Factors Influencing Integration of Information and Communication Technology in Learning and Teaching in Public Secondary Schools: A Case of Trans Nzoia West Sub County, Trans Nzoia County, Kenya

Josiah Mwachi Waiti

Doctor of Education student, Department of Educational Administration and Planning,
University of Nairobi-Kenya
E-mail: josiahmwachi@gmail.com

Abstract: This study aimed at examining factors influencing ICT integration in teaching and learning in public secondary schools in Trans Nzoia West Sub County. The main variables of the study were availability of ICT infrastructure, technical support, attitude and teachers' competence in ICT. The study used descriptive survey research design since the researcher was interested in finding out the characteristics of the respondents as they were. The target population was all the public secondary schools in Trans Nzoia West Sub County, Trans Nzoia County. The target population included 57 principals and 342 heads of department. Ten percent was used as the determinant of the sample size. In that case the sample size was 5 principals and 34 HODs. The methods of data collection were interview schedule for principals and questionnaires for HODs. Observation was also used to check physical presence of ICT facilities. The computer programme, SPSS was used to enhance efficiency in the quantitative data analysis.

Results of this data analysis were presented using frequency distribution tables. Qualitative data was analyzed qualitatively using content analysis of meanings and implications emanating from respondents' information. The results were then reported in descriptive narratives. Regression analysis was done to determine the influence of the dependent variables on the independent variable. The three variables: availability of ICT infrastructure, teacher competence, and technical assistance were found to significantly influence integration of ICT in teaching and learning in the sampled schools. The study concluded that effective integration of technology into classroom practices poses a challenge to teachers. The factors that influenced integration of ICT were teacher competencies in ICT, institutional factors related to ICT infrastructure and technological factors. Teachers' training, knowledge and skills in ICT influence their use of ICT in teaching and learning. In relation to ICT infrastructure, absence of ICT infrastructure, old or poorly maintained hardware, lack of suitable educational software; limited access to ICT ,lack of or unreliable internet connectivity were found to be hindering integration of ICT. In regard to technical support, this study established that most schools had no computer technicians. The study recommended that schools should develop strategies to identify strengths and weakness of various technological resources with a view to adopting ICT in the process of teaching and learning. The schools should source for partners to finance the acquisition of more ICT infrastructure and lessen the workload of teachers so as to enable them find time to learn and integrate ICT. The study further recommended schools to provide teachers with regular trainings and seminars on how to adopt ICT in the teaching and learning process, as well as adopt policies that guide structured integration of ICT in the process of teaching and learning.

Keywords: Curriculum, Infrastructure, Information and Communication Technology, Integration, Teacher competence, and Technical support.

1.0 Introduction

The study of information and communication technology integration in organizations' and institutions' programmes began around 1950s (Clark and Meyor, 2003). These researchers argue that the potential of Information and Communication Technology (ICT) to enhance human capabilities and revolutionize the running of programmes in institutions was first realized in other sectors of society, mostly in the business world, engineering and the military, other than in education. The importance of ICT contribution is also widely recognized both in the workplace and at home (Peterson, 2000; Dawson, 2001). These are just a few examples which point out that ICT is becoming a vital enabling tool that can no longer be ignored in learning and teaching in schools. Many Countries of the world, Kenya included, have now realized that the force driving globalization in the 21st century is undoubtedly ICT. Countries are now focusing on integrating ICT into learning and teaching in schools. With the introduction of computer-based technology in schools, major changes have been observed in the way learning and teaching is being run innovatively and even managed through EMIS. However, the only challenge is that the potential of ICT in learning and teaching in public secondary schools in Kenya is not fully exploited by integrating ICT and utilizing EMIS. This reckoned the need to examine factors influencing ICT integration in teaching and learning in public secondary schools in Trans Nzoia West Sub County.

1.1 Background to the study

The importance of ICT in learning and teaching is quite evident worldwide and especially in Europe and United States of America (Empirica, 2006). Information and Communication Technology was first used in educational institutions in North America and Europe in 1970s. In these Countries, computers are used to enable successful learning in e-learning and to provide professional development for multiple staff in a learning institution and school management systems (SMS), enabling them to be more effective. Brannigan (2010) argues that in recent times, there has been a global explosion in the use of computers in schools as an instructional, communicative and informational resource tools by use of databases, spreadsheets, multimedia, email, and network search engines. In response to demand for ICT as a gateway to learning the 21st century skills, many countries in the world have greatly invested in ICT to improve teaching and learning. The government of the United Kingdom spent £2.5 billion on school ICT infrastructure in 2008 and 2009 (Nut, 2010). In the New Zealand, the government spent over 841 million on schools ICT infrastructure in 2008 (Johnson *et al.,* 2009). This expenditure has left schools in these countries well equipped in terms of ICT infrastructure in learning and teaching for their students to remain competent globally as they advance in their careers.

