International Journal of Emerging Trends & Technology in Computer Science (IJETTCS)
Web Site: www.ijettcs.org Email: editor@ijettcs.org
Volume 4, Issue 6, November - December 2015 ISSN 2278-6856

Analysis of Technological FactorsInfluencing Adoption of ICT in Public Secondary Schools in Kenya

Bernard G. Gakenga[1]Dr. Joyce W. Gikandi[2]John W. Kamau[3]

[1]Mount Kenya University, School of Applied Science,
Department of Information Technology

[2]Mount Kenya University, School of Applied Science,
Department of Information Technology

[3]Mount Kenya University, School of Applied Science,
Department of Information Technology

Abstract

In the current digital society, it is increasingly becoming important for any aspect of human endeavor to integrate Information communication technologies(ICT) for enhancedproductivity. ICT adoption and integration in education is one of the key human endeavors globally. Emphasis on teacher centered teaching could be changed to student centered with the advent of adopting ICT in schoolscreating an interactive and interesting environment for learning. Change of teaching methodologies has been facilitated by adoption of ICT hence an interaction between learners and Teachers in education. Despite the various studies conducted on ICT adoption,integration and implementation, Kenya is still far away from realizing it. This calls into the question as to how ICTtechnological factors influences the adoption of ICTin schools. To fill this gap this study analyzesICTtechnological factors as the key factor influencing adoption of ICTin public secondary schools in Kenya. This understanding is important to the policy makers who can embrace it to enhance the adoption, integration and implementation of ICT in education. ACross sectional anddescriptive survey was carried out using qualitative and quantitative methods and a census donein 32 public secondary schools in Kiambu County. Data was collected using; interview schedules andquestionnaires. The study established various technological factors that influence adoption of ICT in education.As a result this study recommends a review on ICT adoption model used in public secondary schoolsin Kenyan.

Keywords: ICT Adoption, ICT Integration, ICT Implementation, Technical Support and Technological Factors.

1. INTRODUCTION

In the current digital society, it is increasingly becoming important for any aspect of human endeavor to integrate Information communication technologies (ICT) for enhancedproductivity. In the light of this, ICT adoption and integration in education continues to gain momentum in both developed and developing nations. Adoption is defined as a decision that individuals make each time that they consider taking up an innovation[1]. In other words it is the decision of an individual to make use of an innovation as the best course of action available after hearing about an innovation [2]. ICT integration is the means of using any ICT tool to assist teaching and learning[3]. ICT integration is farther linked with the concept of wholeness[4]. In this study Roger'sdefinition of adoptionis adopted as well as Williams' definition of ICT integration.

In most of the countries priority is given to ICT adoption integration and implementation in education.In realization of the huge potentials of ICT in education, governments have heavily invested in developing their respective ICT in Education Plans and bringing various ICT equipment and resources into schools[5]. In Kenya, Ministry of Education Science and Technology (MOEST), in partnership with three companies; Microsoft Corporation, Oracle Corporation and Digital Satellite Television (DSTV), did a pilot e-learning program implementation in Kenya in selected schools[6].

In support of ICT adoption integration and implementation in education, Kenya government in collaboration with other stakeholders involved in enhancing teaching and research in learning institutions have constructed a terrestrial fiber-optic network that connects most institutions of higher learning to enable them integrate their facilities for the purpose of sharing resources[7]. Despite this effort adoption of ICT information systems like: inter Organization Information Systems in education is far from being realized [7]. Reality of ICT is lagging far behind the vision, as advocates of ICT in education tend to only look at the technology and not how it is used [8]. This oversight has continuously remained a great barrier to adoption of ICT, as It was also noted that the success of the implementation of ICT is not dependent on the availability or absence of one individual factor, but is determined through a dynamic process involving a set of interrelated factors[9]. It is therefore clear that our main focus now should be howICT is used [10] as cited in[8].

Theoretical grounding for understanding and developing clear process of ICT adoption, integration and implementation has been lacking, the findings are supported by the study done by [11],[12],[13], [14] as cited in [8]. To build understanding it is important to develop good case studies with nice examples of best practices and new technology tools for learning [8], as presence or absence of one factor is not a sole determinant of ICT adoption[9]. Despite that there is need to develop a theoretical solution, which of which it is an involving task [8]. In this realization various scholars made effort and developed frameworks for adoption of ICT in education. However a search of the literature did not reveal any integrated model for ICT adoption in secondary education. This paper aims to fill that gap with a focus on identifying technological factors anddeveloping an Integrated ICT Adoption Model applicable in adoption, integration and implementation of ICT in education. This paper also aims to enhance understanding of the core components valid and reliable in ICT adoption, integration and implementation in education, as it is highly informed by the empirical study on technological factors in ICT adoption, integration and implementation in teaching and learning.

2. PROBLEM BACKGROUND

Vast advancement in ICTputs the education sector into a struggle in the effort to match the technology trends with its application in education. Use of ICT in some developing countries like Kenya secondary schools is growing at a sluggish rate, which is largely due to the technological factors including internet connectivity[7]. The government of Kenya has put a lot of effort to advance ICT adoption in education, but on the other hand,equivalent results in adoption of ICTare yet to be realized in secondary education. Reference [5]assert that ICT holds promise in providing not only anywhere and anytime access to knowledge, but also equal opportunities for networking and communication that allow knowledge sharing, participation, and lifelong learning.

In realization of the huge potentials of ICTadoption in education, governments have heavily invested on developing their respective ICT in Education Plans and on bringing various ICT equipment and resources into schools[5]. Ministry of Education, Science and Technology (MOEST), in partnership with three companies; Microsoft Corporation, Oracle Corporation and Digital Satellite Television (DSTV), did a pilot e-learning program implementation in Kenya in selected schools[15].

In the same vein, effective integration of online formative assessment as part of ICT integration in teaching and learning promotes students' engagement in self-monitoring and assessment, reflectivity and self-regulatory processes[16]. This implies that online educators can exploit the potential of online formative assessment to develop learner and assessment-centered environments that focus on enhancing learning experiences as opposed to teacher-centered environments where the teacher is the expert and learners assume a passive role [16].

Various types ofICTtools available and relevantin education include teleconferencing, email, video conferencing, interactive radio conferencing, television lessons, radio broadcasts, interactive voice response system YouTube, Internet, websites, animations audiocassettes and CD ROMs among others that have been used in education for different reasons[17].

ICTadoption, integration and implementation is of paramount importance in the access of knowledge and keeping pace with the modern developments[18]. Great contribution of ICT in the creation of digital resources like digital libraries where the students, teachers and professionals can access research material and course material from at anytime from anywhere facilitating sharing of scholarly material avoiding duplication of work[19],[17]. New educational approaches are attainable through adoption of ICT, eliminating time and geographical barriers in education where learners and teachers can log on from any place and access and or provide speedy dissemination of education[17] to target disadvantaged groups along the bond locally and internationally for both formal and non-formal education like health campaigns and literacy campaigns[5]. In addition ICT adoption provides higher order skills such as collaborating across time and place and solving complex real world problemsimproving the perception and understanding of the world of the student[17]. Thus ICT can be used to prepare the workforce for the information society and the new global economy[20].

3. PROBLEM STATEMENT

Notably inability to adopt ICT in education with equal results as the effort and resources invested has attracted various scholars to research and advice, on ways to overcome hindering barriers. Indeed some research works have been done on factors affecting ICT adoption; however, despite these works, the increase in the rate of adoption of ICT is still very low. Lack of technical support in schoolsis the most prominent concern for the reluctance in the adoption of ICT in education [21] as well aslack of expertise in using ICT as well. In view of this, this study answers the following research questions:

3.1 Research Hypothesis

This study collected and analyzed data to test the following hypothesis "H0: ICT technological factors have no influence in adoption of ICT in public secondary schools in Kenya."

3.2 Conceptual Framework for the Study

ICTtechnological factors collectively influence the adoption of ICT in teaching and learning. Some of these factors include internet connectivity, perceived complexity & Compatibility, availability of technical support, use of mobile learning technologies, Technical Knowledge and skills, ICT Resources and policy

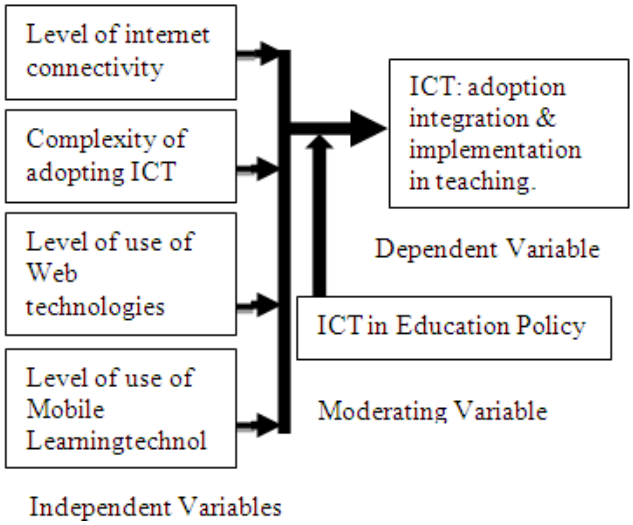

Figure 1: Conceptual Framework (Source: Researcher 2014)

4. METHODOLOGY

4.1 Research design and method

Quantitative research methodology has been used in this study aiming at classifying features, counts them, and constructs statistical models in an attempt to explain what is observed[22]. This is also supported by Wallimanas cited in reference [23], as applicable when working with data containing some magnitude.

