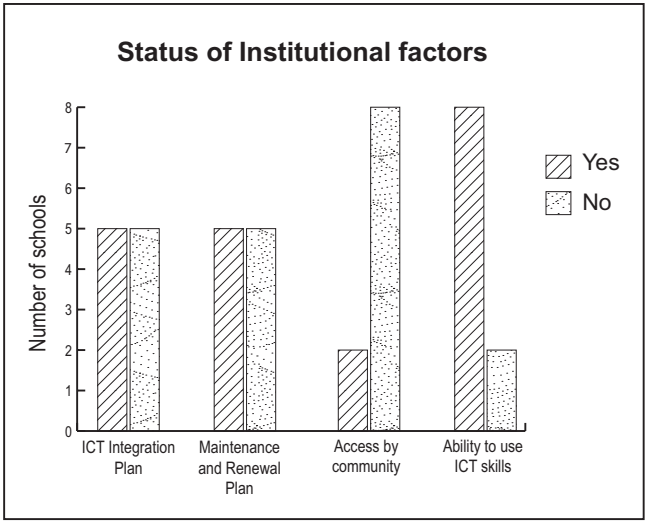


Figure 2: Status of Institutional factors

ICT Integration plans

The findings showed that out of the ten selected institutions, 50% had ICT integration plans. However, the plans emphasized different aspects of ICT

integration. For example in one secondary school, the main focus of the plan is how to increase the number of computers. The head teacher reported that "the school plans to buy 6 computers every year, train all teachers and students in basic computer skills, and inter-connect computers in all the departments in the school. - The Board of Governors and Teacher Parent Association are responsible for computer maintenance in the school".

In another institution, it was observed that there is an ICT integration plan which is highly supported by the Government and funded by a donor. The college is the only one in the country that trains technical teachers and the plan is to ensure that secondary schools get a supply of highly qualified teachers in such areas. ICT has been integrated in the teaching of engineering related subjects and business courses. In the plan, strategies for acquiring and installing ICT infrastructure, maintenance, renewal and training of trainers in its use is well outlined and has been implemented.

Five out of the ten institutions indicated that although they have acquired computers in the school, they did not have a plan on how to use them for teaching and learning purposes. One head teacher of a secondary school explained that they do not have an ICT integration plan because computers were introduced to the school barely a year ago. The main focus has been to install the computers and to have them working. She also reported that that "since there is no policy guideline by the Ministry of Education on the integration of ICT in secondary schools, we have not even contemplated the development of a formal ICT integration plan".

In another school where access to computers is through a partnership with a private entrepreneur, the reason for not having an ICT integration plan was attributed to the fact that the computers in the school are privately owned and therefore no ownership on the side of the school. The computer adviser who is employed by the private owner does not have any ICT plan because it is not clear for how long the arrangement will last. From these responses, it is evident that integrating ICT into teaching and learning is still in its infancy as management has not appreciated the need for developing ICT integration plans.

Strategy for maintenance and renewal of ICT equipment

Another area that was of interest to the researchers was if the schools had a strategy for maintaining and renewing ICT equipment. Out of the ten schools, only five had a strategy while the rest indicated they did not have. Two schools had a standing three year agreement with Computers for Schools Kenya, an organization supported by the government to equip schools all over the country with refurbished computers and to maintain them. The schools pay Kenya Shillings 3000 per year for maintenance. Another school felt that they did not need a service contract and instead relied on the computer teacher. According to the head teacher …"the school does not have a written ICT equipment maintenance and renewal plan as the ICT teacher who happens to be very competent in the use of ICT maintains, services and installs new software in the computers. However, if the problem is beyond him he advises the school management to contract an expert to deal with it". The school management also felt that, because of the small number of computers in the school, it is not economical to have a service contract. Expertise should only be sought as and when needed. This arrangement seems to have increased the workload of the ICT teacher who is also expected to teach.

In another school, the strategy was clear. The school had a plan to purchase six new computers every year. They feel this will enable them, firstly to increase the quantity of the computers and also to replace those with lower capacity. Such a strategy will make it possible to phase out the older and less economical to run computers. The school also plans to enter into partnership with organizations such as the Computer for Schools, Kenya.

Sharing of ICT facilities with the community

The schools were also asked if they provide ICT services to the community. Only two out of ten schools did so. One mixed high school indicated they host a Cisco Centre which offers training to the school community as well as the community around the school. Another one indicated they offer typing and photocopy services to the community around the institution. The rest gave various reasons. Two schools said that they do not provide

access to its ICT infrastructure to the community. This is because the school has only 50 computers with a school population of 1500 hence not adequate to share with outsiders. Another one also said the community has no access to the computers because they are too few and have just been acquired recently. However, the school plans to use them for training during the school holidays and generate some income in the future. Another one reported that the school does not provide any access to the community. This is because of security reasons. According to the ICT advisor, " …the school has suffered several burglary attempts and therefore, we are hesitant to let the community use our computers. We also fear attacks by viruses that can render all the computers useless … this is especially serious as the school does not have Internet connectivity to update anti-virus software and screen and clean the viruses". It appears, therefore, that apart from the few facilities, the fear of theft and viruses was a major reason for not sharing the computers with the community.

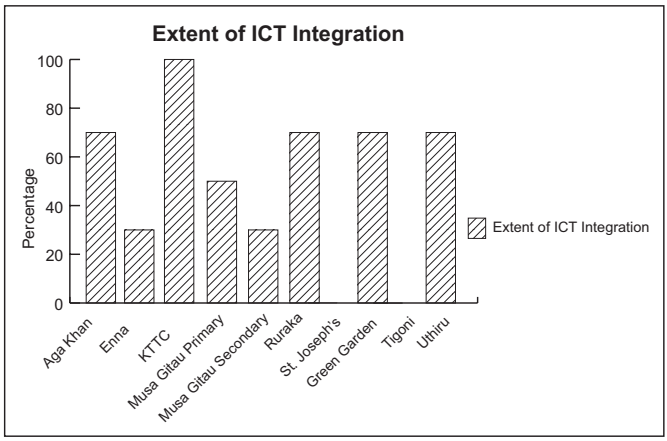


Figure 3: Extent of ICT Integration

Ability of School Managers to use ICT

Of the managers who indicated that they were proficient in ICT skills, only one had advanced training at higher national diploma while seven had only basic skills. Seven indicated they had basic skills while two had no skills at all.

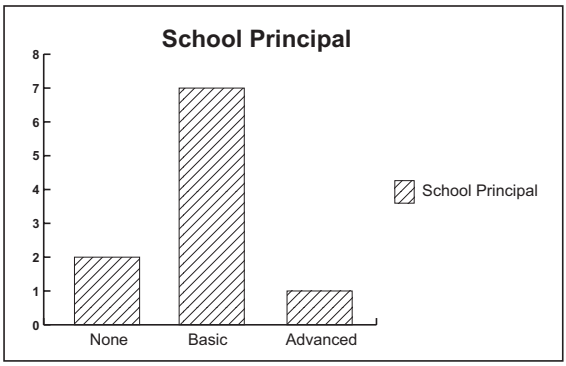


Figure 4: School Principals' Proficiency in ICT

Discussion of Findings

This paper raises some issues about the role of principals in ICT integration in teaching and learning by examining the extent to which School principals in some selected Kenyan schools use ICT. The variables assessed were the presence of ICT integration plans, plans for renewal and maintenance of ICT equipment, policies on sharing of ICT with the community and their ability to use ICT. Findings indicate that50% of the schools have ICT integration plans and renewal and maintenance plans while only 20% had a policy for sharing with the community. On the ability to use ICTs, only one out of ten principal's had a higher national diploma in ICT while the rest had either no skills or just basic knowledge. These findings indicate that the development of ICT skills and knowledge among school principals is slow and may explain the low levels of ICT integration in schools. This finding is not surprising as several studies such as Keiyoro (2010); Afshari et al. (2008) and Bass et al. (2003) reported similar findings.

Successful adoption of ICTs is important for school principals who must use ICTs and model their use for their staff as observed by Tiede (1992) and Anderson & Dexter, (2000).). If this modeling is successful, the staff may then model the use of ICTs for students. In this way, principals who do not have positive expectations for ICT use or do not instill or support a culture of technology use inhibit integration.

Arising from these findings, it is apparent that meaningful opportunities must be provided for Kenyan school principals to develop their skills and dispositions necessary for providing educational leadership. In this way, they will understand that technology use can enhance their professional practice and increase their own productivity. However, improved technology leadership will only occur if the principal becomes proficient in the use of technology for administrative, instructional, and learning functions. The best way to do this is by committing themselves to the process of learning every day throughout their lives (Coughlin, 1994). It means that leaders should never stop learning and honing their skills. In addition they must be familiar with current research and best practice. They must maintain a personal plan for self- improvement and continuous learning (Bennis, 1999). Therefore, such leaders can inspire others and create shared vision; demonstrate effective uses of technology in the areas of learning and teaching; incorporate technology as they support, manage, and operate the school; and actively involve themselves in the assessment and evaluation of technology in the school.

Conclusions and Recommendations

Although several encouraging results have been found, it is important to recognize that the current findings also have limitations. First, the sample size should be increased because using data from a larger number of respondents will permit more powerful findings. Given the self-reporting nature of this instrument, it was quite possible that principals overrated their proficiency or underrated their proficiency. These ratings may not reflect the true proficiency levels of the principals. In spite of these limitations, this study will be useful for policy makers, providers of professional development programs for principals and for system level decision makers to support mechanism and strategies to assist principals to develop their knowledge, skills and their leadership style. Thus, principals will understand the critical role that they play in facilitating the implementation of ICT in schools to improve teaching, learning and administrative processes.

It is also imperative that the Ministry of Education comes up with policies that will guide the use of ICT in schools. The government seems to be

lagging behind because whereas computer studies has been introduced in secondary schools as part of the national curriculum, it has not kept up with the provision of the necessary infrastructure both physical and human resources. For example, there has been no teacher training course with computer studies as a teaching subject. ICT therefore seems to have been left to the ingenuity of the schools. This may explain the low levels of ICT integration among classroom teachers and the apparent advantage that schools with a manager who has ICT knowledge have. Private schools, however, are ahead in ICT use because they have control over their own resources. They also use ICT to maintain a competitive edge in the market because parents tend to associate the use of ICT with good academic performance. Since they operate on enterprise principles, they apply management tools such as strategic plans while public schools rarely develop such plans out of their own effort.