In Africa, the Economic Commission for Africa has indicated that the ability to access and use information is no longer a luxury but a necessity for development (Gray and Smith, 2007). According to Aduwa *et al.,* (2005), alot has been invested on research to monitor integration of ICT in teaching and learning in African schools. An example is a research

carried out in Kenya by Gakuu and Kidombo (2008) and entered in the pan African observation on ICT in Africa. However, Gray and Smith (2007) state that the 21st century school principals and teachers are faced with numerous challenges emanating from ICT integration like attitude issues, lack of ICT competence and lack of ICT infrastructure. Pfluam (2004) in his study on ICT integration in secondary school observed that even in some schools that at least had computers, principals and teachers were not committed to ICT integration. This arises from the fact that many developing countries in Africa are still slow in ICT integration (Aduwa *et al.,* 2005). These are some of the variables of interest in this study. Learning and teaching in education institutions in Kenya in the 21st century, just as in other parts of the world, is increasingly becoming complex requiring tremendous input in terms of creativity. Due to these rapid changes, principals and teachers in Kenyan schools are compelled to carefully analyze the academic and social needs of their students in line with technology. Such school working environments require advanced teacher competence (Mangal and Mangal, 2009).

Principals therefore have no option but to embrace the use and integration of ICT in their schools in order to enhance professional output as well as the overall management of the school curriculum (Muchiri, 2014). The primary motivation of integrating ICT in education is the belief that it supports students in their own constructive thinking and allows them to transcend their cognitive limitations and engage them in cognitive operations that they may not have been capable of otherwise (Mulwa, 2012; Kuvuuka, 2013; Ndirangu, 2013). According to Okumbe (2007) the principal is charged with the task of managing curriculum and instructional supervision of teachers and students. Thus principals are charged with the responsibility of carefully planning and utilizing the available resources in the school to achieve the institutional goals.

According to Gakuu and Kidombo (2010) the major objective for Kenya as a nation is to create ICT readiness in schools so as to adopt characters on the global digital opportunities for all (GODFA) that promotes global ICT participation for the purpose of attaining Sustainable Development Goals (SDGs) and their set targets. The problem, however, is that the penetration of ICTs into the Kenyan public secondary schools is still very low (RoK, 2006). There is this problem despite the fact that the GoK, through the MoEST and the CFSK are trying to emphasize the integration of ICT in public secondary schools curriculum (RoK, 2006).

According to RoK (2006) the value of ICTs in education is not widely felt. This might be due to the disparity in ICT infrastructure where the major institutions in urban enjoy the benefits of ICT whereas the small institutions in rural are still locked out of the information era, due to poor infrastructure (lack of electricity) (Adera, 2010, cited in The Standard, Mon., March 29,2010. P.27). According to Outa, Eta and Aligula (2006), it is interesting to note that even though a number of schools in Kenya had initiated some ICTs, integrating them into school curriculum came with challenges such as lack of technical support, lack of ICT infrastructure, rigid attitude to technological changes and lack of clear ICT policy. These and many other challenges call for more research in this area to ascertain the level of ICT integration in secondary schools.

A study done in Kitui County indicated that although all the principals felt that ICT was important in carrying out administrative tasks, results revealed that ICT was underutilized by principals in performance of management tasks in public secondary schools in the area (Mulwa, 2012). Data collected in Nandi North District indicated that there was shortage of

computer hardware (Menjo and Boit, 2005). A research done in Nairobi by Kanyeki (2006) established that problems hindering effective use of IT in management of secondary schools are lack of funds to provide enough computers, lack of electricity in some schools, expensive internet services and lack of well trained personnel in computer in schools. From the above studies it is clear that the integration of ICT in curriculum is very low in public secondary schools in Kenya despite Kenya government's support and the many benefits associated with ICT integration in the school curriculum. The ICT integration in school curriculum in Trans Nzoia West Sub-County in particular is still patchy as well. Access and availability of ICT in public schools is a challenge. Besides, there is need for principals and teachers to re-examine their attitudes, perceptions, plans, and integration of ICT in their daily curriculum implementation in Trans Nzoia West Sub-County, however challenging it might be. It is against this background that the researcher seeks to investigate factors influencing ICT integration in teaching and learning in public secondary schools in Trans Nzoia West Sub County.