Non-experimental design was used to establish the factors that are influencing the integration and the use of ICT in teaching and learning in secondary schools in Kenya. Non-experimental research design was used as it does not involve manipulation of the situation, circumstances or experience of the participants. A non-experimental design does not compare one group with another but describes the relationship between an intervention (treatment) and its effects on the population of interest[24]. In addition it may provide a rich understanding of the contexts, process, event, or situation and explain why results occurred, which may be essential for building result chains as the case of this study. Although it does not determine the causation, it provides good analysis of data, showing dependence of variables, used in decision making. Non-experimental research designs can be broadly classified into three categories. First, relational designs: in which a range of variables is measured, [24]. This design is also called correlational studies, because correlational data are most often used in analysis [24]. It is important to clarify here that, correlation does not imply causation, butrather identifies dependence of one variable on another. Correlational designs are helpful in identifying the relation of one variable to another, and seeing the frequency of co-occurrence in two natural groups, [24]. This analysis therefore is used to establish the, causal relationships between variables explored.

Survey method of data collection was used as a method of collecting information by interviewing or administering a questionnaire to a sample of individuals[25]. Therefore this study involved collecting primary data from the teachers about technological factors affecting information and communication technology adoption in teaching and learning using questionnaires, observation and interview schedules as they are the key players in adoption of ICT in teaching process. The secondary data was collected from literature review from the internet, journals and relevant books.

4.2 The Location of the Study

The study was carried out in Githunguri sub-County, Kiambu county- Kenya approximately 25 kilometers from Nairobi county- Kenya. Investment in education includes both the private and public primary schools. There is fair infrastructure development such as good roads, communication which includes a local radio station, electrification etc. These make the setting accessible and permits instant rapport with the respondents. No similar study has been carried out in the setting and thus convenience in this location justifieswhy study this area.

4.3 The Target Population

In Githunguri sub-County there are 32 public secondary schools. These schools were considered because there are schools of all categories with teachers from all levels of education and regional backgrounds. Schools in this area have got different level of resource like ICT laboratories ranging from those that have to those who do not have. See Appendix 9 target population.

4.4 Sample Design and Sampling Procedures

A sample design which is an explicit plan was determined before any data were collected for obtaining a sample from the population[26], the statement about the sample should be true in relation to the population and for descriptive study 10% of accessible population is enough[27]. Given that the target population is heterogeneous due to the nature of the schools in the region. Purposive sampling was used to capture sample schools and teachers whom the study felt that they have required information. 16 schools gave a sample size representing 50% of the total population. A sample size for the study was calculated using the formula for sample size determination for population less than 10,000;

$$nf = \frac{n}{1 + \frac{n}{N}} \qquad Nf = \frac{384}{1 + \frac{384}{964}}$$

Figure 2 Formula for sample size determination< 10,000(Source: Researcher 2014)

Where: nf = the desired sample size (when the population is less than 10,000),

n = the desired sample size (when the population is more than 10,000)

N = the estimate of the population size.

Using the above formula nf= [384Teachers] / (1+[384Teachers] 964 Accessible Teachers), =274 Teachers.

There two County schools, one boys school and the other girls' school. The eight sub county boarding schools include four boys' school and four girls' schools. The two sub county schools included in the sample; in the sub county boarding category, were sampled to represent each gender. The rest were sampled from the mixed boarding /day and day schools as outlined in the sample grid. Four subject teachers were randomly picked to be the respondents in each sample school and all principals from sampled school were targeted for interview to represent each category of schools. This gave a total of 274 respondents.

The data collection instrument ought to be varied. The study used formulated questions targeting a number of sample groups. The questionnaire entailed relevant questions to the study of interest. The sampled group was expected to respond to the questions in reference to the options given. The purpose of using this method was to attain records that can be used in future for references and easy access to details that call for less effort. One of the limits accompanying this method was that it could not serve the blind and those who cannot read at all.

The study used the interview schedule involved going to the field interviewing the target population. The advantage of this method was that the interviewer was able to get immediate feed-back from the interviewees.In addition this method was intended to accommodate face to face communication which involved eye contact and this enhanced the researcher's certainty on the feedback reliability.

As it cannot be assumed to be enough; observation had to be scheduled to observe the way learning was carried out in different activities in the school. These include how they do their examinations, how they research for information store and how they retrieve the information. This method allows the researcher to get the real picture of the study. A camera was used to get sample pictures.

This case study attempted to obtain information about ICT from schools and other stakeholders such as ICT champions, education officers and teachers among others, using purposive or judgmental sampling method. A sample frame was used, and Brookdefine it as a complete listing of all the sampling units or elements that can adequately represent that population[28]. However, Brook noted that there is no any complete official list that can adequately satisfy a study as sample frame [28]. In such instances, the study develops a sample frame that produces a representative sample of the population elements with the desired characteristics of attributes.

The study chooses the subjects who are most advantageously placed or in the best position to provide the information required. Therefore the research focused on all the 32 schools registered as examination centers for K.C.S.E by Kenya National Examination Council (K.N.E.C), in Githunguri sub-county in the year 2012.

4.5 Data Collection Tools and Techniques

Piloting was done to test the certainty of the research instruments before the real life undertaking. While undertaking the study, alongside using emails, assistance was sought from a group of youths to issue out the questionnaires to the target population. Using a phone a brief description could be given, on what was expected to be done with the issued questionnaires which were collected after three days. The study aimed to interview the whole target group on the first day, the study and the companion team were expected to follow the organized timetable to collect the data, in addition to using the two methods to collect the data the study involved taking notes hand in hand with the photographs on observations where allowed. To complete this process it took about twenty working days.

4.6 Research instruments

Research instruments are tools that were used in the study to collect data from the sampled respondents[29]. The questionnaires were used to collect data from the teachers while the principals were interviewed. Observation helped to gather crucial information that could not be obtained through interviews and questionnaires. The questionnaires was used to collect bio-data of the teachers, background information of the schools and gather information on the use of ICT in teaching and learning. Interview guide was used to gather information from the principals to establish the ICT policies used in their schools.

5. DATA ANALYSIS RESULTS

5.1 Regression Results

Regression coefficients representing the mean change in the response variable for one unit of change in the predictor variable while holding other predictors in the model constant was used, asthis statistical control that regression provides is important because it isolates the role of one variable from all of the others in the model[30]. On the other hand the p-value for each term tests the null hypothesis that the coefficient is equal to zero (no effect). A low p-value (< 0.05), indicates that you can reject the null hypothesis. In other words, a predictor that has a low p-value is likely to be a meaningful addition to the model because changes in the predictor's value are related to changes in the response variable[30]. Conversely, a larger (insignificant), p-value suggests that changes in the predictor are not associated with changes in the response[30].

The explanatory variables that were considered as seen in table 1; included use of reliable internet connectivity, Perceived Complexity, Compatibility, Technical Support, Web Techno, M-Learning, knowledge Skills, Resources and ICT Policy. These predictors as explained by Jim Frost [30] are therefore considered significant because their p-values are not greater than the alpha level of 0.05.The results of the logistic regression are presented in Table 1

Table 1: Logistic Regression summary(Source: Researcher 2014)

Variable	Coefficients	Std Error	t Stat(Z)	P-value	Lower 95%	Upper 95%
Internet Connectivity	0.97007789	0.13380471	5.650459874	0.02992211	0.18034295	1.331773369
Perceived Complexity	0.98646162	0.12153953	8.506908438	0.01353838	0.51098328	1.556868094
Compatibility	0.952206988	0.13998177	4.408605427	0.047793012	0.01483145	1.219417342
Technical Support	0.994196147	0.08924864	13.06907749	0.005803853	0.7823915	1.550403327
Web Techno	0.963430197	0.211600831	5.084710256	0.036569803	0.165484023	1.986373812
M-Learning	0.951715284	0.17096939	4.384387887	0.048284716	0.01397421	1.485218036
knowledge Skills	0.98646162	0.121539534	8.506908438	0.01353838	0.510983279	1.556868094
Resources	0.995023563	0.0806461	14.12261429	0.004976437	0.791941602	1.485925926
Policy	0.999935664	0.009693053	124.6666667	0.000064336	1.166694804	1.250106488
Number of observation 26	Pseudo R^2> 9.0 i.e. Goodness of fit 90%			Probability Chi .... <0.006		

Log Likelihood (LR), tests gave a value of 46.21 which was statistically significant at 1% level. This implies that the overall logit model that was estimated was statistically significant, that is, there was a significant relationship between the log of odds ratio and the explanatory variables.

