Examining the use of Information Communication and Technology (ICT) in Mathematics Teaching in Kenyan Secondary Schools

Dr. Leonard Mwathi Kamau, Dr. Antony Njue
South Eastern Kenya University

DOI: https://dx.doi.org/10.47772/IJRISS.2023.7665

Received: 12 April 2023; Revised: 17 May 2023; Accepted: 20 May 2023; Published: 07 July 2023

ABSTRACT

The study that used survey research design and was done in several secondary schools in two counties in Kenya: Nairobi and Nyandarua Counties. The study sought to examine the ICT familiarity levels and frequency of use, ICT training, and ICT perceived barriers in mathematics teaching. First, the study found that teachers were most familiar and mostly used Microsoft applications and the Internet on mobile phones as opposed to mathematical software. Second, training mostly focused on Microsoft applications and the Internet with no training on mathematical software. Third, barriers to ICT usage in mathematics teaching ranged from lack of computerized textbooks and the curriculum, lack of support in the classroom and labs, lack of technology enhanced classrooms and labs to lack of technical knowledge. Time was not a significant ICT barrier in the teaching of mathematics. The study recommends that since the Internet on mobile phones and the use of Microsoft applications were mostly used there is a need to use mixed methodology to get quantitative data and stories from teachers on how mobile phones and be used to teach and learning mathematics.

Keywords: Mathematics teaching, ICT usage, ICT training, Barriers, Collaboration

INTRODUCTION

Robert Kozma (1994, 2010) in more than 15 years of research confirmed that ICT in schools have significant importance because the integration of ICT could help to improve student achievement, increase efficiencies, reduce cost, enhance student´s ability to learn, promote their lifelong learning, and prepare them for a globally competitive workforce. Kozma assumes that ICT with adequate strategies can have a greater impact on the social and economic goals of a country and help improve economic development and social progress. Another important approach is the concept of knowledge society, a paradigm that considers technology as a revolution where all countries and individuals need to be competent to fully participate in the global society (Kozma, 1994; 2010). Consistently, ICT in education has the capacity to produce ICT-literate citizens and a versatile, adaptable workforce that is consistent with the human capital theory of education (Wims & Lawler, 2007). Thus, many countries around the world particularly those in the developing countries have begun to understand that ICT in education can play a significant role in developing their economies and societies to match those of the developed countries.

Kenya is one such country that has prioritized the need for ICT in the classrooms to meet these goals. The Kenyan government sees education as a springboard that will thrust the country's economic development to become a middle income country by the year 2030 (Republic of Kenya, 2007). To ensure this dream becomes true, the government of Kenya has developed an ambitious blueprint that strategizes to improve the quality of education.

One of the strategies is to ensure ICT integration into teaching and learning in schools is achieved. It is

believed that ICT in schools will accelerate teacher training, reduce high student-teacher ratios, contribute to basic instructional resources contribute to distance learning, increase access teaching and learning materials, increase pupil achievement, and improve on classroom practice (Wims & Lawler, 2007). Indeed, the government hopes that ICT will formulate new ways of teaching and learning mathematics–a content area that students perform poorly (Kenya National Bureau of Statistics [KNBS], 2012)–and which is ostensibly considered critical in preparing skilled engineers and scientists who are expected to contribute to the success of the Kenya Vision 2030. Thus, mathematics teachers shall play a significant role in this process because the decisions to use ICTs in teaching rest on them (NCTM, 2000). However, the "adoption and appropriate integration of ICT in education may not be accomplished straightaway, as the capacities of education managers require to be built and teachers in-serviced on ICT in education" (CEMASTEA project 2012, p. 28). The ICT skills levels for most teachers in Kenya remain low and there is urgent need to equip these teachers with ICT skills in certain content areas listed as significant in the realization of the Kenya Vision 2030 (Republic of Kenya, 2007), mathematics included. In other countries, research have found that equipping teachers with technology skills in not enough because although teachers may have an understanding of the benefits of ICT integration in supporting students' learning, teachers face enormous obstacles during this process. Some of these obstacles include limited knowledge in choosing worthwhile tasks, a lack of time to integrate ICT in their lessons due to strict curriculum requirements, a lack of confidence using ICT tools, an unfamiliar ICT curriculum, a lack of support from school leadership, a lack of technical support, and a lack of elaborate ICT infrastructure (e.g. Divaharan & Ping, 2010; Demiraslan & Usluel, 2008).