1.2 Statement of the problem

While some countries have reported up to 41% of ICT integration in school management and teaching/learning, the proportion remains substantially low in Kenya despite the huge amounts invested in ICT (Muchiri, 2014). Makhanu (2010) observes that there is massive investment in buying ICT infrastructure. The government has also put in efforts to supply computers, construct computer laboratories, train teachers in some schools and mobilize support from development partners. Researches indicate that public secondary schools in Kenya are endowed with more financial resources which may be used to acquire basic ICT equipment and software. A study done by Maduku *et al.,* (2006) indicate that ICT integration and use in schools in Wareng District is average.

According to Mue (2006), most of the public secondary schools in Lang'ata have embraced ICT in learning/teaching and administration of human resources for instance, in monitoring attendances, performance, staff training and recruiting of the staff. On the contrary, it is observed that most schools' operations in Trans Nzoia West Sub-County are still manual and ICT equipment is used for mundane activities like typing examinations, letters and for students' entertainment. This is in line with a study that was carried out by Waiti (2010) on the "Determinants of the integration of information and communication technology in public secondary school curriculum in Kakamega North District, Kenya". According to the Trans Nzoia West Sub-County Education Office (2017), out of the 57 public secondary schools in the Sub-County, only 6 of them, (10.5%) have integrated ICT in learning/teaching and school management (Trans Nzoia West Sub-County Education Office, 2017).

According to the report, Integrated Financial Management Information System (IFMIS) has never been in use only until the MoE directive that it is a must to register all students via IFMIS. Besides, emails are rarely used and ICT technology is ignored in performance of most of the management and curriculum tasks. Most schools still use nearly obsolete systems and are consequently unable to exploit the educational potential of the emerging technologies (MoE, 2017). Failure to take full advantage of the opportunities offered by technological advances to education represents a drastic lag in skilled innovative manpower (Ministry of Education Science and Technology and National Council for Science and Technology, 2010). There is need to integrate ICT in learning and teaching with the aim of enhancing creativity (Waiti, 2010). The extent to which ICT is being integrated in public secondary schools curriculum in Trans Nzoia West Sub-County needs to be adequately addressed.

1.3 Purpose of the study

The purpose of this study was to investigate factors influencing integration of ICT as a teaching and learning tool in public secondary schools in Trans Nzoia West Sub County, Trans Nzoia County, Kenya.

1.4 Objectives of the study

The paper sought to achieve the following objectives:
   i. To examine how availability of ICT infrastructure influences integration of ICT in teaching and learning in public secondary schools.
   ii. To determine how technical support influences integration of ICT in teaching and learning in public secondary schools.
   iii. To determine how teacher competence in ICT influences integration of ICT in teaching and learning in public secondary schools.
   iv. To determine the influence of principals' attitude on ICT integration in learning and teaching in public secondary schools.

2.0 Research methodology

The research methodology in this study focused on: the research design, target population, sample size and sampling techniques, research instruments, instrument validity, instrument reliability, data collection procedures and data analysis techniques. The study employed both qualitative and quantitative research paradigms. The study adopted specifically a case study design (Best and Kahn, 2006) to investigate factors influencing integration of ICT in learning and teaching in public secondary schools: A Case of Trans Nzoia West Sub County, Trans Nzoia County, Kenya. The major criterion of a case study technique was of using the case at hand for further generalisations in other public secondary schools as social institutions (Orodho, 2009). The researcher collected information about respondents' attitudes, opinions, habits or a variety of education or social issues as per the requirements of ICT integration. The target population constituted 57 principals and 342 heads of departments, hence, a total population of 399 persons (MoE, 2017). A checklist, principal's interview schedule and questionnaires for HODs were used as the research instruments (Mugenda and Mugenda, 2003). The study employed content and construct validity (Ary *et al.,* 2006). Content validity was significant because it addressed two important variables that influenced the validity of the questionnaire. The aspects that were found in the demographic information section of the questionnaire, for instance, gender and teaching experience formed the constructs (Ary *et al.,* 2006). To determine instrument reliability, the raw scores obtained from principal's interview schedule and questionnaires for heads of academics department were summarized, coded, edited, and then the information synthesized to reveal the essence of data (Mbwesa, 2006). Data were tabulated and presented descriptively using frequency tables, graphs, percentages and charts. The Statistical Package for Social Sciences (SPSS) programme was used to organize the data.