From Table 1, the Pseudo R squared of the regression was 0.90, which implies that the included variables explained only 90 per cent of the variations in the adoption of the ICT in secondary teaching. The remaining 10 per cent was explained by other explanatory variables not included in the model. The coefficient of use of reliable Internet Connectivity in secondary teaching was positive (0.97007789), and significant (p = 0.021). This implied that the adoption of ICT in secondary teaching is related to the complexity of adopting ICT in teaching. The coefficient of the perceived complexity of adopting ICT in teaching was positive (0.98646162), and significant (p = 0.013). This implied that the adoption of ICT in secondary teaching is related to the complexity of adopting ICT in teaching.

The coefficient of perceived Compatibility of the ICT facilities necessary for ICT adoption was positive(0.952206988), and significant (p = 0.042), this implied that ICT adoption was proportional to the perceived Compatibility of the facilities necessary for ICT adoption in teaching. This means that the schools that perceive the Compatibility of the facilities necessary for ICT adoption to be incompatibility are less likely to adopt the ICT than the school that perceive the Compatibility of the facilities necessary for ICT adoption. The strong positive (0.994196147), and significant (p = 0.005), coefficient of Technical Support was as expected in this study. It means that in the schools where the Technical Support is provided the likelihood of ICT adoption is higher than in the schools where the Technical Support is lacking. The coefficient of ICT Policy on adoption of ICT in secondary teaching was positive (0.999935664), and significant (p = 0.000). This implied that the adoption of ICT in secondary teaching is highly dependent on ICT policy for its adoption in secondary teaching.

However, there are factors which determine the level of adoption of ICT in secondary teaching, and some of which were considered including, level of use of Web Technology which had a positive coefficient of (0.963430197), and significant (p = 0.036). This implied that the level of adoption of ICT in secondary teaching is related to the level of use of Web Technology in secondary teaching. The coefficient of level of available ICT resources was positive (0.995023563), and significant (p = 0.004). This implied that the level of adoption of ICT in secondary teaching is related to the level of available ICT resources in secondary teaching.

Finally, the coefficient of level of use of M-Learning was positive (0.951715284), and significant (p =0.048). This implied that the level of adoption of new technologies in secondary teaching is related to the level of available resources knowledge & skills and governing policy in secondary teaching.

Policy as a moderating factors demonstrated its effect on other technological factors in adoption of ICT.

The table 2 below shows the results of a correlation test between ICT adoption independent variables and ICTadoption [dependent variable] in the absence of ICT policy in Education.

Table 2: Regression with Varying Policy Value(Source: Researcher 2014)

Results of Regression test Holding other variables constant but Varying policy values						
Variable	Coefficients	Std Error	t Stat(Z)	P-value	Lower 95%	Upper 95%
Internet Connectivity	0.87891	0.25355	3.19154	0.04965	0.00230	1.61610
Perceived Complexity	0.98581	0.08607	10.17287	0.00202	0.60166	1.14947
Compatibility	0.88178	0.19586	3.23817	0.04792	0.01091	1.25756
Technical Support	0.99360	0.07753	12.44192	0.00640	0.63102	1.29818
Web Techno	0.96242	0.17746	5.01171	0.03758	0.12583	1.65293
M-Learning	0.95047	0.14324	4.32461	0.04953	0.00315	1.23579
knowledge Skills	0.64084	0.13868	-1.18057	0.35916	-0.76039	0.43296
Resources	0.99505	0.06656	14.16072	0.00495	0.65611	1.22884
Number of observation 26 Pseudo R2> 9.0 i.e. Goodness of fit 90% Probability Chi ...<0.006						

The results on Table 2 above show that, in the absence of policy, ICT adoption is negatively influenced by the independent variables. For instance in the presence of the policy, Internet Connectivity has a coefficient of 0.97007789 and a coefficient of 0.87891 in absence of the policy, giving a difference of -1. Meaning that in addition to provision of ICT technical support there is need for a reliable ICT policy.

The table below shows the results of a correlation test between ICT adoption independent variables and ICT adoption [dependent variable] in the absence of ICT technical support in Education.

Table 3: Regression with Varying Technical support(Source: Researcher 2014)

Regression test Holding other variables constant but Varying Technical support

Variable	*Coefficients*	*StdError*	*t Stat(Z)*	*P-value*	*Lower 95%*	*Upper 95%*
Internet	0.96739	0.12560	5.40116	0.03261	0.13798	1.21883
Complexity	0.99322	0.07341	12.08711	0.00678	0.57146	1.20319
Compatibility	0.95186	0.09667	6.79900	0.02086	0.24133	1.07323
M-Learning	0.56199	0.15391	-0.96085	0.43801	-0.81012	0.51435
knowledge	0.99850	0.03778	25.78685	0.00150	0.81163	1.13672
Resources	0.99360	0.08226	12.44192	0.00640	0.66954	1.37741
Policy	0.99420	0.06484	13.06908	0.00580	0.56843	1.12641

No. of observation: 26., Pseudo R2> 9.0, i.e. Goodness of fit 90% , Prob Chi . <0.006

The results on Table 3 above show that, in the absence of technical support, ICT adoption is negatively influenced by the independent variables. For instance in the presence of the ICT technical support, level of Internet Connectivity has a coefficient of 0.97007789 and a coefficient of 0.96739 in absence of the ICT technical support, giving a difference of -0.00268789, hence lower level of ICT adoption. This indicates that even though a good policy was provided there is need for a reliable ICT technical supporting education.

5.2 Summary of data analysis

Data collected was analysed, summarised and displayed using tables, charts and textual explanation. Variables tested and analysed were identified as informed by the literature. Dependent variables, independent variables and moderating variables were tested for reliability of presentations of the findings of the study on all the parameters included to determine the adoption of ICT in secondary education. Data collected was analysed. All identified variables as informed by review of literature were tested and results analysed. A regression test was done, asstatistical control, which regression provides is important because it isolates the role of one variable from all of the others in the model[30]. On the other hand the p-value for each term tests the null hypothesis that the coefficient is equal to zero (no effect). A low p-value (< 0.05), indicates that you can reject the null hypothesis. In other words, a predictor that has a low p-value is likely to be a meaningful addition to the model because changes in the predictor's value are related to changes in the response variable. In addition another test was done on the moderating variables for moderation purpose.

5.3 Conclusion on data analysis

From the analysis of data collected the study found that technological support was another very important moderating variable; “intervening variable” which together with policy which is a moderating variable determines adoption of ICT in teaching and learning. From the analysis it was noted that for instance in the presence of the ICT technical support, level of Internet Connectivity has a coefficient of 0.97007789 and a coefficient of 0.96739 in absence of the ICT technical support, giving a difference of -0.00268789, hence lower level of ICT adoption. Findings of this study are presented using tables, percentages, pie charts and textual explanations to justify discussion, conclusion and recommendation of this study.

Findings of chapter four were used to justify the conclusions made in chapter five. The findings of this study were presented using tables, percentages, pie charts and textual explanation used to inform chapter five for discussion and recommendations.

6.Discussion of Data Analysis Results

6.1 Response Rate

Table 4: Respondents summary(Source: Researcher 2014)

Category of School	**Frequency**	**%**
Boarding schools	8	25**%**
Boarding / Day School	2	6**%**
Day Schools	18	56**%**
Total Response	**28**	**87%**
Non Respondent	4	13**%**
Total population	**32**	**100%**

As presented in Table 4the total response rate was 87%, which compares well with the response rate of 70 % recommended by [31]. The response rate shown are explained by the nature of the sensitivity of the information sought from respondents, as most of them found it right to share their views and experiences comfortably.

6.2 Level of Internet Connectivity

Technology provides hardware, software and interconnectivity like, The East African Submarine Cable System (EASSy), which is an infrastructure project, which was initially supported by the World Bank.It is a fiber optic cable intended to connect the six sub-Saharan African countries, including Kenya, necessary for ICT adoption, mainly the availability of internet connection that is used to interconnect the schools to the internet, as a fundamental factor that is expected to influence ICT adoption in secondary school teaching.

From this study table 4.2 above 72% of the respondents indicate that teachers were un-able to reliably access and use internet connection in their teaching as one way of adopting ICT in teaching. On the contrary, 12% of the respondents implied that availability and access to reliable internet connection motivated their schools to adopt ICT. From the observation 72% of the school had no installed

internet devices; the respondents interviewed explained that the cost of internet installation and charges is high.
These findings therefore explain the fact that availability of reliable and fast internet connection motivates a school to adopt ICT in teaching. In support of these findings, previous studiesshow that the state of internet connectivity in Kenya is so poor that 75% of the learners prefer cyber cafés to provide reliable internet connectivity over those available in institution of learning[32].
The internet basically supports sharing of resources over the network; hence lowering the cost of buying sharable resources facilitates communication between parties who are geographically apart and thus improved efficiency. Numerous studies have shown that reliable internet connectivity and access is paramount to adoption of ICT in teaching, in that internet provides reference resource Murphy as cited reference [33], and also provides reliable means of communication amongst the learners and teachers. In additionstudies show that, education and technology are nicely interweaved now days and almost every teacher has a few preferred technology tools, that make doing his or her job and connecting with students a little bit easier and more fun for all involved, in deed there are at least 50web-tools for teachers[34]. Despite that 69% of interviewed respondentsindicating no idea on freely available web tools for secondary teaching. Internet provides access to numerous web-tools for teachers, which are reliable and effective technologies useful in increasing student motivation and facilitate clear thinking and development of interpretation skills with data[33].