It appears, therefore, there is need for the Ministry of Education to develop an ICT policy to streamline this important area of learning. The ministry needs to provide ICT teachers to schools and reward those who have the skills and are offering services so as to motivate them. It might also help to include integration of ICT in teaching as part of the school manager's annual performance appraisal to encourage them to adopt ICT integration in teaching and learning. The success or failure of integration of ICT in teaching and learning rests largely on institutional managers. The managers have therefore a professional responsibility and accountability to ensure that they are well trained in ICT and that their institutions have management strategies to enable them achieve appropriate ICT integration in teaching and learning. At a time when information and communication technologies are being integrated into the classroom as learning tools, and when teachers are being asked to incorporate technology into their teaching practices, principals who are more competent in ICT are more likely to achieve success in their schools.

While this study focused only on the role of the school manager in ICT integration in teaching and learning, future studies need to pay attention to the impact of ICT in academic performance in situations where it has been adopted to enhance our understanding of the worthiness of technology use in education.

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Integrating ICT into Teacher Education Curriculum: Faculty Perceptions of their Technology Professional Development Needs in Two Ghanaian Universities

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Abstract

This study investigated faculty perceptions of their technology professional development needs and how these needs relate to faculty use of instructional technology in two Ghanaian teacher education universities. The goal was to document the experiences of academics of the two Ghanaian universities in getting the faculty to use technology. Participants were 132 teacher education faculty members selected purposively. The study used survey methodology supplemented by interviews. The study found no significant relationship between faculty perceptions of their technology professional development needs and faculty use of technology for teaching and learning. However, based on participants' responses to an open-ended question and interviews, this insignificant relationship could be explained within the context of faculty members' (a) limited technology knowledge and skills, (b) limited participation in the technology innovation decision process, and (c) inadequate opportunity for faculty to have hands-on experimentation with technology in instruction because of limited technology resources in classroom settings. The findings of the study can inform faculty technology professional development facilitators and academic administrators about the technology needs and concerns of their faculty and about the need to consider these needs and concerns in their technology professional development programs in the Ghanaian context.

Keywords: Faculty technology professional development, faculty perceptions, faculty technology use, contextual conditions for integrating instructional technology, faculty concern and needs.

Background to the Study

Information Communication Technologies (ICTs) are major factors in shaping the new global economy and are also producing rapid changes in society. They have produced significant transformations in industry, agriculture, medicine, business, engineering and other fields. They also have the potential to transform the nature of education, where and how learning takes place and the roles of students and teachers in the learning process (UNESCO, 2007). It is therefore imperative that Higher Educational Institutions (HEIs) which are sources of students learning and change agents to organizations and society be responsive to this global change. There is an urgent call particularly for teacher education institutions to assume a leadership role in the transformation of education in this rapid changing technological era (UNESCO, 2007). It is thus important that teacher educational institutions and programmes model new pedagogies and tools for learning. They must also provide leadership to determine how the new technologies can best be used in the context of helping the young generation entering a world that is changing in all spheres. HEI must also be equipped to cope with the emergencies of the knowledge-based society, which is changing the global economy and the status of education.

The above expectations present a challenge to educational systems all over the world (UNESCO, 2007). The key challenge confronting HEI's ,particularly UEW and UCC, is how to transform the curriculum and teaching learning process to provide dynamic information-rich and technology enabled learning environment. ICT tools have not yet been formally integrated into all levels of Ghana national curriculum. For example, in Ghana the rationale of ICT policy for education is found in the ICT for Accelerated Development (ICT4AD) Policy (Republic of Ghana, 2003). This national policy seeks to promote ICT in education by deploying and exploiting the potential of ICTs in education. The ICT4AD strategies for deploring ICTs in education include:

- Harnessing ICT potential to modernize, expand access, and improve quality of education at all levels;
- Deployment of ICT tools for teaching and learning.

The educational sector is expected to modernize the curriculum at all levels to cater for the integration and introduction of computers studies and the use of technology in teaching and learning. The Ghanaian situation is similar to what happens in Belgium (Ministry of Flemish Community, Department of Education, 2002, 2004), and is in a direct contrast to countries such as the United Kingdom (Qualification and Curriculum Authority/Department of Education and Employment, 1999), and Canada (Albert Learning, 2000).

In the UK, Canada and USA, the ICT competence requirements have been included in the formal national curriculum. In these countries technology competency benchmarks and standards for teachers and learners have been set. The implementation of the latest educational reforms and the ICT in education policy in 2007 introduced ICT studies. Teaching and learning with technology across the school curricula are also required of all teachers. However, Ghana does not have the benchmarks and standards for teachers and learners in their adoption of technology. The lack of standards and benchmarks for pedagogical integration of ICTs makes it difficult to measure faculty's ICT competence and levels of use. The general perception is that most faculty members in all public universities in Ghana do not use computer-based technologies in teaching and learning.

The Faculty of Education of the University of Cape Coast (UCC) and the University of Education, Winneba (UEW), as tertiary teacher education institutions, have accepted the challenge to produce technologically literate teachers to meet the national educational goals. The UEW has designed an elaborate Information and Communication Technology (ICT) plan, spanning over five years (2003-2008) to meet this challenge. The UCC has a similar ICT plan (2002 – 2007).

The ICT Plans of UEW and UCC seek to improve the technology infrastructure through the setting up of computer networks, access to the internet via dedicated bandwidth and local area networks through optic fiber cable, satellite and radio communication linkages across their regional campuses. Most academic departments have also set up their Local Area Networks (LANs) in all regional campuses, which are being integrated into the university's wide area network (WAN). The two universities, during the initial stages of the implementation of their ICT plans, organized large

group technology literacy workshops aimed at conscientizing faculty about technology use in education and equipping them with technology basic literacy skills and knowledge. Though every faculty member of the two institutions has a university assigned email account and server space of 10 Gb by policy, faculty members' actual use of these facilities for academic purposes is rather limited. These institutions have begun to deploy open and flexible learning environment the ever-increasing for demand for higher education in Ghana. However, new ideas and practices that are neither fully understood by, nor in accord with the managers' and staffs' traditional values and practices have also emerged that need re-orientation of faculty.

Several research findings (Bauer & Kenton, 2005; Collier, Rivera, & Weinburgh, 2004; Watson, 2006; Whale, 2006) indicate that when integrated with emerging models of teaching and learning, technology can enrich the curriculum and serve as an effective tool for instruction. Though the literature contains volumes on technology professional development issues over the last decade, in a developing country like Ghana, research on access to educational technology resources, contextual conditions for technology integration, faculty technology expertise, and technology use for teaching and learning has been scanty.

Technology professional development facilitators (i.e, technology experts or leaders who design and develop technology integration plans and assist faculty to acquire technology skills and knowledge for teaching and learning) need faculty input and participation and an understanding of the contextual conditions to address faculty members' concerns in order to meet their real technology integration needs. Knowledge of faculty experiences with instructional technology and their concerns and needs also assist academic administrators with the implementation of the innovation, because useful feedback from faculty members would help streamline deficiencies in the system.

Faculty members play an important role as implementers of institutional technology innovations (Ensminger, 2002; Judson, 2006; Palak, 2004, Rodriguez & Knuth, 2000). The essence of technology professional development is therefore to help faculty to discover appropriate and effective

ways that technology as a tool supports their instructional strategies and students' learning needs and styles.

The Problem

The main issues with faculty use of instructional technology go beyond their technology skills and availability of technology resources (Zhao & Bryant, 2007). Faculty members need to develop the competence of integrating technology in teaching and learning, and this can be accomplished through appropriate technology professional development programmes that factor in their levels of technology experience, needs and concerns. Teaching and learning with ICT generally was formally introduced in the Ghanaian school system in 2007. Studies from the Ministry of Education, however, showed that most teachers (80%) of classroom teachers hardly use available instructional technologies. The situation at the tertiary level is not different either due to a number of factors. It is desirable to empirically find out what enhancers and inhibitors are responsible for this situation from the perspectives of academics. The study thus aims at assessing the existing contextual conditions for effective technology integration from the perspective of education faculty, the experiences of faculty technology use, and their technology professional development needs and concerns in two Ghanaian tertiary teacher education institutions.

Purpose

This study seeks to explore the relationship of education faculty perceptions of technology professional development needs and their use of instructional technology in the tertiary teacher education curriculum in two Ghanaian universities. Knowing the exact levels and experience of faculty use of instructional technology, the contextual conditions, and faculty needs and concerns would help in the design of appropriate technology professional development programmes as a means of equipping faculty with educational technology integration skills and knowledge. Knowledge of how faculty members perceive educational technology would also throw light on the psychological aspects of the integration process and dispositions of faculty for the adoption and use of educational technology.

Research Questions

This study was guided by the following research questions:

i. What are the dominant perceptions of faculty about their technology professional development needs?

ii. How do faculty perceptions of technology professional development needs relate to faculty use of technology for teaching and learning?

iii. How do faculty members differ in their perceptions of technology professional needs based on their levels of technology use?

Literature Review

The use of ICT in Higher Education (HE) is not new and has an established tradition in education and other professional organizations in developed counties, particularly Europe, USA, Canada and Australia. However, the use and scholarship of ICT at the HE in Ghana is only starting to examine its feasibility as a tool that support curriculum and instructional approach as outlined in ICT Strategic plans in 2002 for UCC and 2003 for UEW). As a result, the adoption of innovation such as ICT by teachers involves a critical examination of faculty current perceptions about teaching and learning with technology, their technology professional needs and concerns and how these relate to their classroom practices.

This study adopted the Hall and Hord's (1987) Concern Based Adaptation Model (CBAM) as a way to understand change processes that occur in educational setting as a result of implementing innovation (ICT). The CBAM provides a theoretical sequence of stages that show how teachers (or other individuals) progress through a series of stages of concern when they are attempting or expected to use innovative materials.