3.0 Critical Overview of ICT Integration in Teaching and Learning in Public Secondary Schools

3.1 Availability of ICT Infrastructure and Integration of ICT in Teaching and Learning

The schools technical subsystem is shaped by the following elements: knowledge, techniques, facilities and equipment. Each of these elements should be adapted selectively to suit the special requirements of the school and to make use of the appropriate technology. This will involve the preparation of computer sites, purchase, introduction, operation and maintenance of hardware and software (Mahapatra, 2005). Access to ICT infrastructure and resources in schools is a necessary condition to the integration of ICT in education (Plomp *et*

al., 2009). Mumtaz (2000) points out that lack of computers and software can seriously limit what teachers can do in the classroom with regards to integration of ICT. Access to ICT is a first and necessary step in the integration process even though mere access will not automatically lead to use of ICT for teaching and learning. Effective adoption and integration of ICT into teaching in schools depends mainly on the availability and accessibility of ICT resources such as hardware, software, etc. Obviously, if teachers cannot access ICT resources, then they will not use them. Therefore, access to computers, updated software and hardware are key elements to successful adoption and integration of technology (Afe, 2002; Olekulehin, 2007). A study by Yildrim (2007) found that access to technological resources is one of the effective ways to teachers' pedagogical use of ICT in teaching.

While developed countries have advanced in equipping schools with ICT infrastructure, it is not the case with schools in developing countries. Developing countries are unable to afford large-scale national school computerization programs without increasing educational budgets (Siddiqui, 2007). Access to hardware and software is not only important, but also the use of suitable kind of tools and programs to support teaching and learning (Maki, 2008). "Access to appropriate technology means that affordability and constraints of a technological tool need to be carefully considered when the tool is incorporated in a lesson" (GoK, 2007). Obviously, to encourage student centered technology learning, it is necessary that learners have access to quality technology resources. Though it is the government policy to integrate ICT in learning in public secondary schools in Kenya, there is no money factored in the Free Day Secondary Education Funds for ICT integration. Also, only a few schools have been given ICT facilities, but even with them no monitoring and evaluation has been done to monitor ICT integration in teaching and learning. Otherwise, little is known about availability of ICT infrastructure in secondary schools in Trans Nzoia West Sub–County. This study therefore sought to examine how availability of ICT infrastructure influenced the integration of ICT in teaching and learning in public secondary schools in Trans Nzoia West Sub-County.

3.2 Technical Support and Integration of ICT in Teaching and Learning
Administration is the process of working with and through people in order to achieve organizational goals (Owen and Valesky, 2011). School leaders play a key role in administrative functions which include goal setting, making decisions, building relationships and establishing an effective management structure (UNESCO, 2012). According to Wango (2009), the work of school administrator is to ensure that specific programmes are accompanied with technical support, and there is a continuous feedback to improve school curriculum. According to Mujibul (2004), technology is helping to shape school curriculum through ICTs and EMIS. Teachers need to be aware of what technical support is available and how to access it so as to integrate ICT in teaching and learning and utilize EMIS effectively for purposes of productivity (Tearle, 2004).

Computers have become an integral part of education institutions. However the task of undertaking ICT integration in Learning and teaching is challenging to most principals and teachers as ICT is a relatively new field (Kavagi, 2010). Principals and teachers therefore need to develop new competencies in order to be effective in their new roles as technology leaders in managing the use of ICT in schools (Mutuma, 2005). It's important to training administrators and staff designated to work with the new technological programs like ICT integration, IFMIS and EMIS. To effectively manage the use of computers, teachers and principals must have basic competencies like being able to choose applications that are appropriate for a given school situation, select the best software and hardware and develop implementation plan for computer application (Mutuma, 2005). The greatest challenge facing

the Ministry of Education in Kenya is the need to in-service teachers, especially in the effective use of new technologies (GoK, 2012). In a research study done in Nairobi most principals suggested that the MoEST should make it mandatory for all school principals and HODs to be trained in IT before taking over leadership responsibilities and the government should provide resources for training. They also suggested that IT to be included in the teachers training curriculum (Kanyeki, 2006). The slow uptake of computers in Kenyan schools can be partly attributed to inadequate human resource capacity at all levels (Mumbua, 2009). In order to stay ahead and become a competitive person, a school leader needs to keep abreast with the latest technology.

From the reviewed literature it is clear that principals and HODs in public secondary schools in Kenya are not literate enough to use computers. That's why there is need to keep on offering in-service courses to school administrators in order to cope with technological changes. Lack of training for administrators in ICT is a major drawback in their ability to integrate the technology in learning and teaching. The researcher embarked on ascertaining the level of ICT skills among secondary school administrators and establishing whether the school had put in place mechanisms to help teachers acquire ICT skills to help them cope with the fast changing ICT world in order to be able to integrate ICT in learning and teaching and even utilising modern technologies like EMIS and IFMIS in the administration of secondary schools. Becta (2004) agreed that if there is a lack of technical support in a school, then it is likely that technical maintenance will not be carried out regularly, resulting in a higher risk of technical breakdowns. Little is known about ICT technical support in secondary schools in Trans Nzoia West Sub–County. This study therefore sought to determine how technical support influenced the integration of ICT in teaching and learning in public secondary schools in Trans Nzoia West Sub-County.