6.2.1 Level of use of Web technologies

ICT resource accessibility via the internet provides a great support to adoption of ICT in teaching. In conjunction with access to reliable internet connection, web technology provides resources which can be accessed and shared by individuals who are geographically apart via internet connection. Lack of access is the principal obstacle and those different obstacles to using ICT in teaching were reported by teachers, e.g. lack of computers and internet connection[35]. Sharing of resources lower the cost of purchasing shared resources and maximizes production from available shared resources.
Findings of this study observed that 76 % of the respondents unlike the 20% of respondentsare un-able to adopt use of web technologies in teaching. From the observation 72% of the schools had not installed internet devices and the respondents interviewed explained that the cost of internet installation and charges is high, thus no access nor use of web-technologies.
In ability to access and use ufweb technology tools for teaching hinder adoption of ICT in teaching, these findings are supported by previous study indicating that learning institutions like universities in Kenya are still at low levels of internet access and thus hindering use of web technologies[32].

6.2.2 Levelof perceived complexity and Compatibility challenges

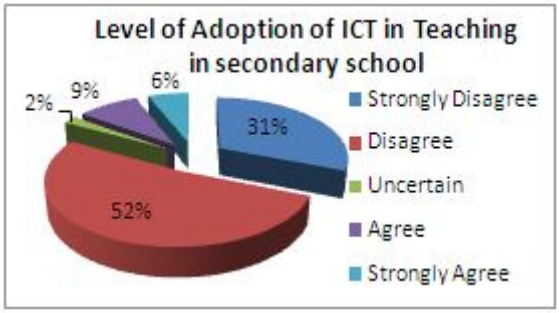

Figure 3: Perceived complexity and Compatibility challenges(Source: Researcher 2014)

Many stakeholders of education find it difficult to adopt ICT in teaching due to various challenges; some could argue that they are not able to combine their teaching methods with the ICT skills they have. Others find it tricky to convert their teaching material to e-material. The findings of this study figure 3 above, show that a total of 57% respondents were of the view that adopting ICT technology was complex to understand and use, while 34% were of the contrary opinion. Similarly as observed from figure3 that 83% of the respondentsindicated that their schools had not adopted ICT, while 15% had adopted. This high percentage of respondents with the perception that the ICT was complex could possibly explain the low level of ICT adoption by schoolsin Kenya. 16% of interviewed respondents explained that teachers argue that it is time consuming to prepare electronic material for use in teaching. They also felt that incase of computer system failure in the process of teaching a lot of time is wasted trying to amend it hence fearing to use ICT in lesson work. They also indicated that schools lack technical support for ICT adoption; in additional from observation 0% of schools had a computer technical assistant.
Findings of this study are supportedby a previous studywhich identified five technological attributes influencing the decision to adopt an innovation [2]. Technology characteristics influence the diffusion processes of an innovation and are significant factors impacting an innovation adoption. Evidence suggests that innovation attributes: relative advantage, compatibility, complexity, trial-ability and observables as perceived by individuals influence the rate of adoption [2].
Variance in ICT use can be explained by effects of technology resources and computer attributesi.erelative advantage, compatibility, ease of use and observableson innovative educational and administrative uses [36]. In addition, relative advantage, complexity, observables, and image are the most significant factors in predicting student teachers' intentions to make use of technology[37]. Finally "innovations that offer advantages, compatibility with existing practices and beliefs, low complexity, potential trial-ability and observables have a more widespread and rapid rate of integration" [38].

6.2.3 Knowledge and skills

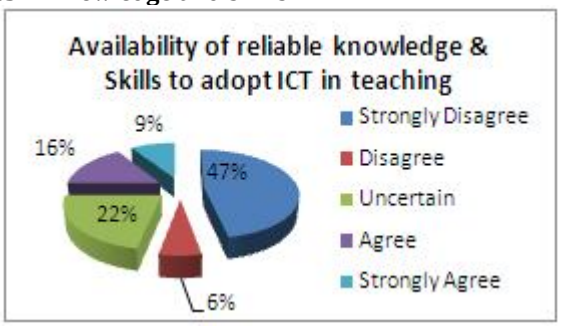

Figure 4: Reliable knowledge & Skills to adopt ICT(Source: Researcher 2014)

As observed from figure 4, that 53 % of the respondentsindicated that their school teachers were lacking ICT knowledge and skills, competent enough to adopt use of ICT in teaching, while 25% were of the opinion that they have knowledge and skills useful in adoption of ICT in teaching. 22% were missing and or uncertain whether they are competent enough in technology adoption, implying that they do not know what it requires to adopt ICT in teaching. This shows that the ICT knowledge and skills are low in the secondary school labor force, as justified in the reviewed literature on (barriers) that discourage the use of ICT by teachers. The factors that prevent teachers from ICT use can be categorized into: teacher level, school-level and system-level barriers. Teacher-level barriers include lack of teacher ICT skills; lack of teacher confidence; lack of pedagogical teacher training; lack of follow-up of new and lack of differentiated training programs[39].

Inadequate training, lack of access to computer laboratories, lack of technical support and inadequate technology resources are factors discouraging teachers from implementing ICT into their teaching[40]. Lack of teachers' time to learn new skills, old ICT equipment, large classes, number of computers available for pupils' use, lack of technical and pedagogical support and lack of collaboration among teachers were constraints to teachers' confidence and competence in the use of ICT[41]. Understanding the extent to which these barriers affect individuals and institutions may help in deciding how they are to be tackled [42].

6.2.4 Availability of ICT resources

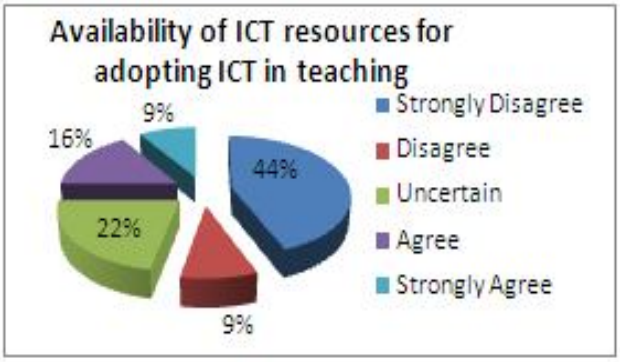

Figure 5: Available ICT resources for adopting ICT(Source: Researcher 2014)

As observed from figure 5, that 53 % of the respondents indicated that their schools had no ICT resources to adopted ICT in teaching, while 25% had the resources to adopt ICT in teaching, although they also could not effectively and reliably adopt ICT in teaching due to lack of reliable mentors on the same. From the interview, principals argued that even when they buy ICT resources they find a few teachers using them reliably, arguing that they need some technical assistance on technology adoption. This shows that the ICT resources for adoption of ICT are low in the secondary schools in Githunguri sub-county, as justified in the reviewed literature. the school-level barriers comprises absence of ICT infrastructure; old or poorly maintained hardware; lack of suitable educational software; limited access to ICT; limited project-related experience; lack of ICT mainstreaming into school's strategy and the system-level barriers include rigid structure of traditional education systems; traditional assessment; restrictive curricula and restricted organizational structure.

Teachers mainly use technology to prepare lesson notes and assessments instead of improving students' performances. Some barriers to the use of technology include congested classes, insufficient training, inadequate technical and pedagogical support, rigid school syllabi, inadequate motivation, lack of strong leadership and inadequate cooperation among teachers[43]. Finally lack of access, time pressure, lack of mentors and opportunities for training have effect on teachers' use of ICT in teaching and learning[44].

6.2.5 Lack of technical support

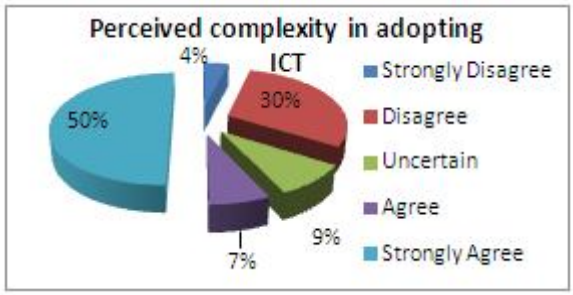

Figure 6: Perceived complexity in adopting(Source: Researcher 2014)

Lack of technical support posesdifficulties in adoption of ICT in teaching, as observed in figure 6 above, a total of 57% respondents were of the view that adopting ICT technology was complex to understand and use, while 34% were of the contrary opinion. Some teachers argued that they lack the skills to intertwine the technology with their traditional methods of teaching. This high percentage of respondents with the perception that the ICT was complex explains the low level of ICT adoption by schools in Kenya.In line with this study done in Turkish education system reported that the technology integration processes in the Turkish education system, provide schools with hardware and internet connections, it is also crucial to provide the schools with technical

support with regard to repair and maintenance for the continued use of ICT in schools[45].