The model further stipulates that in any organization implementing an innovation, as the change process unfolds, individuals feeling about the this innovation will change and follow a sequential seven stage path. This sequential seven-stage path of Hall and Hord's model starts with: the unawareness stage; this they said occurs when an individual does not indicate any significant interest or involvement in the innovation. Next

is the information stage; which occurs when a person becomes aware of and expresses an interest in learning about the innovation. Then followed by personal stage; the person feels uncertain about his or her role in the process of adoption of the innovation. Examination of the potential personal implications for use is considered. Management stage; at the Management stage, the individual is focused on the processes and task of using the innovation. The consequence stage occurs when the user evaluates the impact of the change on others;. The collaboration stage is when the individual communicates and works cooperatively with colleagues when adopting the innovation. At the final or Refocusing stage, the user considers alternative ways of using the innovation. In other words, the user is exploring "the possibility of major changes or replacement [of the innovation] with a more powerful alternative" (Hall & Hord, 2006: 140).

These stages are also categorized into three levels of concern of adoption as: self concern; task concerns and impact concerns, which in this study correspond to low, moderate and high-level instructional technology users' concerns. At the self concerns level, participants are interested to know what the innovation is, how it works, and what strategies they could adopt to use the innovation. Participants at the task concerns level begin to manage the innovation through demonstrations, training, and corrective feedback from facilitators. At the impact level, participants begin to implement their training and build their competence to a routine level of task management. Participants in each of these levels have unique needs, which technology integration facilitators should address before they can move to a higher level of practice. This model was proposed by Hall and Hord's (1987, 2006) and used as a framework to analyze the Collaborative Inquiry group's experiences during Project Based Learning adoption. We find the Hall and Hord's CBAM as the appropriate models in this study because the model explores the personal aspects of change, and therefore helps to analyze faculty personal experience and perceptions as they adopt ICT in HE.

Ely's conditions for successful technology implementation indicate that faculty members' dissatisfaction with the status quo (feeling a need to change), rewards or incentives (internal and external motivators preceding and following technology adoption), availability of time for implementation,

motivational academic leadership, availability of technology resources and faculty participation in decision-making are some of the important contextual conditions that motivate faculty to adopt and use technology for teaching and learning.

The CBAM was used to find out education faculty levels of concerns and needs with regard to their technology use for instruction. Ely's (1999) contextual conditions were used to establish education faculty perceived importance of conditions that facilitate their technology integration. The purpose was two-fold: (i) to determine which conditions were perceived to be most influential in enhancing faculty technology integration in instruction, and (ii) to determine the adequacy or otherwise of the existing contextual conditions for effective technology integration in the two Ghanaian universities.

Studies of technology professional development by Hall (2005), United States Department of Education (2005), and Fullan and Hargreaves (1996) have shown that professional development enhances faculty adoption and use of technology for teaching and learning. Moreover, Palak (2004) and others (Irani & Telg, 2002; Protheroe, 2005, Vaughan, 2002) have shown that taking faculty needs and concerns into consideration when designing professional development programmes enhances the effectiveness of such programmes. Leh's (2005) study of faculty use of technology reported that using (a) large group workshops, (b) small group meetings, (c) individual mentoring, and (d) just-in-time training had a positive impact on faculty members' ability to use technology in instruction. However, Zhao and Bryant (2007) reported that technology integration training is effective at the basic level, but it alone cannot lead to higher levels of technology integration. They concluded that although technology training opportunities have become widely available to teachers (in USA and other developed countries), their study indicated a need for more post training or one-on-one mentoring experiences in order to better support teachers' integration of technology, perhaps using other technology mediated learning spaces.

The use of other mediated learning tools and space have become necessary because of the paradigm shift of HE from traditional mode of teaching and learning towards blended learning (Kohen, 2002, Danish Technological

Institute, 2005, PLS RAMBOLL Management, 2005), open and flexible educational systems (Latchem 2004, PLS RAMBOLL Management, 2005), lifelong professional development and new virtual partnerships. The new trend also moves towards non-formal types of education, such as distance and life-long education (Jung, 2005). These are as a result of technological drivers and a combination of other factors, such -economic as socio changes, new educational needs, internationalization of education and students' demand for flexibility in class scheduling. Still on socio-economic factors, Latchem advances the argument that due to rapidly changing societal and work environments there is a demand for continuous learning. Also because non-traditional students are the new majority, this has resulted in greater needs for pursuing higher education for career development, job security, upward mobility, recareering and other professional and personal pursuits. This has therefore necessitated the adoption of Mediated Technology, particularly for faculty technology professional development.

The paradigm shift towards mediated technology and pedagogical changes challenge faculty and may trigger insecurities (Bower, 2001). This is because adoption of educational technology requires new skills for both the instructor and the student. Educational experience shifts away from teacher-centered to learner-centered. Instructors become more facilitators, intermediaries between the students and the resources they need for their own independent study (Bower, 2001). Latchem (2004) stated that staff can experience many problems when institutions move into open and flexible learning and import new ideas and practices that are neither fully understood by, nor in accord with the managers' and staffs' traditional values and practices. Therefore, combining new technologies with effective pedagogy has become a daunting task for both initial teacher training and in-service training institutions" (Jung, 2005. p.94). Other difficulty as a result of adoption of Mediated Technology is that teaching is becoming one of the most challenging professions in our society where knowledge is expanding rapidly and much of it is available to students as well as teachers at the same time (Perraton, Robinson, & Creed, 2001).

Notwithstanding these, Faculty generally perceives educational technology as a positive force in helping students' achieve their learning objectives

(Colaric, 2004; Jamlan, 2004). Today, there has been increasing evidence that ICT may be able to provide more flexible and effective ways for lifelong professional development for faculty staff (Jung, 2005). In this regard, information and communication technology (ICT) can provide more flexible and effective ways for professional development and connect faculty to the global community. Also, the provision of ICT-based training environments where on-demand access to materials, peers and networks of experts is one of the best ways to develop faculty's ICT skills and promotes ICT-pedagogical integration in faculty staff (Pacey, 1999). Consequently, the approach of using ICT to support teachers' on-going professional development and networking can be very effective as long as organized support is provided (Pacey, 1999 ; Office of Technology Assessment for the US Congress, 1995). Alexander (2001) claims that using educational technology in classroom teaching will produce advantages like improving the quality of learning and access to education and training. It will also reduce the costs of education and improve the cost-effectiveness of education apart from the operational benefits that relate to flexibility, effectiveness and efficiency.

The above indicate that there is a "growing tension between demands for radical change in educational priorities and processes and the expectations for teachers, especially with respect to the use of ICT in the teaching and learning process" (Kirsehner & Selinger, 2003: 6). Kirsehner and Selinger concludes that the teaching profession is therefore accused of having trouble adapting to these priorities at a pace that is fast enough to support the radical changes demanded. This is in line with Zhao and Bryant's (2007) argument that the main issues with faculty members' use of instructional technology go beyond their technology skills and availability of technology resources.

Highlighting on the professional competencies with regard to curriculum and concepts of organizing the learning experience with ICT, Collis and Jung (2003) see the need to make for two clear distinctions. These are first, a distinction between the use of ICT as a core technology (i.e., learning how to use ICT), and second as a complementary technology (learning with ICT). This study focuses on issues which inform pedagogical integration

of ICTs. They also talk about competences a teacher requires to work with ICT and new media. In this respect, Collis and Jung highlight the concept of ICT as tool for problem solving and as medium for educational process. They further comment that using ICT as a tool, the competences the teacher is required to know border on the ability to use ICT as a tooltype for structured learning task, cognitive and multimedia tasks and how their impact are properly managed in the learning environment for the desired effect. There is also the need for the teacher to conceptualize the levels of these competences and how they relate to working with ICT and new media. This conceptualization links well with the CBAM three-level model, which categorizes faculty concerns into self concerns, task concerns and impact concerns. These categories of concerns correspond to low-, moderate- and high-level instructional technology use.

Kirsehner and Selinger (2003) highlights four key benchmarks: competence users of ICT for personal use; as a mindtool; as a tool for teaching; and mastering a range of educational paradigms. These benchmarks make use of ICT level in pedagogical practices within prevailing views of teaching and learning. Reflecting on the benefits of these benchmarks, Kirsehner et al think that if ICTs are properly integrated in teachers' professional development, two key benefits can be derived. These perceived benefits are: teachers' ability to reflect on the concept of professional learning and organizational learning. According to them, these benefits are also believed to generate general purposeful and concerted action to act as catalyst for change.

Methodology

Participants and Setting

The participants for this study were 132 education faculty members of two Ghanaian universities, both tertiary teacher education institutions in Ghana. These participants were regarded as a time sample and were purposively selected for the study because the study focused on education faculty. Faculty members from these two universities have similar characteristics in terms of age distribution, computer experience, and their access to ICT facilities and equipment.

The two universities train teachers in pedagogy, educational foundations, and curriculum issues as well as content-related academic disciplines, at both the undergraduate and graduate degree levels. To facilitate students' computing activities, the two universities have set up computer centers with access to the Internet in all their campuses. These Centers are mainly used to teach computer literacy courses to students. In both universities, however, instructional technology is conspicuously absent in their classroom settings.

Research Design and Variables

The study used a blend of quantitative and qualitative methodology. The main instrument for data collection was survey. Fifteen items based on Soloway and Norris's (1999) faculty technology professional development needs survey were adopted and modified to suit the Ghanaian context (Appendix A). The survey also included one open-ended question that requested faculty members' views about their university's technology integration programmes. The survey was supplemented by eight interviews, involving a mix of technology adopters and non-adopters.

In the first part of the survey, faculty members were asked to rate their use of computer-based technology for personal communication and document preparation, research work, classroom management and student assessment purposes, and for teaching and learning purposes. Four Likert-scale survey items (Items 1- 4) were set on these broad technology use areas, six items (Items 5 - 10) on the use of specific application software, and ten items (Items 11 – 20) which asked faculty to indicate their level of agreement on the extent they would use specific technologies, if they were available. This last set of items was adopted and modified from a survey used by Soloway and Norris (1999).

The second part of the survey was used to collect data on faculty use of technology for teaching and learning. In all, 20 items were set on this variable (Appendix B). A one-item technology user level survey based on the CBAM (Hall & Hord, 1987) was also used to classify the faculty member's level of instructional technology use.

A pilot study was conducted to ascertain the reliability as well as the content and construct validity of the survey. Participants in the pilot study had

similar characteristics as the target population. Cronbach's alpha reliability coefficient was .81 (N = 127), which according to the reliability criterion suggested by Robinson, Shaver, and Wrightsman (1999) is exemplary.