3.3 Competence of Teachers in Use of Computers
Encouraging a computer culture to develop will gradually enable teachers to embrace the use of computers in such a way that when it is removed they feel something important is missing (Wango, 2009). There are several advantages of using computers in school curriculum (Kavagi, 2010). According to Mumbua (2009), the use of ICT ensures efficiency in the learning and teaching process, utilization of school resources, steps up accuracy and speed of handling data, enhances decision making process, ensures easy access of information and leads to lower manpower requirement. Although the advantages of using ICT in learning and teaching are obvious, most schools in Kenya have not changed from manual to ICT based integration However, to perform these tasks calls for competence of teachers. Computer competence is defined as being able to handle a wide range of varying computer applications for various purposes (van Braak, 2004).

According to Bordbar (2010), teachers' computer competence is a major predictor of integrating ICT in teaching. Researchers suggest that majority of teachers who report negative or neutral attitude towards the integration of ICT into teaching and learning processes lacked knowledge and skills that would allow them to make more "informed decision" (Bordbar, 2010). Peralta and Costa (2007) found that technical competence influenced Italian teacher's use of ICT in teaching. Teachers with more experience with computers have greater confidence in their ability to use them effectively. Jones (2004) reported that teachers competence relate directly to confidence. Teachers' confidence also relate to their perceptions of their ability to use computers in the classroom, particularly in relation to their student's perceived competence.

In Kenyan secondary schools, teachers are either employed by the BOM or posted directly by the TSC. Their training may not have included ICT skills hence their inability to use the technology. This is further complicated by insufficient technical assistance and insufficient and inefficient number of computers. Poor lesson preparation by teachers due to overload whereby little time is allocated for practice can also be blamed for causing ineffectiveness when teaching with computers. In secondary schools there are no in service programs for computer literacy facilitated by the MOE or the schools themselves unlike the SMASSE project. Lack of research into possible options for policies and strategies towards teaching using computer technology and teachers perceptions on the use of computer in teaching of the curriculum all form part of the problems encountered by the teachers. In this regards, the researcher was prompted to find out how incompetence among teachers leads to inefficient use of computer technology in teaching and learning. According to Kidombo *et al.,* (2012) the competence of the school principal is key for establishing and maintaining a learning environment compatible with student centered approaches to teaching and learning with ICT.

They are also seen as curriculum and pedagogy leaders and are considered by stakeholders as central figures in leading the process for creating the conditions to teach and learn with ICT. 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 (Kidombo *et al.,* 2012). All institutions wishing to integrate ICT in teaching and learning need to equip the teachers with the competencies either through pre-service or in-service training and keep them updated on technological or social change through capacity building as need arises (UNESCO, 2012). This study aimed at determining the extent of the influence of teacher competence in the integration of ICT in teaching and learning in Trans Nzoia West schools.

3.4 Influence of Principals' Attitude on ICT Integration in Learning and Teaching
The obstacles of integrating ICT in school curriculum are within the attitudes of the principals. There is a lack of self-assurance and confidence by teachers when using the technology due to the principal's negative attitude. Effective integration of ICT in learning and teaching involves the principal instilling confidence in the teachers. Case studies done in three fully residential schools in Malaysia on Computer Assisted Administration (CASA) revealed that only staff attitude is perceived to be a crucial success factor of CASA implementation (UNESCO, 2012). According to Kavagi (2010), studies show that among educational administrators, the positive attitude towards use of computers is strongest when the role of computers in school management is made clear.

The attitude of school administrators towards ICT determines the speed, spread and depth of computer usage in learning and teaching. School administrators also perceive the introduction of computers as boosting the institution's image and prestige as a modern school. It's necessary to encourage teachers to think of computers as tools of for doing a job. As a tool there is no need to understand exactly how it works but the only knowledge necessary is how to use the tool and how to maintain it properly (UNESCO, 2012). A research done in Nairobi indicated that the perception of secondary school principals on the use of ICT in learning and teaching was still very low.

The perception of school administrators on the use of ICTs in school curriculum would determine its success (Mumbua, 2009). With the different views given about the attitude of school administrators towards the use of ICT in schools, the researcher sought to find out the

influence of the principal's attitude on ICT integration in learning and teaching in public secondary schools in Trans Nzoia West Sub-County.

3.5 Research gap

It is acceptable that computers play a central role in school curriculum. However, progress is generally limited to computer assisted instruction and learning. Less attention has been paid to it specifically the area of ICT integration in school curriculum. While some countries have reported to have successfully integrated ICT in school management and teaching/learning, the proportion remains substantially low in Kenya despite the huge amounts invested in ICT (Muchiri, 2014).