Both good technical support in the classroom and whole-school resources are paramount for teachers to overcome the obstacles preventing them from using ICT[46].For bothprimary and secondary teachers, one of the top obstacles to ICT adoption in education is lack of technical assistance[47]. Nevertheless breakdown of a computer causes interruptions and if there is lack of technical assistance, then it is likely that the regular repairs of the computer will not be carried out resulting in teachers not using computers in teaching[48]. The effect is that teachers will be discouraged from using computers because of fear of equipment failure since no one would give them technical support in case there is a technical problem.

6.2.6 Level of use of Mobile phone

Mobile phone as a form of microcomputer has vast capacity to enhance reliable communication and even supporting data manipulation process [34], showed that yet as with anything related to technology, new tools are hitting the market constantly and older ones rising to prominence, broadening their scope, or just adding new features that make them better matches for education, which can make it hard to keep up with the newest and most useful tools even for the most tech-savvy teachers. In this study different mobile phone users had different perception on mobile phone use in teaching.

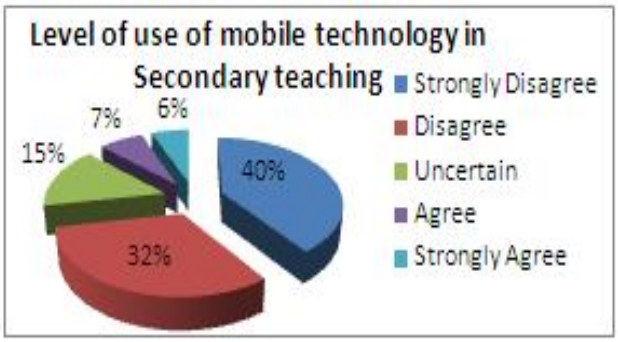

Figure 7: Use of Mobile technology in teaching(Source: Researcher 2014)

As observed from figure 7, that 72 % of the respondents indicated that their schools do not use mobile phone in teaching, while 13% do use. From the observation no teacher was found using a mobile phone in the teaching process. This shows that the use of mobile phone in teaching is low in the secondary school in Githunguri sub-county, despite the fact that mobile phone technologies provide different types of connectivity access that use the infrastructure of mobile telephone networks. These allow for voice and data communication via small hand-held devices or larger mounted devices, both of which can be connected to a computer or a computer network. There were several developments with these technologies during 2006 and 2007. Celtel and MTN are already providing mobile Internet technologies in Zambia. General Packet Radio System (GPRS), provided and further introduced a more advanced technology called EDGE which is faster than GPRS. This requires gadgets to be used to connect the Personal Computer to the mobile services via USB and PC cards.

The explanatory variables that were considered include use of reliable internet connectivity, perceived complexity, compatibility, technical support. However, as observed from figure 8, it was noted that 83 % of the respondents indicated that their schools had not adopted ICT, while 15% had adopted. In line with the questionnaire 80% of the respondents interviewed knew the importance of adopting ICT, but they explained lack of ICT technical support as a major challenge.

6.2.7 Adoption of ICT in secondary teaching

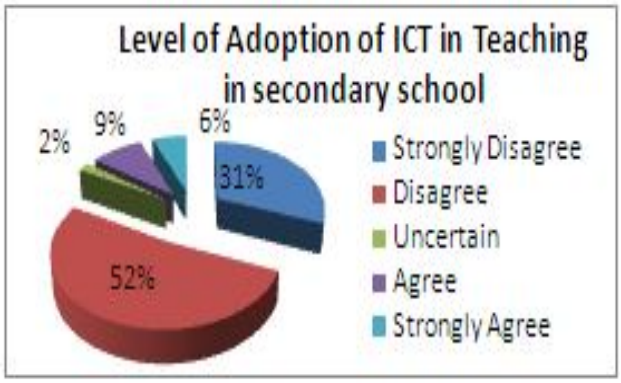

Figure 8: ICTAdoption in Teaching(Source: Researcher 2014)

In reference to the predictor variables tested in the regression test in chapter four above, it was noted that absence of one predictor reduced the level of adoption of ICT in secondary education and hence the need to provide for all predictors, so as to achieve a great level of adoption of ICT in secondary education. Otherwise this justifies the reason for 83% of respondents not adopting ICT in secondary education.

6.2.8 ICT Policy in Education

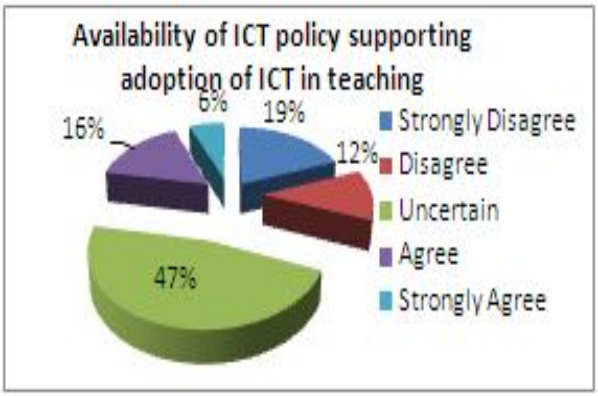

Figure 9: ICT policy in Education (Source: Researcher 2014)

From the data collected 47% of respondents seemed not to be aware of the support given by ICT policy on ICT adoption in secondary teaching while 22% of respondents agreed that ICT policy supports adoption of ICT in secondary teaching and finally 31% disagreed, to have enjoyed any support from ICT policy on adoption of ICT

in teaching. From the 47% of respondents who seemed not aware of ICT policy, some argued that they have never come across any publication about the school policy on ICT or engaged in any forum where ICT policy is mentioned other than news headlines in the local Television. From the interview, the principal response showed some knowledge on availability of the policy.

6.3 Conclusion

To build on confidence, competence in knowledge and skills for ICT adoption, professional development has to be emphasized. For reliable accessibility of ICT resources internet connectivity needs to be improved, for this can support access to resources via network as well as ensuring efficient sharing of internet resources. with this effect to realize the goal of the Kenya Education Network (KENET), which is to "establish sustainable communication and networking among educational institutions in Kenya that will facilitate wide use of Internet technology in teaching, research, and sharing of other information resources to the general populace at affordable cost."

The findings of this research indicates that various technological factors are important determinants of ICT adoption in teaching as supported by past studies, which shows that there is a significant relationship between adoption and technological factors [7], thus this study recommends that the government should adopt a more reliable model, which should help to harmonize integration of technological factors in ICT adoption in teaching, the model clearly point out areas of concern in the effort of ICT adoption in teaching as depicted in figure 13 .

Implementation of Kenya national ICT policy promulgated in January 2006 which aims to "improve the livelihoods of Kenyans by ensuring the availability of accessible, efficient, reliable and affordable ICT services, require to work hand in hand with a reliable ICT adoption model in teaching as shown in figure 13 in order to enjoy a great success in its implementation.

There is need to promote a mentorship program to propagate adoption of ICT in teaching, facilitate more access to ICT resources and internet connectivity as well as emphasizing on training related to use of ICT in teaching, this should go hand in hand with supporting teachers in part-time, distance and e-learning as it is in line with the ICT policy in place. This is in line with findings of previous study that claimed that lack of access, time pressure, lack of mentors and opportunities for training have effect on teachers' use of ICT in teaching and learning [44].

As seen from the discussion above the study proposed and developed an ICT adoption model for teaching as supported by aprevious study by KhalidAbdullah Bingimlas, who claims thatno one component in itself is sufficient to produce good teaching[33].However, the presence of all components increases the likelihood of excellent integration of ICT in learning and teaching opportunities.

6.3.2 The proposed ICTAdoptionModel

Proposed Education ICTAdoption Modelintegrates Technical SupportTeam (TST) as the intervening technological factor inICT adoption, integration and implementation in teaching and learning process. TST together with a policy which is a moderating variable determines adoption of ICT in teaching and learning.

TSTprovides technical documentation used to guide teacher trainers on how to develop subject content and pedagogical content. TSTprovides and or customizes ICT tools for use by teachers of various subjects.TST guide the policy makers on how to develop Specific, Measurable Attainable, realistic and Time bound (SMART) policy.

TST are responsible of lowering ICT adoption complexity by improving the tools available and providing required skills. TST redesign, develop and customize ICT educational tools for ease of compatibility in teaching and learning.