Data Collection and Screening Procedures

In all, 316 surveys were distributed to faculty members of the participating universities through departmental contact persons. Participation was voluntary. A total of 143 surveys were returned. However, after the data screening, 132 were found to be usable, representing a 42% response rate. Using case summaries, the researchers identified only one wrong data entry in Factor 2 item 2 (3 was entered as 33). This was corrected. From the correlation table it was clear that scores of cases 106 through 110 were identical (dependency) in Factors 3, 4, 5 and Use. Therefore it was decided to remove cases 107 through 110. Cases 13, 78, 101, 105, and 130 also were deleted because all the items on several factors were blank, which were considered critical to the research questions. Two other cases were deleted because of clear case of satisficing because their responses to both negatively and positively worded items of similar measures were identical. In all, 11 cases were therefore removed from the data, resulting in 132 usable surveys. There were other missing values but they were mainly with the demographic data. The few scattered missing values were replaced by their series means since not more than one really occurred on a given item. So no item was deleted

The semi-structured interview protocol was based on Ely's (1999) contextual conditions for effective implementation of educational technology innovations, as described earlier. In all, eight education faculty members participated in the interviews, two from each of the four regional campuses. The interviewees represented the colleges of agriculture education, applied arts education, general culture and social science education, language education, science education, and specialized professional studies in education. The interviews were conducted in participants' offices on campus and ranged from 15 to 25 minutes. With their permission, these interviews were recorded using a digital voice recorder.

Data Analysis Procedures

The survey used a five-point Likert scale (5 = strongly agree, 4 = agree. 3 = neutral, 2 = disagree, and 1 = strongly disagree). Scores on negatively worded items were recoded using SPSS for a uniform interpretation of item scores. Descriptive statistics and one-way analysis of variance (ANOVA) were used to analyze the quantitative data to answer the research questions. An aggregate of mean scores for faculty perceptions of technology professional development needs, and faculty technology use for teaching and learning were used to represent the two dependent factors. The independent factor for the ANOVA was faculty level of technology use.

The interviews were transcribed and coded according to Ely's (1999) conditions. The interviews were analyzed alongside the results from the quantitative data in an integrated way, using the research questions and themes around the study constructs.

Results

This section covers the most important results of the study, discusses the implications of these results and makes recommendations for further study.

Demographic Information

Of the 132 faculty members participating in this study, 87.9% (n = 116) were male. The average age of participants was 45.6 years (standard deviation = 9.2). Forty-one percent (41%, n = 50) of the 127 participants who reported their ages were within the age range of 41-50 years. One hundred and sixteen participants (87.9%) were full-time faculty members, 7.6% (n = 10) were part-time faculty and 4.5% (n = 6) were retirees on short-term contracts. In terms of faculty ranks, 3.8 % (n = 5) were professors or associate professors, 75% (n = 99) were lecturers or senior lecturers, and 21.2% (n = 28) were either assistant lecturers or tutors. These figures show that majority of faculty members were advanced in age.

Participants were asked to indicate their technology experience. Figure 1 showed that of the 124 respondents to this item, 75% (n = 95) had been using technology from 0 to 5 years, while 2% for 16 to 20 years (N = 124).

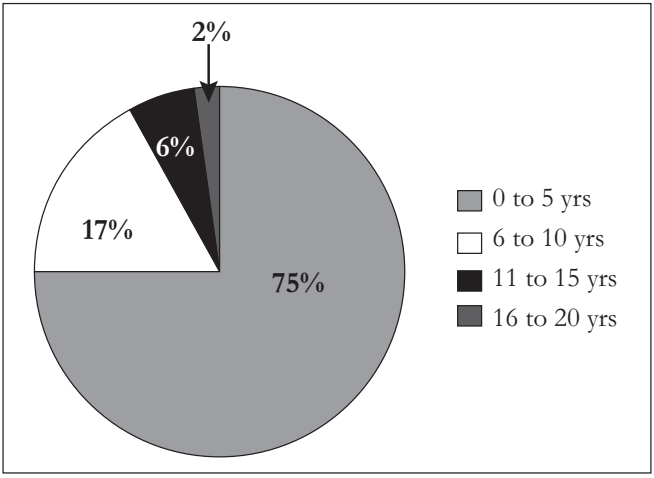

Figure 1: Technology experience

These frequencies indicate that the majority of participants (92%) are new to computer-based educational technology.

Faculty members were asked to indicate their level of technology use for teaching and learning.

Figure 2 indicated user levels of participants. As expected, 50.8 % (n = 66) of participants indicated they were in the low users category and 14.4% (n =19) in the high users' category.

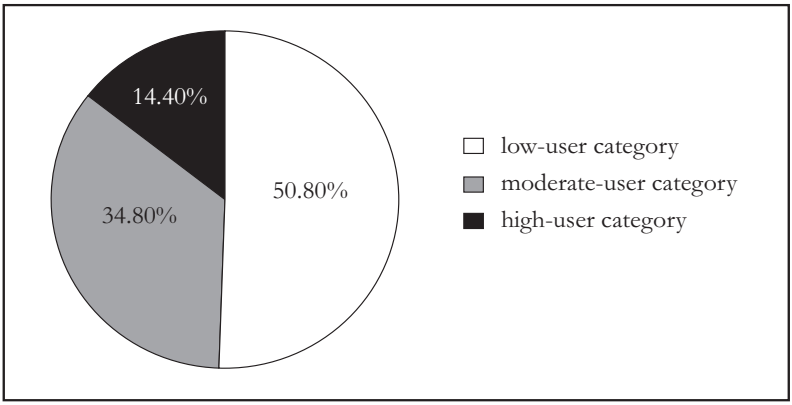

Figure 2: User technology adoption level

These figures indicate that most faculty members (85.6%) in this study were in the early stages (low or moderate users) of technology adoption for teaching and learning.

Participants were asked to indicate the level of technology training that they have had in the past five years. The majority (46.2%, n = 61) of them indicated they had basic computer literacy training (for example, Microsoft Windows operations) or no training at all, 40.9% (n = 54) said they had training on computer applications such as Microsoft productivity tools (for example, Word, PowerPoint and spreadsheets), while 12.9 % (n = 17) said they had training in computer-based technology for teaching and learning. This finding implies that, though 72.7% of participants might have had basic computer literacy or training in computer applications, training in technology integration for teaching and learning purposes was on the low side.

Descriptive Statistics

Table 1 (Appendix B) shows the descriptive statistics for the items on faculty perceptions of their technology professional needs. A high mean score ($M \geq 4.0$) is interpreted as a stronger agreement that an item is perceived to be an important need or condition. A low mean score ($M \leq 3.0$) indicates a disagreement with a condition or need. The items were rank ordered in order to interpret their relative importance.

The three most important technology needs expressed by faculty members were: (a) reliable access to the internet, (b) software that is subject-specific or curricular-based, and (c) training opportunities with teaching strategies that integrate instructional technology. Faculty members were also not satisfied with the following situations: (a) that attending a few technology workshops and seminars is enough for them to start using instructional technology and (b) that their university's faculty technology professional development plan meets their technology needs.

Overall, these results indicated that the contextual conditions as prescribed by Ely (1999) for the integration of technology into the curricula were not met in the participating universities. For instance, faculty members' needs

in terms of instructional technology resources and technology professional development programmes that focus on technology integration in instruction and students' learning were not met, as pointed out in the interviews and the survey findings. For instance, one of the interviewees stated:

> *Most of us lack the technology know-how and skills to integrate technology into our teaching. The workshops have had marginal effects because most faculty members do not have the opportunity to put into practice what they have learned. Without the follow-up workshops and technology equipment and other resources, faculty members sooner forget whatever they have learned.*

The interviews also support the survey finding that faculty members are not satisfied with the level of their involvement in the technology decision-making process. When asked how much faculty members were involved in the technology plan for their university, one of the interviewees remarked that:

> *That is one area that the university administration has not done well. They go to Accra [capital city of Ghana] and hire some technology experts to draw the plan with a few members of the technology management committee. They only inform faculty members after they have finalized everything with the external consultants.*

On a scale of 1 to 5, the mean score for faculty perceptions of their technology needs was 4. 73 (SD = .39), while the mean for faculty technology use was 4.70 (SD = .51). These high values, however, indicate that faculty members have a high positive perception of the use of technology for instruction. As one faculty member stated:

> *I think it [ICT] is an important tool that will help take teaching and learning to greater heights. [I] will need an expert in ICT to take me throughout stage by stage. The many things that the computer can [do] make me even more confused to attempt using it as a tool in my teaching. Nonetheless, the benefits are tremendous.*

However, the bivariate correlation between faculty perceptions of their technology professional needs and their technology use for teaching and learning was not significant ($p = .08$; two-tailed coefficient $r = .152$). This finding implied that faculty perceptions of their technology professional development needs did not significantly relate to their use of technology for teaching and learning.

A one-way ANOVA was conducted to determine if there were significant differences in the means of faculty perceptions of their technology professional needs based on the three technology user levels. The test was statistically insignificant ($F(1) = 3.08$, $p = .08$). Thus faculty members did not differ significantly in their perceptions of technology professional needs based on their technology user levels. This means that faculty members, irrespective of their level of use of instructional technology and academic discipline, generally have similar technology needs and concerns in these two universities.

Discussions

This study provided evidence that the majority of teacher education faculty members surveyed in Ghana were receptive to the use of technology for teaching and learning. From the survey findings and the interviews, participants reported a strong need for (a) more technology resources for instruction, (b) their participation in the technology decision-process, and (c) more professional development related to technology integration into their teacher education curricula. Participants also generally found the sporadic large-group technology workshops that were typical of their universities' technology professional development programs inadequate in meeting their technology needs and concerns.

A surprise in this study, however, was the insignificant relationship of faculty perceptions of their technology professional development needs with faculty technology use for teaching and learning. In other words, faculty members had similar technology needs, irrespective of their levels of technology use, as indicated by the high mean scores for their technology professional needs. This finding seems to agree with Vaughan (2002) and Zhao &Bryant (2007) (2007), who argued that professional development has been only moderately effective in bringing about higher level technology integration because of faculty limited participation in planning and designing their technology professional development programmes. Other research (Palak, 2004; Fullan & Hargreaves, 1996) supported the view that faculty technology professional development enhanced faculty adoption and use of technology for teaching and learning when such programmes are tailored to the needs and concerns of faculty.