Makhanu (2010) observes that there is massive investment in buying ICT infrastructure. The government has also put in efforts to supply computers, construct computer laboratories, train teachers in some schools and mobilize support from development partners. Researches indicate that public secondary schools in Kenya, as much as are well endowed with more financial resources which may be used to acquire basic ICT equipment and software, it is observed that most schools' operations in not only in Trans Nzoia West Sub-County are still manual and ICT equipment is used for mundane activities like typing examinations, letters and for students' entertainment. According to the Trans Nzoia West Sub-County Education Office (2017), out of the 57 public secondary schools in the Sub-County, only 6 of them, (10.5%) have integrated ICT in learning/teaching and school management (Trans Nzoia West Sub-County Office, 2017). Most schools still use nearly obsolete systems and are consequently unable to exploit the educational potential of the emerging technologies (MoE, 2017). This reckoned the need to adequately address this issue.

4.0 Conclusion

The rise of ICT has complicated its adoption and integration by teachers in classroom teaching. The effective integration of technology into classroom practices poses a challenge to teachers more than connecting computers to a network. For successful integration of ICT into teaching, this study has highlighted on factors that influence teachers' use of ICT in teaching and learning. These are personal factors related to teacher competencies in ICT, institutional factors related to ICT infrastructure and technological factors.

On teacher competency, this study revealed that teacher's training; knowledge and skills in ICT influence their use of ICT in teaching and learning. Teachers' professional development is a key factor to successful integration of computers into classroom teaching. In relation to ICT infrastructure, absence of ICT infrastructure; old or poorly maintained hardware; lack of suitable educational software; limited access to ICT, lack of or unreliable internet connectivity were found to be hindering integration of ICT in teaching and learning in secondary schools in Trans Nzoia West Sub-County. In regard to technical support, this study established that most schools had no computer technician and that there was inadequate technical support across Trans Nzoia West Sub-County which hampered integration of ICT in teaching and learning. Also, secondary schools in Trans Nzoia West Sub County had made little efforts to ensure availability of computer laboratories which when equipped with the relevant computers and other relevant ICT facilities could contribute immensely to the integration of ICT in teaching and learning. In terms of internet connectivity, findings revealed that schools had no connectivity to internet access points. Only 6 schools (10.5%) that were connected to the internet, they mostly relied on modems and Wi-Fi Tethering & Portable hotspot.

According to the findings on principals' opinion on influence of ICT infrastructure on integration of ICT in teaching and learning, head teachers in general were of the opinion that there was inadequate ICT infrastructure across Trans Nzoia West Sub County which hampered integration of ICT in teaching and learning. One of the head teachers said "Few schools have been equipped with adequate ICT infrastructure and this greatly hampers integration of ICT in teaching and learning". Another school head said "some schools have low teacher to ICT facilities ratio". Another school head was of the opinion that some facilities were old and poorly maintained making it difficult to integrate ICT in teaching and learning in secondary schools in Trans Nzoia West Sub County. Furthermore, few schools have started computer lessons though not all schools due to poor infrastructure. This is an indication that inadequate ICT infrastructure was negatively affecting the integration of ICT in teaching and learning in secondary schools in Trans Nzoia West Sub County. This affected majority of the teachers not to bother even attending training or refresher courses in computer studies. A few who did attend indicated that training programmes often focus more on basic literacy skills and less on the integrated use of ICT in teaching and learning.

5.0 Recommendations
For the integration of ICTs learning and teaching in public secondary schools to be realized, there was need for the study to provide recommendations that would guide policy-makers. The recommendations are therefore divided into those with policy implications and those meant for further research.

5.1 Policy implication
i.　Secondary schools should develop strategies to identify strengths and weakness of various technological resources with a view to adopting ICT in the process of teaching and learning.
ii.　Secondary schools should source for legalized development partners like NEPAD, well-wishers, stakeholders and sponsors to finance the acquisition of more ICT infrastructure. This will ensure the adequacy of computers in the schools so as to improve their use in the process of teaching and learning.
iii.　Public schools should adopt the national ICT policy plan for its implementation. This could act as a guide for teachers and principals in administrative purposes and ICT integration in learning and teaching.
iv.　Schools should lessen the workload of teachers so as to enable them find time to learn and integrate ICT in the process of teaching and learning. Adoption of ICT in the process of teaching and learning would also go a long way in ensuring that the workload of teachers is lessened.
v.　Secondary schools in Trans Nzoia West Sub-County should provide teachers with regular trainings and seminars on how to adopt ICT in the teaching and learning process. The schools should ensure that teachers undergo refresher training on regular basis.

5.2 Recommendations for further research
The following are recommended areas for further research basing on this study:
i)　Factors influencing Kenya Education Management Institute (KEMI) in training of teachers on ICT integration in public secondary school curriculum implementation.
ii)　The influence of ICT integration in learning and teaching on students' performance.

iii)   Further comparative research is needed to evaluate the cost-effectiveness of integration of ICT in teaching and learning. Further research can be conducted in other sub counties countrywide.