The Education ICT Adoption Model

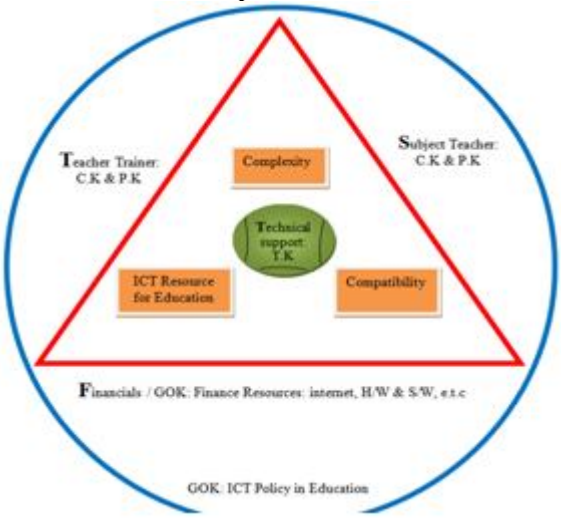

Figure 10: Proposed ICT AdoptionModel

Finally, of key importance from this study is the need for technological support team in schools.The team should provide technical support, to the teachers who adopt and integrateICT in their day to day teaching process. In line with this aprevious studyimplied that there is lack of teachers' preparedness for a class lesson due to lack of expertise in using ICT as well as lack of technical support in schools[21]. Therefore it is justified for this study to ask: "why is it that; it seems justifiable for schools to have laboratory technicians for other sciences and yet no consideration for computer laboratory technicians in schools?"

6.4 Recommendation

1. Testing and adoption of the proposed ICT adoption model developed above.
2. Education stakeholders to recognize and introduce computer laboratories technicians in schools liaising with computer scientist in the country
3. This study recommends for testing of the model designed for integration of role players in ICT adoption in secondary education.

4. Further studies on how to better the ICT adoption model designed in this study, by integrating other components of ICT adoption models found in other models.
5. A study to find out the relationship between technological factors and adoption of ICT in secondary education.
6. Mentorship project on ICT adoption to reduce perception that ICT adoption is Complex
7. Teachers Service Commission (TSC) should also join in supporting teachers' part-time, distance and e-learning as it is in line with the ICT policy in place so as to attain vision 2030 as stipulated.
8. The ministry of education to adopt this model to facilitate and evaluate level of ICT adoption in secondary teaching.
9. These argument provide basis to argue that there is need for model school, an addition subject on ICT adoption by teacher trainer
10. Future research to findout emerging technological factors affecting ICT adoption in teaching.
11. Extend the research even to the entire country of Kenya and abroad.
12. Find an answer for "why that it seems justifiable for schools to have laboratory technicians for other science laboratory and yet no consideration for computer laboratories in schools?"

References

[1]. Rangaswamy, A. and S. Gupta, "Innovation adoption and diffusion in the digital environment: some research opportunities," 2000.
[2]. E. M. Rogers, Diffusion of Innovations 5th Ed. New York: The Free Press, 2003.
[3]. M. D Williams, "Technology integration in education. In Tan, S.C. & Wong, F.L. (Eds.)," Teaching and Learning with Technology, pp. 17-31, An Asia-pacific perspective. Singapore, 2003.
[4]. R.S. Earle, "The integration of instructional technology into public education:Promises and challenges," ET Magazine, vol. vol. 42, no. 1, pp. pp. 5-13, 2002.
[5]. UNESCO, "Integrating ICTs in education, lessons learned," 2008.
[6]. Mildred. A, "E-learning in secondary Schools in Kenya. A Case of the NEPAD E-schools," 2010.
[7]. Waithaka. S.T. Kimani. T.M. Korir. J. and Muathe. S., "The Relationship between Technological Factors and Inter-Organizational Information Systems Adoption by Universities in Kenya," Engineering International, pp. Volume 1, No 1(2013), 2013.
[8]. Mishra, P., & Koehler, M.J, "Technological pedagogical content knowledge," A framework for teacher knowledge Teachers College Record, vol. 108(6), 1017–1054. doi:10.1111/j.1467-9620.2006.00684.x, 2006.
[9]. Morgan A. et al, "Factors Affecting Teachers.," 2009.
[10]. Mishra & Koehler, , 2003.
[11]. American Association for the Advancement of Science, "Dialogue on early childhood science,mathematics, and technology education," , Washington, DC: Author, 1999.
[12]. American Association for the Advancement of Science, "Project 2061: Proceedings of the second AAAS technology education research conference," , Washington, DC: Author, 2001.
[13]. Issroff, K., & Scanlon, E., "Educational technology: The influence of theory," Journal of Interactive Media in Education, June 29, 2004, from http://www-jime.open.ac.uk/ 2002.
[14]. C Selfe, "Technology in the English classroom: Computers through the lens of feminist pedagogy. In C. Handa (Ed.)," Computers and community: Teaching composition in the twenty-first century, pp. (pp. 118–139). Portsmouth, NH: Boynton/Cook., 1990.
[15]. Mildred A. Ayere, F. Y.Odera and J. O. Agak., "E-Learning in Secondary Schools in Kenya," Educational Research Reviews, pp. Vol. 5(5), pp. 218-223., 2010.
[16]. Gikandi, J.W.,Morrow,D., & Davis, N.E., "Online Formative Assesment in High education. A Review of the literature," Computer and Education, 2011.
[17]. Bhattacharya, I. & Sharma,K., "India in the Knowledge economy-an electronic paradigm," International Journal of Educational Management, pp. Vol.21 No.6, 543-568., 2007.
[18]. T.:Pelgrum,W.J.& Law,N. Plomp, "International Comparative servey of pendagogical Practices and ICT in Education," Education and Information Technologies, pp. Vol12,No2, 83-92., 2007.
[19]. V. S. Cholin, "Study of the application of information technology for effective access to resources in Indian university libraries," The International Information & Library, Review Vol.37,No.(3), pp. 189-197., 2005.
[20]. R. Komza, "ICT, Education reform and Economic growth," 2005.
[21]. A. T. Tella, "An Assessment of Secondary School Teachers Uses of ICTs," Implications for Further Development of ICT's Use in Nigerian Secondary Schools, Online Submission, p. 6(3)., 2007.
[22]. James Neill, Practical Guidelines for conducting research Summarising good research practice in line with the DCED Standard., 2007.
[23]. Kamau. W. Sanders. D., "An Empirical Investigation into the Effect of Usability on Adoption of Desktop Open Source Software by University Students in Kenya Computer and Information Science," , 2013, pp. Vol. 6, No. 3; 2013 ISSN 1913-8989 E-ISSN 1913-8997.
[24]. Mohammad Muaz Jalil. (2015, October) Donor Committee for Enterprise Development (DCED). [Online]. http://www.enterprise-development.org
[25]. Vehovar, V., Lozar Manfreda, K, ""Overview: Online Surveys". In Fielding, N.; Lee, R. M.; Blank, G.," The SAGE Handbook of Online Research Methods. London: SAGE., pp. pp. 177-194, 2008.