A myriad of faculty members' needs and concerns were expressed in their responses to the open-ended question and interviews. Many lamented their lack of training opportunities, their inability to practice what they have been taught because of the lack of follow-up workshops and inadequate focus on their unique needs. This finding supports Palak's (2004) assertion that taking faculty needs and concerns into consideration when designing professional development programmes enhances the effectiveness of such programs.

The qualitative findings from the interviews and open-ended responses supported faculty members' low perceptions of the effectiveness of technology workshops and seminars (M = 2.92) and of their university's faculty technology professional plans' meeting their needs (M = 2.32). Faculty members saw technology integration as an important tool for teaching and learning, but they felt they were not adequately equipped with the needed skills and knowledge to integrate technology into their teaching. As pointed out by some of the interviewees, it would appear that large-group technology workshops, though they have been helpful in creating a general awareness of technology issues in education, have not had significant impact on faculty use of technology for teaching and learning. A blend of large group workshops, smaller departmental workshops, and peer-peer mentorship on an ongoing basis is needed to address the needs and concerns of this diverse group of faculty members (Zhao & Bryant, 2007).

Another possible reason why faculty perceptions of their technology professional development needs appeared to have no significant relationship with faculty's use of instructional technology may be their lack of technical knowledge and skills needed for effective technology integration into their teaching, as pointed out by many of the interviewees. Research (Becker, 2000; Ely, 1999; Palak, 2004) indicates that teachers who have a reasonable amount of technical skill, and who use computers to address their own professional needs, use computers in broader and more sophisticated ways with their students than those who have limited technical skills and no personal investment in using computers themselves.

Faculty members may also be discouraged from the adoption and use of instructional technology by the lack of their involvement in their institutions' technology innovation plans. Research (Vaughan, 2002; Zhao &Bryant, 2007) has shown that professional development programs do not seem to make significant impact on actual practices because faculty members are not involved in the planning and designing of such programs. This study supports (Palak, 2004) findings that, in most cases, professional development programs are designed, organized, and delivered based on the skills and knowledge of policymakers, and that external facilitators assume faculty members' needs, rather than allowing faculty to identify their needs and concerns and designing programs to address those needs.

Conclusion

Faculty perceptions of their technology professional development needs across the teacher education curriculum of the research sites appeared to have no significant relationship with faculty's use of instructional technology in this study. This shows that, irrespective of their academic disciplines and technology use levels, faculty members of these institutions face similar problems and concerns in getting them to use instructional technology. However, research (Eifler, Dinsmore, & Potthoff, 2004; Kadel, 2005; Watson 2006) shows that faculty perceptions of their technology needs, among other factors, determine their motivation to go the extra mile in the acquisition of technology integration skills and techniques for teaching and learning. This finding may imply that the contextual conditions for technology integration are inadequate in these institutions, a situation that calls for refocusing the ICT programs on teaching and learning.

The purpose of professional development is to bring about positive changes in the beliefs, attitudes, and classroom practices of faculty. Technology integration facilitators should therefore see faculty professional development programs as a means to promote faculty's knowledge, skills and dispositions towards technology integration for instruction and learning. Although faculty members in this study reported limited personal use of technology for teaching and learning, the majority had a very positive view of the value of technology as an instructional tool. The mean score

for faculty perceptions of their technology needs was 4. 73 (SD = .39). Academic administrators and technology integration facilitators of the two institutions could capitalize on this receptive posture to diffuse technology innovations further toward the practical integration into the teacher education curriculum.

It is also important that technology integration facilitators consider the diverse needs and concerns of faculty when planning professional development activities (Zhao & Bryant, 2007; Finley & Hartman 2004; Vaughan, 2002). Since the levels of individual expertise and technology use differ significantly among faculty members of the study participants, the choice of mode of inservice training should be based on their preferences, expertise levels, and particular needs (Kelsey & D'souza, 2004; Palak, 2004; Schnell, 2003). This means that support for the use of instructional technology in classrooms should be tailored to the diverse needs of faculty in a coordinated way (Schnell, 2003), and should be ongoing, according to the expressed needs and concerns.

Thus, academic administrators and technology integration facilitators in these two universities should determine the expressed needs and concerns of faculty prior to the design of their technology professional development programs instead of relying on experts' assumed faculty needs and concerns as reported in this study. This would enhance the implementation of their ICT plans.

The findings of this study suggest that faculty members across the curriculum of the two Ghanaian institutions need regular comprehensive technology professional development programmes rather than sporadic workshops that lack follow-up. Also faculty members' participation in technology decision-making in their institutions would give them ownership of such programs and thus motivate them to integrate technology in their teaching and learning. This finding is supported by the study of Zhao and Bryant (2007) that faculty members need more technology integration training or one-on-one experiences in order to better support faculty integration of technology. Finally, academic administrators of these institutions should provide reliable Internet access and computer-based technology resources in classrooms for instruction and learning. The availability of these resources

in classroom setting motivates faculty to use them for instructions and for their student learning.

It is recommended that future studies on this topic should focus on designing a faculty technology professional development plan for the participating institutions in Ghana and evaluating its implementation in action from the perspective faculty classroom practices over a longer period. It is also recommended that future studies should cover a larger target population of academics that include other disciplines other than educational studies (teacher educators) in order to get a complete picture of how academics in Ghanaian Higher Education pedagogically integrate ICTs.

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Appendix A

Faculty Perceptions of their Technology Professional Development Needs Survey

Please, circle the option that best reflects how you feel about each of the statements.

Rating Scale: Strongly Agree (SA = 5), Agree (A = 4), Neutral (N = 3), Disagree (D = 2), Strongly Disagree (SD = 1)

Item	SA	A	N	D	SD
1. I have an immediate need for more training with curriculum that integrates technology.	5	4	3	2	1
2. I need convenient access to more computers for my students.	5	4	3	2	1
3. I need more reliable access to the Internet.	5	4	3	2	1
4. I need more software that is subject/curricular-based.	5	4	3	2	1
5. I would need more technical support to keep the computers working during instruction.	5	4	3	2	1
6. I need more resources that illustrate how to integrate technology into the curriculum.	5	4	3	2	1
7. I need more training opportunities with teaching strategies that integrate technology.	5	4	3	2	1
8. I need more compelling reasons why I should incorporate technology into teaching.	5	4	3	2	1
9. I need more time to change the curriculum to incorporate technology.	5	4	3	2	1
10. I believe faculty members must have a stronger voice in the technology professional development programme.	5	4	3	2	1
11. Attending a few technology workshops and seminars is enough for me to start using instructional technology.	5	4	3	2	1
12. I need more regular instructional technology seminars/workshops.	5	4	3	2	1
13. I would like to collaborate with my colleagues on instructional technology issues.	5	4	3	2	1
14. My effort is primarily directed towards mastering tasks required to use instructional technology.	5	4	3	2	1
15. My university's faculty technology professional development plan meets my technology needs.	5	4	3	2	1

Appendix B

Faculty Technology Use for Teaching and Learning

(a) How often do you use computer-based technology in the following areas?

Please, rate your frequency of use as follows: Almost Always (AA = 5), Frequently (F = 4), Sometimes (S = 3), Rarely (R = 2), Never (N = 1)

Item	AA	F	S	R	N
1. Personal communication and document preparation, i.e. email and word processing	5	4	3	2	1
2. Research work, i.e. web browsing	5	4	3	2	1
3. Classroom management and student assessment/ evaluation purposes	5	4	3	2	1
4. Teaching and learning activities for your students	5	4	3	2	1

(b) How often do you use the following application software for instruction?

Please, rate your frequency of use as follows: Almost Always (AA = 5), Frequently (F = 4), Sometimes (S = 3), Rarely (R = 2), Never (N = 1)

Item	AA	F	S	R	N
5. Microsoft Word for word-processing and instruction.	5	4	3	2	1
6. Microsoft Excel/Access for instruction and course management.	5	4	3	2	1
7. Microsoft PowerPoint for presentation in class and seminars.	5	4	3	2	1
8. Statistical Package for Social Sciences (SPSS) for data analysis and research work.	5	4	3	2	1
9. Internet/E-Mail for research and instruction.	5	4	3	2	1
10. Subject-based instructional software.	5	4	3	2	1

(c) Please, circle the option that best reflects how you feel about each of the following statements.

Rating Scale: Strongly Agree (SA = 5), Agree (A = 4), Neutral (N = 3), Disagree (D = 2), Strongly Disagree (SD = 1)

Statement	**SA**	**A**	**N**	**D**	**SD**
11. I would use instructional technology tools more often, if they were available in my classroom.	5	4	3	2	1
12. I would like to use subject/curricular-based software in my instruction.	5	4	3	2	1
13. I would like to use a computer for instruction more often, if it were provided in my classroom.	5	4	3	2	1
14. I would like to perform Internet searches in my classroom.	5	4	3	2	1
15. I would like to use a campus-wide web-based system (e.g. UEW Online Student Information System and UCC Online Student Information System) for instruction online.	5	4	3	2	1
16. I hardly ever use instructional technology in my class.	5	4	3	2	1
17. I use basic computer applications (e.g., word processing, spreadsheets and PowerPoint) for instruction.	5	4	3	2	1
18. If I get the opportunity, I would like to use audio and video web-based systems for instruction.	5	4	3	2	1
19. I use the Internet to search for teaching materials.	5	4	3	2	1
20. Overall, the use of instructional technology has been helpful in my teaching and learning tasks.	5	4	3	2	1

Level of Technology use Survey

How would you describe your level of use of computer-based technology for teaching and learning? Please, select only one level.