References
1. Afe J.O. 2002. Reflections on becoming a teacher and the challenges of teacher education. Paper presented at the inaugural lecture series 64 of the University of Benin.

2. Ary, D., Jacobs, C.L., Razavieh, A. and Sorensen, C. 2006. Introduction to research in education. 7th Edition, Canada, US: Thomson Wadsworth.

3. Ayere, M.A., Odera, F.Y. and Agak, J.O. 2010. E-learning in secondary Schools in Kenya: A Case of the NEPAD E-schools; Journal of Educational Research and Reviews, 5(5): 218-23.

4. Becta, 2004. A review of the research literature on barriers to the uptake of ICT by teachers. Retrieved June 10, 2015, from http:/ /partners. becta. org.uk/ page_ documents/research/ barriers.pdf.

5. Best, J. and Kahn, J.V. 2006. Research in Education. 10th Edition, Boston: Allyn and Bacon.

6. Bordbar, F. 2010. English teachers' attitudes toward computer-assisted language learning. International Journal of Language Studies, 4(3): 27-54.

7. Brannigan, N. 2010. Enhancing Leadership Capacity in ICTs in Education throughtechnology Enabled collaboration, Pedagogy for Technology Enhanced Learning. The Turkish Online Journal of Educational Technology, 7(4): 89-112.

8. Clark, R.E. and Meyor, R.E. 2003. Media in teaching. In: Wittrock, M.C., (Ed.), Handbook of Research on Teaching. 3rd Edition, New York: Macmillan.

9. Dawson, C.G.B. 2001. A national study of the influence of computer technology training received by K-12 principals on the integration of computer technology into the curricula of schools. Doctorate Thesis, University of Louisiana at Monroe.

10. Emperica, 2006. Benchmarking access and use of ICT in European schools: final report from head teacher and classroom teacher surveys in 27 European countries. Retrieved 15 August 2008 from http://ec.europa.ell/information societyeurope/;2010/docs/studies/final report3.pdf.

11. GoK, 2007. National ICT strategy for Education and Training, Government printer: Nairobi, Kenya.

12. GoK, 2012. Education Management Information System (EMIS) and the formulation of Education for All (EFA) Plan of Action, 2002-2015.

13. Gray, D.L. and Smith, E.A. 2007. Case studies in 21st Century School Administration: Addressing challenges for educational leadership; Thousand Oaks, Carlifornia; Sage Publications. Inc.

14. Johnson, M., Calvert, E. and Raggert, N. 2009. ICT in schools Final report. Retrieved June 12, 2015 from http://www.2020.org.nz/template/ict_09_online_final_.pdf.

15. Jones, A. 2004. A Review of the Research Literature on Barriers to the Uptake of ICT by Teachers. British Educational Communications and Technology Agency. Retrieved May 20, 2015 from http://www.becta.org.uk.

16. Kanyeki, W.M. 2006. An Investigation into the Use and Impact of Information Technology in Management of Public Secondary Schools in Nairobi Province. Kenyatta University. Unpublished Masters of Education Project.

17. Kavagi, L. 2010. Computers in Schools. Nairobi: Jomo Kenyatta Foundation.

18. Kessy, D., Kaemba, M. and Gachoka, M. 2006. The reasons for under use of ICTs in education. In the context of Kenya, Tanzania and Zambia. Journal of the proceedings of the 4th IEEE International Workshop on Technology for Education in Developing Countries.

19. Kidombo, H.J., Gakuu C.M and NdIritu, A. 2012. Institutional management and integration of information and communication technology in teaching and learning in selected Kenyan schools. Journal of Open, Continuing and Distance Education, 2(1): 151-174.

20. Kuvuuka, B. 2013. Factors affecting information communication technology integration in teaching and learning in public secondary schools in Mutito Constituency, Kitui County Kenya. Master's Thesis, University of Nairobi, Kenya.

21. Mahapatra, B.C. 2009. Information Technology and Education. New Delhi: Sarup and Sons.

22. Makhanu, S.E. 2010. Principals' ICT Literacy towards Improving Secondary School Performance in Kenya. Published Doctoral Thesis, Pretoria: University of South Africa.

23. Maki, C. 2008. Information and communication technology for administration and management for secondary schools in Cyprus. Journal of Online Learning and Teaching, 4(3): 18-20.

24. Manduku, J.G., Kosgey, A.K. and Sang, H. 2006. Adoption and Use of ICT in Enhancing Management of Public Secondary Schools: A Survey of Kesses Zone Secondary Schools in Wareng District of Uasin Gishu County, Kenya: Kabianga University College.