[26]. Orodho.J.A., "Techniques of Writing Research Proposal and Reports in Education and Social Sciences. Maseno, Kenya: Kanezja.," 2009.
[27]. Mugenda and Mugenda, "Research Methods: Questionnaire and Qualitative Approaches," Africa Centre of Technology Studies. Nairobi, 2003.
[28]. Brook, Selecting a sample. Educational Research., 250., 2013.
[29]. D. K. Kombo, "Proposal and Thesis Writting: An introduction. Nairobi: Pauline's Publications Africa.," 2006.
[30]. Frost Jim. (2013, may 07) How to Interpret Regression Analysis Results: P-values and Coefficient. [Online]. www. qualitydigest. com /inside/ quality-insider-column/interpret-regression-analysis-results-p-values-and-coefficients
[31]. Yun, G. W., & Trumbo, C. W, "Comparative response to a survey executed by post, e-mail, and Web form," Journal of Computer-Mediated Communication, vol. 6, no. 1. Retrieved February 6, 2015, from www.uky.edu/~kdbrad2/Web-basedSurveys.pdf, September 2000.
[32]. Pretorial Kashorda M, W. T., "National Plan for Hihger Education in South Africa," Readiness Survey of East Africa Universities Kenya Education Network (KENET) , pp. 13-37, 2009.
[33]. Bingimlas Abdullah Khalid, "Barriers to the Successful Intergration of ICT in Teachin and Learning Environments- A review of Literature," Eurasia Journal of Mathematics, Science & Technology Education, pp. pg 235-245, 2009.
[34]. Guest Writer. (2012) 50 Education Technology Tools Every Teacher Should Know About.
[35]. Empirica, "2006 Benchmarking access and use of ICT in European schools 2006: Final report from Head Teachers and Classroom Teachers Survey in 27 european countries," Germany: European Commission. , 2006.
[36]. Usluel,Y. K. , Aşkar, P. Baş, T, "A structural equation model for ICT usage in higher education. ," Educational Technology & Society, vol. 11, no. (2), pp. 262-273., 2008.
[37]. Yi, M. Y., Jackson, J. D., Park, J. S., & Probst, J. C, "Understanding information technology acceptance by individual professionals," Toward an integrative view. Information & Management, vol. 43, pp. 350-363, 2006.
[38]. Dillon, A., & Morris, M. G, "User Acceptance of Information Technology Theories and Models," Annual Review of Information Science and Technology, vol. 31, pp. 3-32, 1996.
[39]. Balanskat, A., Blamire, R., & Kafal, S, "A review of studies of ICT impact on schools in Europe European Schoolnet," 2007.
[40]. Chigona, A., & Chigona, W, "An investigation of factors affecting the use of ICT for teaching in the Western Cape schools. 18th European Conference on Information Systems," , 2010.
[41]. Peralta, H., Costa, F.A, "Teachers' competence and confidence regarding the use of ICT," Educational Sciences Journal , vol. 3, pp. 75-84, 2007.
[42]. Becta. (2004) Retrieved from Bectar Organisation:. [Online]. WWW.becta.org.uk/page_documents/research/barriers.pdf
[43]. S Yildirim, "Current Utilization of ICT in Turkish Basic Education Schools: A Review of Teacher's ICT Use and Barriers to Integration," International Journal of Instructional Media, vol. 34, no. 2, pp. 171-86, 2007.
[44]. Slaouti, D., & Barton, A, "Opportunities for practice and development: newly qualified teachers and the use of information and communication technologies in teaching foreign languages in English secondary school contexts," Journal of In-service Education, vol. 33, no. 4, p. 19, 2007.
[45]. N.P Yilmaz, "Evaluation of the Technology Integration Process in the Turkish Education System," Contemporary Educational Technology, vol. 2, no. 1, pp. 37-54, 2011.
[46]. S Lewis, "Enhancing teaching and learning of science through use of ICT: Methods and materials," School Science Riview, vol. 84, no. 309, pp. 41-51, 2003.
[47]. W.J. Pelgrum, "Obstacles to the Integration of ICT in Education: Results from a Worldwide Educational Assessment.," Computer Education, pp. 37.163-178, 2001.
[48]. A. Jones. (2004, May,20) A Review of the Research Literature on Barriers to the Uptake of ICT by Teachers. British Educational Communications and Technology Agency. [Online]. http://www.becta.org.uk.
[49]. A. Orodho, "Essential of Educational and Social Science Research Methods. Masola," 2003.
[50]. J. Voogt, "Consequences of ICT for Aims, Contents, Processes and environments of Learning in J. Van den Akker, W. Kuipper & Hameyer (Eds)," Curriculum landscapes and trends (blz. 217–236). Dordrecht: Kluwer, 2003.
[51]. K.p., and Trinidad, S.G. Tong, "Conditions and Constraints of Sustainable Innovative Pedagogical Practices Using Technology.," Journal of International Electronic for Leadership in Learning, pp. 9(3),1-27, 2005.
[52]. A. C. A. Ten Brummelhuis, "Models of Educational Change: The ntroduction of Computers in Dutch Secondary Education (Doctoral dissertation)," University of Twente, 1995.
[53]. N.B., & Wetzel, K. Strudler, "Lessons from Exemplary Colleges of Education: actors Affecting Technology Integration in Preservice Programs.," Educational Technology Research and Development, pp. 47(4),63-81, 1999.
[54]. J.P. Spillane, "External Reform Initiative and Teaching Effort to Reconstruct their Practice Mediating Role of Teachers' Zones of Enactment,"

Journal of Curriculum Studies, pp. 31(2),143-175, 1999.
[55]. D. Schmidt, "Technology and Teacher Education: Pre-service Teachers Can Help Make a Difference," Journal of Computing in Teacher Education, pp. 14(2),2-3, 1998.
[56]. I. G. Rosenthal, "New Teachers and Technology: Are They Prepared?," Technology and Learning, pp. 19,(8),22-24,28-29, 1999.
[57]. E. M. Rogers, Diffusion of Innovations 4th Ed. New York: The Free Press, 2003.
[58]. R. D. Parker, "Increasing Faculty Use of Technology in Teaching and Teacher Education," Journal of Technology and Teacher Education, pp. (2/7),105-115, 1997.
[59]. NCATE. (1997) Preparing for the 21 Century Classroom. [Online]. http://www.ncate.org/accred/ptojects/tech/tech-21.htm
[60]. J., & Gerschner, V. T. Lawton, "A review of the Literature on Attitudes Towards Computers and Computerized Instruction.," Journal of Research and Development in Education, pp. 16(1),50-55, 1982.
[61]. K. & Croninger, W. R. Kortecamp, "Addressing Barriers to Technology Diffussion," ournal of Information Technology for Teacher Education, pp. 5(1/2),71-82, 1996.
[62]. A. Koohang, "A Study of Attitudes Toward Computers: Anxiety, Confidence, Linking, and Perception of Usefulness," Journal of research on Computing in Education, pp. 222,137-150, 1989.
[63]. G., Lynch, B. Kearsley, "Educational Leadership in the Age of Technology the new skills," Journal of Computing in Education, pp. 25(1,)50-61, 1992.
[64]. C., Cennamo, K. S., Ertmer, P. A. & Johnson, T. Hruskocy, "Creating a Community of Technology Users: students become technology experts for teachers and peers," Journal of Technology and Teacher Education, pp. 8,69-84, 2000.
[65]. Y. Gülbahar, "Tnology Planning: A Roadmap to Successful Technology Integration in Schools.," Journal of Computers & Education,(ARTICLE IN PRESS). , 2005.
[66]. M. Fullan, "Successful School Improvement: The Implementation Perspective and Beyond," Philadelphia, USA, 1992.
[67]. M. Evans, "Open Windows: Becoming an e-learning School College for School Leadership (NCSL)," 2002.
[68]. P., Addison, P., Lane, M., Ross, E. & Woods, D. Ertmer, "Examining Teachers' Beliefs about the Role of Technology in the Elementary Classroom.," Journal of Research on Computing in Education, pp. 32,(1)pp. 54-72, 1999.
[69]. [69] J. Efaw. (2005) EDUCAUSE QUARTERLY 28(4). [Online]. http://connect.educause.edu/Library/EDUCAUSE+Quarterly/NoTeacherLeftBehindHowtoT/39946
[70]. M., & Meelissen, M. Drent, "Which Factors Obstruct or Stimulate," Journal of Computers & Education, p. (Article in Press), 2007.
[71]. J. O. Dooling, "What Students Want to Learn about Computers.," Education Leadership, pp. 53, 20-24, 2000.
[72]. K Brownell, "Technology in Teacher Education: Where Are We and Where Do We Go From Here? ," Journal of Technology and Teacher Education, pp. (2/3),117-138, 1997.
[73]. W. Bennis, "Why leaders can't lead:," Jossey-Bass, 1990.
[74]. Barker.P, "Using intranets to support teaching and learning.," Innovations in Education and Training International, pp. 36(1),3-10, 1999.
[75]. U Bangkok. (2004) ICT in Education. [Online]. http://www.unescobkk.org/index.php?id=1793
[76]. S.N Almusalam, "Factors related to the use of computer technologies for professional tasks by business and administration teachers at Saudi technical colleges," ProQuest Digital Dissertations (UNI No AAT 3011019), 2001.
[77]. Almanac, World Book of Facts , Students Per Computer in U.S. Public Schools. New York: World Almanac Books., 2002.
[78]. A Albirini, "Teachers' attitude Towards Information and Communication Technologies," Journal of Computer & Education, pp. 47,373-398, 2006.
[79]. Baylor, A. L., & Ritchie, D., "What factors facilitate teacher skill, teacher morale, and perceived student learning in Technology?," Computers & Education, pp. 39,395-414, 2002.
[80]. Harrison, A. W. & Rainer, R. K., "The Influence of Individual Differences on Skill in End-User Computing.," Journal of Management Information Systems, pp. 9(1),93-111, 1992.
[81]. Flanagan, L. and Jacobsen, M., "Technology Leadership for the Twenty-first Century Principal.," ournal of Educational Administration, pp. 41(2),124-142, 2003.
[82]. Dias, L.B., & Atkinson, S. (2001) Where Do Teachers Stand? International Electronic Journal for Leadership in Learning. [Online]. http://www.ucalgary.ca/~iejll/volume5/dias.html
[83]. Anderson R.E et. al., "School Technology Leadership Incidence and Impact," California, Irvine., 2000.
[84]. Grabe, M., & Grabe, C., "Integrating Technology for Meaningful Learning," USA, 2001.
[85]. Knezek, G. & Christensen, R., "Impact of New Information Technologies in Teachers and students," Education and Information Technologies, pp. 7(4),369-376, 2002.
[86]. Richardson, J., and Schaffer, "ICT Implementation in Education: an Analysis of Implementation Strategies in Australia, Canada, Finland and Israel," Luxembourg, 2004.
[87]. Volman, M., & Van Eck, E., "Gender equity and Information Technolog in Education," The Second