Low (I am able to perform basic functions, but I still require help on a regular basis.)
Moderate (I am competent in a number of computer applications for instruction.)
High (I am proficient in using a wide variety of computer technologies for instruction)

Open-ended Question

Please, give your general view (s) about the integration of ICT into the teacher education curriculum and for teaching and learning as a teacher educator in the space below:

Appendix B

Table 1

Item Means and Standard Deviations by Rank

Item	Mean	SD	Rank
I need more reliable access to the internet.	4.42	.82	1
I need more software that is subject/curricular-based.	4.38	.77	2
I need more training opportunities with teaching strategies that integrate technology.	4.33	.85	3
I would like to collaborate with my colleagues on instructional technology issues.	4.23	.68	4
I need convenient access to more computers for my students.	4.20	.83	5
I need more resources that illustrate how to integrate technology into the curriculum.	4.17	.91	6
I need more regular instructional technology workshops/ seminars.	4.11	.83	7
I would need more technical support to keep the computers working during instruction.	4.09	.99	8
I believe faculty members must have a stronger voice in the technology professional development program.	4.08	.77	9
I have an immediate need for more training with curriculum that integrates technology.	4.05	.98	10
My effort is primarily directed towards mastering tasks required to use instructional technology.	3.61	.82	11
I need more compelling reasons why I should incorporate technology.	3.52	1.26	12
I need more time to change the curriculum to incorporate technology.	3.19	1.10	13
Attending a few technology workshops and seminars is enough for me to start using instructional technology.	2.92	1.11	14
My university's faculty technology professional development plan meets my technology needs.	2.32	1.02	15

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STUDENTS' EXPERIENCES AND PERCEPTIONS OF MASTER OF BUSINESS ADMINISTRATION PROGRAMME OFFERED THROUGH DISTANCE EDUCATION AT KENYATTA UNIVERSITY, KENYA

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Abstract

As a strategy to increase access to the ever growing demand for university education, Kenyatta University offers distance education programmes in various fields of study including Master of Business Administration (MBA). The quality of distance education degree programmes offered by Kenyan public universities has been a source of concern from stakeholders in education. Students are among the key stakeholders. This study therefore examined students' experiences and perceptions of MBA programme offered through distance study methods at Kenyatta University. The study adopted a descriptive research design. The study population and sample consisted of all the 40 students who were in August residential session. Data were collected using a closed and open ended questionnaire. Out of the 40 questionnaires issued, 34 (85%) were returned. Most of the students (70.6%) were motivated to join the programme by future career prospects. They identified independent learning using study modules as the single most emphasized (93.5%) aspect of programme delivery. Most of the students (62.9%) reported irregular and untimely supply of study modules which were supposed to facilitate independent learning. Majority of the students (63.6%) noted that the programme had inadequate number of instructors. There was also limited instructor-learner interaction (79.4%). They also reported poor coordination of the programme (47.1%). The university was poorly rated in the provision of accommodation facilities during residential sessions (60.7%), involvement of distance education students in formulation of policies (58.6%) and provision of guidance and counselling services (51.9%). The study concluded that the programme needed improvement in timely provision of high quality study modules, instructor – student interaction, students' support services and administration of the programme.

Introduction

Distance education has been described as a process of creating and providing access to learning when the source of information and the learners are separated by time, distance or both. The concept 'distance education' (DE) was first used in 1970 but was officially adopted in 1982 when the International Conference for Correspondence Education (ICCE) changed its name to International Council for Distance Education (ICDE). According to Keegan (1996), the concept distance education refers to terms such as distance learning, correspondence study, home study, independent study, external study, and distance teaching. The terms have previously been used to describe education that takes place in a non-traditional environment although the terms are not synonymous. This method of imparting education is applauded for providing systematic teaching-learning process to persons living in isolated areas where facilities for traditional form of classroom teaching cannot be developed. Moreover, it addresses needs of specific target groups and has great variation in the range of programmes offered.

Distance education is particularly popular in developed countries and has gained momentum in developing countries. In developing countries, DE is presented as a panacea that will democratize education. In line with this, major events have been organized in Africa in the last two decades to promote technology enhanced education. Such events include; the World Information Technology Forum (WITFOR) in Botswana in 2005; and in Ethiopia in 2007; and the e-learning Africa Conference in Ethiopia in 2007 and in Kenya in 2007.

With the proliferation of DE programmes and modes, the question of quality of the courses and degrees offered through DE has come to the forefront (Moore, 2003). Quality is an elusive term that means different things to different people. For instance, students may focus on facilities provided and usefulness of education provided on future employment. The academic staff may pay attention to the learning-teaching process. Management may lay emphasis to the institution's achievements; parents and guardians may consider the achievements of their children while employer may give importance to the competence of the graduate (Commission for Higher

Education, 2008). Meyer (2002) states that regardless of who is interested in quality in the unique environment that DE establishes, the key focus is to have a better understanding of what contributes to quality in DE courses and programmes. Although students are more likely to have a different idea of what quality of DE means, their view are nevertheless important (Meyer, 2002). It is therefore important for curriculum planners to find out what students find most effective in DE courses and programmes. Indeed, Sahin and Shelly (2008) opine that in designing, developing and delivering DE courses, students' needs and perceptions should be central. To ensure that needs of individual students learning at a distance are met requires an understanding of who they are. Thomson (1998) cited in Gibson (1998) informs us that distance learners are likely to be older, female, employed on full-time basis and married. Tucker (2003) emphasizes that it is important to examine such characteristics of distance learners in order to best serve them.

Several studies that have investigated students' experiences and perceptions of DE programmes and courses they were studying compared to those on tradition classroom have found some or no major differences. In a study conducted by Mitchell, Gadburge-Amyot and Simmer-Beck (2007), students said they expected to achieve the same grades in the on-line course as in a classroom indicating that they were receiving same quality education as their counterparts attending classroom on-campus. Similarly, Osei (2010) found that Executive Master of Business Administration (MBA) students in Ghana held positive perceptions towards the DE course. They further indicated that they were satisfied with teaching and learning offered through distance and with learner support services provided by the host institution. However, they had concerns about delay in provision of feedback on assignments by facilitators and lack of adequate facilities. In a study conducted by Shiao-Chuan (2002) in China, students cited subject matter, cost, reputation of the institution and time flexibility as the most important considerations in deciding on whether to pursue DE courses.

In a study conducted in Bangladesh by Islam and Jahan (2009), the learners opined that the time allocated for and the number of tutorial classes was not sufficient to cover the syllabus. The students made serious complaints that

instructional materials were delivered late. They also emphasized the need for transparency in the examination process. Xiaobin (2009) study in China found that the curricular in distance education are inadequate. The teaching models adopted were not always very reasonable, theories taught were not always connected to developing practices, support for student learning was not enough, and the interaction between instructors and students was low. Bukhsh (2010) study on students' perception regarding teacher education through distance learning in Pakistan found that majority (66.7%) of the students received instructional materials well on time, 85.9% were contented with the counselling services provided by the regional office. However, the study revealed that majority (88.7%) of the students complained of inavailability of tutors. Majority (53.6%) were not satisfied with the content of the study modules which they indicated were not updated, modern and containing latest knowledge of the subject. It is therefore evident that how learners experience and perceive DE courses has important implications on their satisfaction with the course and thus quality.

The double-edged need to increase access to higher education and generate much needed revenue has informed intent, development and ultimate introduction of part-time distance study programmes in public universities in Kenya. The universities can be described as dual mode institutions for they conduct both face-to-face and DE forms of instruction within the same institutions. The DE programmes are offered both on-campus and via outreach programmes at satellite centers. On-campus students attend lectures during the day, evening, weekends or vacations. Outreach programmes are administered and delivered at designated 'outreach' centers that are physically located off-campus. These centers tend to be poorly equipped and facilitators hired are usually recruited from outside the parent university's faculty (Juma, 2008). However, in most cases, staff performing administrative functions at the centers are full time university employees.

The predominant DE delivery model in Kenya is print based with little or no Information Communications Technology [ICT]. Other models include: institution-based model of study where residential sessions at university are conducted during vacation periods of April, August and December; mixed mode provision which is a combination of face to face and distance learning

strategies; and satellite and web-based DE at African Virtual University [AVU] (Juma, 2008). To gain admission to the universities, the DE learners must meet the same admission requirements as full-time students. Both full-time and DE students are exposed to the same curriculum, use same course syllabus and take similar examinations. All the programmes are moderated, controlled and approved by senates of the respective public universities (Commission of Higher Education [CHE], 2008). Public universities in Kenya are established under separate Acts of Parliament and are therefore not subjected to External Quality Assurance by CHE. Although public universities have instituted internal quality control measures to achieve Total Quality Management (TQM) by conforming to International Organizational Standards (ISO), issues on quality of certificates and degrees awarded to DE learners still arise.

As Keegan (1996) and Bates (1995) posit, the quality of DE programmes is still regarded as inferior to that of traditional institutions despite available literature that DE and traditional institutions are equal in terms of products. Many contentious disagreements exist among critics and experts as to the modus operandi and quality of part-time programmes, especially outreach programmes (Madunabum, 1997) and the notion that expansion of DE programme is driven by demand rather than sound pedagogy (Gladieux and Swail, 1999). This has raised concerns in the education circles. Students' experiences and perceptions of programmes offered through distance education are therefore important in providing insights on underlying issues that impact on the quality of the programmes. It was important, therefore, to investigate the experiences and perceptions the MBA students had on DE programmes.

The study was therefore guided by the following research questions:

1. What are the demographic characteristics of learners in the MBA programme?
2. What factors did learners perceive as important in deciding to enroll in the MBA programme offered through distance study methods?

3. What are the students' experiences with regard to teaching and learning aspects emphasized in the MBA programme offered through distance study methods?
4. What study provisions and conditions do the distance learners experience in the MBA programme?
5. What are the students' perceptions of the strengths, weaknesses, and areas for improvement in the distance education programme?

Theoretical Framework

The study is based on Holmberg's (1983) theory of didactic conversations which he later renamed 'learning conversations' (Holmberg, 2003). The theory hinges on the fact that the instructor and the students in distance education are physically separated and seek a means of remedying this fundamental gap between them. Holmberg argues that it is feasible to recreate the learner support and learning provisions of traditional classroom in distance education. This is critical in an effective distance education programme considering that distance education learners with previous conventional learning experience expect to get similar experiences in distance education (Holmberg, 1983). Learner support refers to a range of activities which complement the mass-produced study materials in distance education (Tait, 1995). Robinson (1995) outlines the key elements of learner support to include dialogue between learners and support agents (people in variety of roles with variety of titles), individual or group face-to-face tutorials, peer contact, feedback to students on their learning, well organized and coordinated tudy groups and centers – actual or virtual (electronic), and access to libraries, laboratories and equipment. Tait (1995) also incorporated counselling services for students. Learning provisions includes contents and quality of primarily pre-produced course materials, regular feedback on learning progress and support that is incorporated within the course materials and tutorial sessions (Robinson, 2004). Holmberg (2003) maintains that when these elements are present in the distance learning process, they lead to an increase in motivation, learning pleasure and successful programme completion results among the students. This

study therefore employed Holmberg theory to assess students' perceptions towards teaching - learning provisions and learner support provided by the institution and, experiences of students enrolled in the MBA programme.