25. Mangal, S.K. and Mangal, U. 2009. Essentials of Educational Technology. New Delhi: PHI Learning Private Limited.

26. Mbwesa, J.K. 2006. Introduction to Management Research. Nairobi: Jomo Kenyatta Foundation.

27. Menjo, D. and Boit, J. 2005. The challenges of using ICT in school administration in Kenya. Educational Journal, 20(1): 23-40.

28. MoEST. 2010. Sessonal paper no. 14 0f 2012; a policy framework for educational training; reforming education and training in Kenya. Nairobi. Government printers.

29. Muchiri, G.M. 2014. Factors influencing school principals in integration of ICT in administration of public secondary schools in Githunguri subcounty, Kiambu County, Kenya. Unpublished Master's Thesis, University of Nairobi.

30. Mue, J.S. 2014. Application of ICT in school Administration in Public Secondary Schools in Lang'ata Division, Nairobi, Kenya. Unpublished Master's Thesis, Kenyatta University.

31. Mugenda, O.M. and Mugenda, A.G. 2003. Research Methods: Quantitative and Qualitative Approaches. Nairobi: African Center for Technology Studies (ACTS) Press.

32. Mujibul, H.S. 2004. Challenges of Education Technology. New Delhi: S.B. Nangia APH publishing Co-operation.

33. Mulwa, A.S. 2012. The influence of institutional and human factors on readiness to adopt e-learning in Kenya: the case of Secondary schools in Kitui district. From< http:/erepository. uonbi. ac. ke> retrieved on, 2(04): 2012.

34. Mumtaz, S. 2000. Factors Affecting Teachers' Use of Information and Communications Technology: A review of the Literature. Journal of Information Technology for Teacher Education, 9(3): 319-342.

35. Mutuma, L. 2005. ICT in Education: An Integrated Approach. Nairobi: Rinny.

36. Ndirangu, J.K. 2013. Adequacy and sustainability of secondary schools' Computerization in meeting instructional needs in selected schools in Kitui County, Kenya. Master's Thesis, Unpublished: Kenyatta University.

37. Nut, J. 2010. Professional educators and the evolving role of ICT in schools: Perspective report. Retrieved on June 12, 2015 from http://www.ictliteracy.info/rf.pdf/ICTinSchools.pdf.

38. Okumbe, S. 2007. Human Resource Management. An Educational Perspective. Educational Development Research Bureau.

39. Olakulehin, J.K. 2002. Information and communication technologies in teacher training and professional development in Nigeria. Turkish journal of Distance educational TODSE, 8(1): 133-142.

40. Orodho, J.A. 2009. Elements of Education and Social Sciences Research Methods. Maseno: Kanezja Publishers.

41. Outa, G., Etta, F. and Aligula, E. 2006. Mainstreaming ICT Research Perspectives from Kenya, Nairobi: Mvule Africa Publishers.

42. Owen, S.R.G. and Valesky, T.C. 2011. Organizational Behavior in Education. Leadership and School Reforms. New Jersey: Person Education, Inc.

43. Peralta, H. and Costa, F.A. 2007. Teachers' competence and confidence regarding the use of ICT. Educational Sciences Journal, 3: 75-84.

44. Peterson, R.B. 2000. Principals' perceptions of the technological knowledge and skillsnecessary for effective school leadership. Doctorate Thesis, The University of North Carolina at Chapel Hill.

45. Pflaum, D.W. 2004. The technology fix: The promise a reality of computers in our schools. Alexandria: Association for Supervision and Curriculum Development. 99-100 p.

46. Plomp, T., Anderson, R. E., Law, N. and Quale, A. (Eds.). 2009. Cross-national information and communication technology: policies and practices in education. Charlotte, N.C., Information Age Publishing.

47. RoK. 2006. National ICT strategy for education and training Nairobi, Government press.

48. RoK. 2012. Kenya Education Statistical abstract. Nairobi: Government Printer.

49. Siddiqui, M.H. 2007. Challenges of Educational Technology. New Delhi: APH Publishing Corporation.

50. Tearle, P. 2004. The Implementation of ICT in UK secondary schools (Report). University of Exeter. Retrieved from Citeseerx.ist.psu.edu/viewdoc/doc.

51. Trans Nzoia West Sub-County Education Office. 2017. Education Management Information (EMIS).

52. UNESCO. 2012. Elementary ICT Curriculum for Teacher Training, Moscow: UNESCO.

53. Waiti, M.J. 2010. Determinants of the integration of information and communication technology in public secondary school curriculum in Kakamega North District, Kenya.

54. Yildirim, S. 2007. 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, 34(2): 171-86.