Decade. Review of educational Research, pp. 71(4),613-634, 2001.
[88]. Mosteller, F., & Tukey, J. W, "Data analysis and regression Reading, MA:," 1977.
[89]. Vehovar, V.; Lozar Manfreda, K, ""Overview: Online Surveys". In Fielding, N.; Lee, R. M.; Blank, G.," The SAGE Handbook of Online Research Methods. London: SAGE., pp. pp. 177-194, 2008.
[90]. Vockell, E.L. & Asher, J.W, "Educational research. 2ndedition. ," 1995.
[91]. Bosley, C. & Moon, S., "Review of Existing Literature on the Use of Information and Communication Technology Within an Educational Context," University of Derby, 2003.
[92]. Routledge, Taylor & Francis S. Ackroyd and J. A. Hughes, Data Collection in Context., 1981.
[93]. D. W. Sweet, "ICT in non Formal education and adult education. Supporting aut of School Youth and adults. Paris: OECD.," 2007.
[94]. A. SchoolNet, "Towards a strategy on developing African teacher capabilities in the use of information and communication technology. Uganda.," 2004.
[95]. J. Ratemo, "Doing away with books in the classroom. Standard: Online Edition.," 2009.
[96]. W. Olatokum, "Gendar and National ICT Policy in East Africa. Issues, Strategies and policy Options," pp. 53-65, 2008.
[97]. F. K. Olakulehin, "Information and communication technologies in teacher training and professional development in Nigeria," Turkish Journal of Distance Education TODJE, pp. 8(1), 133-142, 2007.
[98]. S. M. Ochuodho, "ICT policy making in East Africa. Civil Society involvement in ICT policy making," pp. (pp. 68-83). Nairobi: E.A.E.P., 2004.
[99]. S. Mutula, "IT Diffusion in sub-Saharan Africa. Implication for Developing and Managing Digital Libraries," pp. 281-289., 2004.
[100]. T. Mooij, "Design of Eductional and ICT conditions to integrate differences in learning," Contextual Learning Theory and a first transformation step in Early Education 'Computer in Human Behaviour, pp. Vol. 23, No (3), Pp: 1499-1530., 2007.
[101]. MOEST, "Kenya Education Sector Support Programme 2005 –2010; Delivering Quality Education and Training to all Kenyans," Nairobi, 2005.
[102]. E.-I. MoE. (2014b) Ministry of Education. [Online].
[103]. [103] M. Minish-Majanja, "Maping and Communication Technologies in lis Education in Africa. A Literature Review.," Education for Information, vol 21 no 2-3, pp. pp. 159-179., 2003.
[104]. [104] M. Minish-Majanja, "Intergration of ICT in Library Information Science Education in Sub-Sahara Africa, Department of Information Science, University of South Africa, Prectorial South Africa.," 2007.
[105]. [105] C. Microsoft, 2007.
[106]. MHEST, "ICT capacities and capabilities in secondary schools in Kenya 2009/2010. 046 Ministry of Higher Education, Science and Technology and National Council for Science and Technology," 2010.
[107]. K., Jeffrey, L., & Kinshuk. (2014 Mac Callum, "Factors impacting teachers' adoption of mobile learning," Journal of Information Technology Education, Volume 13, p. pp 144., 2014.
[108]. M.O.E, "National Plan for Higher Education in South Africa," 2001.
[109]. A. Kelles-Viitanen, "The Role of ICT in Porverty Reduction," pp. pp. 82-94, 2003.
[110]. G. Kariuki, "Growth and improvement of information communication technology in Kenya [Electronic Version].," International Journal of Education and Development using ICT, http://ijedict.dec.uwi.edu/viewarticle.php?id=6., 2009.
[111]. Jan.H, "Using mobile technologies to develop new ways of teaching and learning.," 2009.
[112]. M. I. Fund. (2011) MoE ICT Fund. Retrieved 07 05, 2014. [Online]. from ICT Fund: http://www.education.go.ke
[113]. G. Farell. (2007) Survey of ICT and Education in Afriac: Kenya Country Report. [Online]. www.infodev.org/en/document.409.pdf.
[114]. C. Communications Commission of Kenya, "Communications statistics report-Second. Nairobi: CCK.," 2009.
[115]. B. E. Charles, "Factors influencing teachers' adoption and integration of information and communication technology into teaching. A review of the literature.," 2012.
[116]. J. Afe, Reflections on becoming a Teacher and th Challenges of a Teacher Education. presented at Inaugural Lecturer Series 64 of the University of Benin, 2002.
[117]. Nduati, C., & Bowman, W., "Working from the sidelines: the Kenya private sector foundation ICT board story. VIn E. F. Etta & L. Elder (Eds.). At the crossroads: ICT policy making in East Africa, (pp. 56-67)," Nairobi, 2005.
[118]. Venkatesh, V., & Morris, M. G., "Why Don't Men Ever Stop to Ask for Directions? Gender, social influence, and their role in technology acceptance and usage behavior. MIS Quarterly.," 2000.
[119]. Ndidde, A. L., "Uganda Report. In T.Karsenti (Ed.). The Pan African research Agenda on the on the Pendagogical Intergration on Information and Communications Technologies: Phase 1 national reporta , 55-75. Ottawa: IDRC.," 2009.
[120]. Ndidde, A. N., Lubega, J., Babikwa, D., & Baguma, G. (2009), "Uganda report. In T. Karsenti (Ed.). The PanAfrican Research Agenda on the Pedagogical Integration of Information and Communications Technologies: Phase 1 National Reports, 55-75.,".
[121]. Sarah, H. E., "Teachers factors Influencing Influencin Classroom Use of ICT in Sub-Saharan Africa. A Review of Literature.," 2010.

[122]. Boakye, K.B., & Banini, D.A. , "Teacher ICT Readiness in Ghana. In K. Toure, T.M.S. Tchombe & T. Karsenti (eds.)," ICT and Changing Mindsets in Education. Bamenda, Cameroon: Langaa; Bamako, Mali: ERNWACA/ROCARE., 2008.

[123]. Akaslan, D. and Law, E.L.-C., "Measuring Teachers' Readiness for E-learning In Higher Education Institutions associated with the Subject of Electricity.," in Paper presented at the 2011 IEEE Global Engineering Education Conference (EDUCON),– "Learning Environments and Ecosystems in Engineering Education., Amman, Jordan, Turkey., (2010).

[124]. Etta, F. E., & Parvyn-Wamahiu, S., Information and communication technologies for development in Africa. The Experience with Community Telecentres, Vol2. Ottawa: IDRC., 2003.

[125]. Cross, M. & Adam, F., "ICT Policies and Strategies in Higher Education in South Africa," National and Institutional Pathways, Higher Education Policy, Vol. 20, No.(1), pp. Pp; 73-95., 2007.

[126]. MoE., E.-I. (2011a) Ministry of Education. [Online].

[127]. Macharia J. and Nyakwende E., "Factors Affecting adoption and diffusion of Internet in Higher educational Institutions in Kenya," Journal of Language, Technology and Entrepreneurship in Africa, pp. Vol. 1 (2), 2009 pp1-3., 2010.

[128]. Mohamed. A. et al, "Exploring the Relationship between Teaching Staff' Age and Their Attitude towards Information and Communications Technologies (ICT).," 2003.

[129]. Gordon O. Ouma, Fredrick M. Awuor, Benjamin Kyambo, "E-Learning Readiness in Public Secondary School in Kenya," 2014.

[130]. Magutu P.O., Mwangi M.,Nyaoga B.R.,Ondimu G.M, Mutai K.,Kilonzo H.,Nthenya P., "E-Commerce products and Services in the Banking Industry: The Adoption and Usage in Commercial Banks in Kenya," Journal of Electronic Banking Systems, pp. Vol. 2011, 1-8., 2011.

[131]. Gikandi J.W and Bloor, "Adoption and effectiviness of Elctronic Banking in Kenya," Electronic Commerce Research and Applications, pp. 277-282, 2010.

[132]. Ochuodho, S., & Matuga, M., "A national orchestra? Civil society involvement in ICT policy making. In E. F. Etta & L. Elder (Eds.),. At the crossroads," ICT policy making in East Africa , pp. (pp. pp. 68-83). Nairobi: E.A.E.P., 2004.

[133]. Dillon, A., & Morris, M. G., "User Acceptance of Information Technology," Theories and Models. Annual Review of Information Science and Technology, pp. 45, 33-61, 1996.

Author Profile

Mr. Gakenga Bernard Gathogo is a Computer Studies Educator and a director of Life is Digital Society Kenya. He holds a Master of Science in Information Technology and a BED from Mount Kenya University. He is an upcoming scholar with research interests mainly in Software Engineering, Databases, Artificial Intelligence, Online-Learning, Information Systems, and Computer Security. He has presented a conference paper on Integrated ICT Adoption Model- IIAM.

Dr. Joyce W.Gikandi is the head of E-learning and the director of postgraduate studies in Mount Kenya University (Nairobi Campus). She holds a PHD in E-learning. She has strong interests in E-learning and information Systems. She has widely published and presented papers in conferences mostly on areas to do with online learning.

MR. John Wachira Kamau is a lecturer at Mount Kenya University. He holds a MSC. IT and is currently a third year PHD student at the University of South Africa (UNISA). He has strong interests in Databases, artificial intelligence, software engineering and information Systems. He has widely published and presented papers in conferences mostly on areas to do with Open Source Software adoption (OSS).