Methodology

The study adopted descriptive survey research design. The survey population consisted of 40 Master of Business Administration students pursuing the course through distance education at Kenyatta University in the 2004/2005 academic year. The students were attending the August residential session. The use of this cohort in the study was to achieve a more comprehensive view of how students perceive distance learning since they had participated in the traditional on-campus programme at undergraduate level. The students were in their second year by the time the survey was conducted and were therefore conversant with the practices of the programme. All the 40 students pursuing the MBA through distance study methods at the university were asked to participate in the study. Thirty four (85%) of the students who participated in the study completed and returned the open and close ended questionnaires developed by the researchers. The demographic data collected include; gender, age, marital status, type of secondary school attended, and whether the student was in employment before joining the course. Data on important factors in enrolling in the course, aspects of teaching-learning process that are emphasized, and rating of study provisions and condition were collected using items developed on a five point Likert type scale. Three open ended questions were used to collect data on students views on the strengths, weaknesses and areas for improvement in the DE programme.

Study findings

Demographic characteristics of the respondents

Demographic information of the students was sought in order to help in interpretation of data while at the same time shed light on their perceptions and experiences. The data obtained are summarized in table 1.

Table 1 : Background characteristics of the respondents

Demographic characteristic	Labels	Frequency	Percentage
Gender	Female	10	29.4
	Male	24	70.6
	Total	*34*	*100*
Age	26-35 Years	5	14.7
	36-45 Years	23	67.6
	46-55 Years	6	17.7
	Total	*34*	*100*
Marital status	Single	5	14.7
	Married	29	85.3
	Total	*34*	*100*
Secondary school attended	National	10	29.4
	Provincial	15	44.1
	Harambee/District	8	23.5
	Private	1	2.9
	Total	*34*	*100*
Whether previously employed	No	1	2.9
	Yes	33	97.1
	Total	*34*	*100*

The results indicated gender disparity of students enrolled in the MBA programme. Majority (70.6%) of the respondents were male. The age bracket of the majority (67.6%) of the students was 36-45 years and most of the students (85.3%) were married. A good number of students (44.1%) had attended provincial schools. Almost all the respondents (97.1%) were in gainful employment. The findings are in agreement with Akintayo and Bunza (2000) who reported that learners in distance education are adults with professional responsibilities (jobs) and social responsibilities (families). They are therefore more likely to be mindful of disparities between their expectations of experiences in distance education and the reality of its provision.

Important factors in learner's decision to enroll in the MBA programme offered through distance education

It was necessary to determine the important factors that inform students' decision to enroll in the distance education programme. Students were given some factors to choose from. They were expected to rate the factors as 1) Very important, 2) important, 3) neutral, 4) less important and 5) not important at all. Valid percentages based on the number of respondents per factor were calculated. The data obtained is presented in table 2.

Table 2 : Important factors in the students' decision to enroll in the MBA programme

Factor	Rating					
	1	**2**	**3**	**4**	**5**	**Total**
Future career prospects (n=34)	**24 (70.6%)**	2 (5.9%)	2 (5.9%)	1 (2.9%)	5 (14.7%)	34 *100%*
Grades and admission cut-off points (n=32)	**12 (37.5%)**	**9 (28.1%)**	6 (18.8%)	1 (3.1%)	4 (12.5%)	32 *100%*
Expected income from the job (n=32)	6 (18.8%)	4 (12.5%)	**7 (21.9%)**	**5 (15.6%)**	**10 (31.2%)**	32 *100%*
Social recognition of the course (n=32)	**10 (31.2%)**	**8 (25.0%)**	2 (6.3%)	1 (3.1%)	11 (34.4%)	32 *100%*
Advice from teachers and guardians (n=33)	6 (18.2%)	8 (24.2%)	4 (12.1%)	1 (3.0%)	**14 (42.4%)**	33 *100%*

The data revealed that the most important factor informing students' decision to enroll in the distance education programme was future career prospects (70.6%). Evidently, grade and cut-off points, and social recognition of the course appeared to be important factors with the respective ratings being skewed towards 'very important' (37.5% and 31.2%) and 'important'

(28.1% and 25%). Surprisingly, expected income from the job appeared less important with majority of the students rating the factor as 'not important at all' (34.4%)' and 'less important' (15.6%). It would be expected that additional qualifications may result to increased salary and benefits from the employer (Wanjala & Otieno, 2010). Advice from parents and guardians was ranked as not important at all by 42.4% of the students. Based on the findings, designers of the programme should focus on learning experiences aimed at meeting the learners' need for their future career development. This should be reflected in the course modules which should be up to date and therefore equipping learners with latest knowledge of the subject that will provide them with a competitive advantage in the job market. Moreover, the programme providers should strive for equivalence of learning experiences in order to improve on public perception of the quality of degree programmes offered through distance study methods which may also affect employability of the graduates and largely, their future career prospects.

Aspects of teaching and learning emphasized in the MBA programme

A concern of the study was to investigate the aspects of teaching and learning that were emphasized in the programme. The students were expected to rate the emphasis of certain predetermined aspects as 1) Very good, 2) good, 3) fair, 4) bad and 5) very bad. The data obtained is summarized in table 3.

Table 3 : Aspects of teaching and learning that were emphasized

Factor	**Rating**					
	1	2	3	4	5	**Total**
Factual and practical knowledge (n=33)	**8 (24.2%)**	**8 (24.2%)**	**12 (36.4%)**	1 (3.0%)	4 (12.1%)	33 *100%*
Theoretical, conceptual and pragmatic knowledge (n=32)	**6 (18.8%)**	**9 (28.1%)**	**9 (28.1%)**	**8 (25.0%)**		32 *100%*
Attitude and interpersonal skills (n=28)	**10 (35.7%)**	**6 (21.4%)**	**8 (28.6%)**	3 (10.7%)	1 (3.6%)	28 *100%*
Independent learning (n=31)	**29 (93.5%)**			1 (3.2%)	1 (3.2%)	31 *100%*

Factor	**Rating**					
	1	2	3	4	5	Total
Regular class attendance during face to face sessions (n=33)	6 (18.2%)	3 (9.1%)	7 (21.2%)	**8 (24.2%)**	**9 (27.3%)**	33 *100%*
Teachers as main source of information (n=33)	3 (9.1%)	3 (9.1%)	8 (24.2%)	**12 (36.4%)**	**7 (21.1%)**	33 *100%*
Study materials as main source of information (n=32)	**14 (43.7%)**	**4 (12.5%)**	6 (18.8%)	8 (25.0%)		32 *100%*
Project and problem based learning (n=29)	**3 (10.3%)**	**12 (41.4%)**	**10 (34.5%)**	3 (10.4%)	1 (3.4%)	29 *100%*
Detailed regular assessment of academic progress (n=26)	6 (23.1%)	4 (15.4%)	6 (23.1%)	4 (15.4%)	6 (23.1%)	26 *100%*
Critical thinking (n=31)	**11 (35.5%)**	**10 (32.3%)**	**5 (16.1%)**	4 (12.9%)	1 (3.2%)	31 *100%*

The data revealed that independent learning was the single most emphasized (93.5%) aspect. Study materials as the main source of information was also highly emphasized though to a lesser extent (56.2%). The findings are in line with the main characteristics of distance education where students learn on their own guided by study materials arranged by instructors who are location and time apart from the students (Bukhsh, 2010). The instructor and the instructional strategy/methods in distance learning are subsumed into the study materials that have been designed as a self-directed learning guide for the student (Yang, 2008). Availability and efficient distribution of study materials is therefore a prerequisite to quality teaching and learning at a distance (Juma, 2003).

Teachers as the main source of knowledge and regular class attendance during face to face sessions appeared to have a weak emphasis (51.5% and 57.5% respectively). According to Alexander, Perreault, Waldman and Zhao (2002), lack of face-to-face interactions between the instructors and

students have been cited as a common barrier or disappointment reported by students in pursuing programmes through distance learning. Therefore, the low emphasis given to regular class attendance during tutorials suggests that the students may not be benefiting from the invaluable guidance of the instructors. This may cause apprehension among the students and largely affect the learning outcomes. Factual and practical knowledge (84.8%); theoretical, conceptual and pragmatic knowledge (75%); attitude and interpersonal skills (85.7%); project and problem based learning (86.2%); and critical thinking (83.9%) were also emphasized in the programme. Majority of the students opined that the aspects ranged between 'very good' and 'fair'. The findings therefore suggest that the programme strives to develop specific competencies in the learners in order to prepare them for effective functioning in their professions, organizations, positions or roles. The findings also show that CHE guidelines of preparing curriculum designed for residential programmes had been adopted in the programme.

Students' rating of detailed regular assessment of academic progress appeared to be evenly distributed across the scale. This may imply lack of established standards of assessment of academic progress in the programme. According to Dan and Ming-Li (2011), assessment allows both the instructors, teachers and programme administrators understand the teaching efficiency and the learners' progress and problems in a period. With timely feedback, the teaching is adjusted and improvements done. The students may therefore have lacked adequate formative feedback on the extent to which they were achieving course objectives. Similarly, teachers may not have intervened on learning areas that needed improvement. This may greatly constrain the reading habits of learners in distance education programmes.

Study provisions and conditions that learners experience in the university

The students were asked to rate the study provisions and conditions they experienced using a scale of 1-5 where 1=Very good, 2= good, 3= fair, 4= bad and 5= very bad. The data obtained and summarized in table 4 show that learners in the programme perceived that they had high quality

lecturers (70.6%). However, the lecturers in the programme were few as reported by majority of the students (63.6%). This finding concurs with Gudo, Maureen and Oanda (2011) who reported shortage of lecturers in public universities. In the case of distance education, the shortage may lead to lack of instructors to offer regular tutorials to the students. This denies students opportunity for deeper understanding of subject matter through critical enquiry in guided debate and practice. The shortage may also suggest inadequate number of course developers leading to recycling of old modules with no updated content. It was therefore not surprising that majority of the students (73.5%) had issues with the quality of the distance learning materials which were rated within the range of 'fair' and 'very bad'.

Opportunity for out of class interaction with the faculty was also lowly rated with 79.4 percent of the students rating the condition in the range of 'bad' to 'very bad'. Similar findings on limited instructor-learner interaction were reported by Mayeku and Odera (2011) study on policy guidelines and challenges in quality assurance in distance learning in Kenyan public universities. The students also decried poor supply (85.1%) of study materials which they rated within the range of 'fair' and 'very bad'. Similar findings on poor supply of study materials were reported by Islam and Jahan (2009) study on tutors and learners perceptions and experiences of Open and Distance Learning in Bangladesh. The students also seemed uncomfortable with the quality of administrative staff. Majority of the students (67.6%) rated the staff within the range of 'fair' to 'very poor'. Administrative staff in DE are the link between the programme and the institution's administrative structure. Poor rating of the staff by the students suggests that issues raised by the students in the centers were not adequately attended to or were not reported to the institution's management leading to inaction. This may affect students' confidence in the quality of the programme being offered. The students were also uncomfortable with testing, continuous assessment tests, and grading system. This was an area of concern considering that evaluation results are often the main means by which tutors communicate with individual learners. The university was poorly rated in the provision of accommodation facilities during residential sessions (60.7%), counseling services (51.9%), stocking of libraries (57.7%)

and provision of game facilities (57.7%). The findings therefore point to challenges as a result of expanding access to university education without regard to existing resources.

Table 4 : Study provisions and conditions learners experience in the university

Study provisions and conditions	**Rating**					
	1	2	3	4	5	**Total**
Opportunity for out of class interaction with faculty (n = 34)	2 (5.9%)	2 (5.9%)	3 (8.8%)	**14 (41.2%)**	**13 (38.2%)**	34 *100%*
Teaching quality of lecturers (n=34)	**9 (26.5%)**	**15 (44.1%)**	8 (23.5%)	2 (5.9%)		34 *100%*
Adequacy of teaching staff (n=34)	6 (18.2%)	4 (12.1%)	**8 (24.2%)**	**13 (39.4%)**	2 (6.1%)	34 *100%*
Quality of distance study materials (n=34)	2 (5.9%)	7 (20.6%)	**12 (35.3%)**	**6 (17.6%)**	**7 (20.6%)**	34 *100%*
Supply of study materials (n=27)	3 (11.1%)	1 (3.7%)	**6 (22.2%)**	**8 (29.6%)**	**9 (33.3%)**	27 *100%*
Quality of administrative staff (n=34)	4 (11.8%)	7 (20.6%)	**8 (23.5%)**	**9 (26.5%)**	**6 (17.6%)**	34 *100%*
Testing, continuous assessment tests, and grading system n=33)	5 (15.2%)	4 (12.1%)	**16 (48.5%)**	**7 (21.2%)**	1 (3%)	33 *100%*
Chance for students to have an influence on university policies (n=29)	4 (13.8%)	1 (3.4%)	2 (6.9%)	5 (17.2%)	**17 (58.6%)**	29 *100%*
Stocking of libraries (n=26)	3 (11.5%)	3 (11.5%)	5 (19.2%)	**5 (19.2%)**	**10 (38.5%)**	26 *100%*
Accommodation facilities for residential sessions (n=28)	3 (10.7%)	2 (7.1%)	**11 (39.3%)**	**6 (21.4%)**	6 (21.4%)	28 *100*

Study provisions and conditions	**Rating**					
	1	2	3	4	5	**Total**
Counseling services (n=27)	2 (7.4%)	2 (7.4%)	2 (7.4%)	7 (25.9%)	**14 (51.9%)**	27 *100%*
Game facilities (n=26)	3 (11.5%)		3 (11.5%)	5 (19.2%)	**15 (57.7%)**	26 *100%*

Strengths of the programme

The strengths of the programme identified by the students are summarized in table 5.

Table 5 : Strengths of the programme

Strength*	**Frequency**	**Percentage**
Flexibility of the programme	19	55.9
Giving the student a chance to work and pursue education	14	41.2
Being able to study near home and near family	2	5.9

* Multiple responses, n = 34.

The data presented in table 5 show that majority (55.9%) of the students listed flexibility as the major strength of the programme. Forty one point two percent (41.2%) reported giving students a chance to work and pursue education at the same time while 5.9% were of the opinion being able to study near home and family were strengths in the programme. Evidently, the identified strengths are in line with the needs of learners pursuing distance education. Considering that majority of the students were employed and with families, they need programmes that allow them to pursue education as they meet their social and professional responsibilities (Akintayo & Bunza, 2000).

Weaknesses of the programme as identified by the respondents

Data on the weaknesses of the programme as reported by the students is presented in table 6.

Table 6 : Weaknesses of the programme as identified by the respondents

Weakness*	Frequency	Percent
Poor coordination of programme activities e.g. timetabling	16	47.1
Few tutorial hours	13	38.3
Delayed examination results	8	23.5
Lecturers missing tutorials	8	23.5
Delayed delivery of tutorial materials	8	23.5
Lack of individual learner attention	6	17.6
Poor communication	6	17.6
Lack of access to computers	6	17.6
Poor learning environment during residential sessions	6	17.6
Poor record keeping	4	11.8
Outdated module contents	4	11.8
Lack of library services at the centers	3	8.8

*Multiple responses, n = 34

Almost half of the students (47.1%) decried poor coordination of programme activities. Key among the coordination issues identified was timetabling of face-to-face sessions and continuous assessment tests. About thirty eight percent (38.3%) of the students reported few contact hours. It was therefore not surprising that 17.6% of the students reported lack of individual learner attention in the programme as a major weakness. This was compounded by lecturers missing tutorials (23.5%). A student noted in a questionnaire: *"When I am stuck, nobody can explain"*. Schmidt and Gallegos (2001) emphasize that in a quality DE programme, instructors

must be available to respond to students' questions. The findings imply that the programme has not effectively broken the barrier of space and time in teacher-learner interaction in DE.

Confidence in examination procedures may be absent in the programme considering delayed examination results (23.5%) was a reported concern. Another concern raised was delay in delivery of tutorial materials for the various units (23.5%). A student lamented: *"The materials are insufficient. I am forced to make photocopies from other students despite having paid all the fees". Another commented: It is very unfair to receive modules after sitting for the continuous assessment tests or a few days to the final examinations".* Poor communication (17.6%) was also reported in the programme. Clarke et al (2004) contend that for distance education to be effective there is need for a well-managed communications network to direct queries to the right person and to be responsible for ensuring there is a timely response. It was also evident that there was poor record keeping in the programme (11.8%). The students also decried outdated module contents (11.8%). A student noted: *"The modules should be customized to fit the changing market needs. The curriculum is foreign and Indian examples are cited where local examples would still apply".* This raises some concerns that current issues may not be covered in these materials and the curriculum may not have made reference to local contexts.

Lack of library services at the satellite centers (8.8%) was also a reported weakness. Libraries are expected to be an integral part of quality education. According to Aina (2008), inadequate library facilities are perhaps the most fundamental problem affecting the quality of distance education programme in Africa. In a survey involving four major institutions offering distance education programme in Africa, Aina found that the library services to distance education learners in the universities surveyed were almost non-existent.

Areas for improvement

The areas for improvement reported by the students are summarized in table 7.

Table 7 : Areas proposed for improvement by the respondents

Area for improvement*	Frequency	Percent
Increase in contact hours	18	52.9
Update tutorial materials to include emerging issues	10	29.4
Timely communication to students	10	29.4
Provision of quality compact discs	10	29.4
Timely delivery of study modules	7	20.6
Improve programme coordination	5	14.7
Commitment among some faculty members	5	14.7
Proper record keeping	5	14.7
Timely provision of results for assignments/ CATs/examinations	4	11.8
More decentralization of programme activities	2	5.9

** Multiple responses, n = 34*

Majority of the students noted the need to increase the contact hours (52.9%), 20.9% were of the opinion that the tutorial materials should be updated to include emerging issues, 20.9% also suggested the need for timely communication to the students with a similar number listing the need to provide compact discs that are of high quality. There was also need to ensure that modules were supplied on time (20.6%), improved programme coordination (14.7%), more commitment among some faculty members (14.7%), proper record keeping (14.7%), and timely provision of results for assignments, CATs, and examinations (11.8%). The students also felt that there should be more decentralization of programme activities (5.9%) in line with the marketing strategy of the programme "Education at Your Door Step".

Conclusions of the study

The study concluded that majority of the MBA students in the programme offered through distance study methods were adults with social (family) and professional responsibilities. They were largely motivated to enroll in the programme by future career prospects and flexibility of the programme. Independent learning using the printed course modules was highly emphasized. However, there was irregular and untimely supply of the modules. The programme content aimed at developing specific competencies in the learners in order to prepare them for effective functioning in their professions, organizations, positions or roles. Factual and practical knowledge, theoretical, conceptual and pragmatic knowledge, attitude and interpersonal skills, project and problem based learning, and critical thinking were emphasized in the programme. While the programme had recruited high quality instructors, they were few resulting to limited face-to-face contact between the students and the instructors. The programme also had administrative challenges resulting to poor coordination at center level as evidenced by delayed examination results and poor record keeping. Accommodation, counseling and game facilities during the residential sessions were limited. Similarly, the students did not have a chance to have an influence on university policies.

Recommendations from the study

a) The University should ensure timely delivery of study modules to the students through the learning centers. It should be the University's policy that all registered students should have all the study materials at least two weeks prior to the commencement of the programme. There seems to be no indicator that the institution's service charter addresses this.

b) The government should fast tract the implementation of ICT policy. This would ensure that ICT infrastructure is available even in remote villages. This may serve to ensure timely delivery of study modules through on-line portals.

c) The University should consider increasing the number of tutors serving distance learners. This would ensure increased instructor – learner interaction leading to improved learning outcomes.

d) The University should consider training its staff at the centers. The training should largely focus on customer care and university policies on issues affecting students. This may serve to improve efficiency in the administration of the programme.

e) Considering the financial constraints affecting public universities in recent times, the University should consider outsourcing certain facilities such as accommodation. It should encourage public-private partnership in the provision of such facilities.

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