The Kenyan Context

With the attainment of independence in 1963, the campaign for free education (at no cost) in Kenya began. The Kenya Education Commission (The Ominde Commission) was set up in 1964 under Professor Ominde. The Ominde commission was mandated to survey the existing educational resources and advise the government on the way forward in promoting social equality, and national unity through educational reforms. The commission recommended, in its first report that educational facilities be located in underprivileged regions, and the religious convictions of all people be safeguarded and respected (Alwy & Schech, 2004). This commission became the blueprint that laid the foundation of the post-independence Kenyan educational system (Ojiambo, 2007).

However, other commissions were formed later on including The Presidential Working Party on the Second University (The Mackay Commission) (Republic of Kenya, 1981). The commission was mandated to investigate the feasibility of a second university in Kenya (after the University of Nairobi, which was established in 1970) to meet the goal of+ training graduates in vocational skills to minimize the problem of unemployed youth. Coincidentally, its recommendations were based on the previous educational commissions that had emphasized on practical and technical aspects of education. Following the Mackay report, Moi University was established and the A-level education system was scrapped paving way for the 8-4-4 system of education that emphasized on eight years of primary education, four years of secondary education and four years of university education similar to the American education system.

The new system of education adopted in 1985 was intended to make the educational system move away from an examination-centered form and promote self-reliance among learners after leaving school, thus providing school leavers with a wide range of employment opportunities (Kinuthia, 2009; Webuyele, 2003). To meet these goals, the "curriculum was reorganized and improved with greater orientation towards science subjects and practical subjects such as carpentry, arts and crafts, home science and agriculture" (Webuyele, 2003, p. 15).

Despite these reform efforts the 8-4-4 system of education has been criticized for failing to meet the educational needs of its citizens. One of the arguments leveled against the 8-4-4 system of education has

been the employability of the students who graduate from secondary schools and the universities. Faced with the unemployment challenge, the government of Kenya has started to readjust and reassess the 8-4-4 system of education by introducing ICT in schools to meet the needs of its people (Republic of Kenya, 2007). The government projects that the students who graduate from secondary schools will be a technologically skilled workforce equipped to succeed in the job market.

The ICT revolution in Kenyan classrooms started in the early 1980's when the Ministry of Education, Science and Technology (MoEST) decided to allow for some experimentation of ICT in education through a pilot project (Webuyele, 2007). Since then the growth of ICT in the Kenyan education system has been slow and scattered. However, in 2006, the adoption of ICT in Kenyan schools received a boost when the government, through the Ministry of Information, Communication and Technology, developed a national technology policy (the National ICT Policy) that embedded the Kenya National ICT Strategy for Education and Training developed earlier in 2005 by the ministry of education. The strategy was mandated to develop policy and institutional frameworks for ICT, ICT infrastructure, and professional development with the aim of achieving the Education For All (EFA) by 2015 and the Universal Primary Education (UPE) by 2010, consistent with the national and international commitments on education (Republic of Kenya, 2006). According to this strategy, ICT has the potential to meet these objectives and resolve emerging issues such as overcrowded classrooms, shortage of teachers in certain subject areas, and mitigate high cost of instructional materials, in addition to positioning Kenya on the global economy. However, the strategy notes that such goals may not be achieved in vacuum as the educational system needs a complete makeup for ICT to take up the role of resolving such issues.

As a result, schools will need to be equipped with ICT facilities and resources and teachers will have to assume new roles effectively with new skills and mindsets to successfully use ICT in teaching and learning (Kumar, Rose, and D'Silva, 2008). Recently, a lot of activities have been going on in Kenyan secondary schools with the intention of equipping schools with ICT resources and infrastructure and also training mathematics teachers on ICT through initiatives such as the ICT Champion teacher programme and others. In light of this, the use of ICTs in mathematics teaching in Kenya is just beginning to take shape and there is a need for more research to assess the extent of ICT integration and the underlying issues.

A REVIEW OF LITERATURE

ICT integration in education is influenced in many ways by many factors. In this literature review, we synthesize the literature across developing countries focusing on how the availability of ICT resources, knowledge of ICT, ICT training, school support, perceptions and attitudes about ICT, and demographic information influence ICT uses in schools.

Availability of ICT Resources

The availability of ICT resources has been found to be a key component in ICT integration in schools. In a study conducted in Kenya, Ayere, Odera, and Agak (2010) found that in both Nepad and non-Nepad schools desktop computers were the most common tools, and Nepad had more ICT resources compared to the non-Nepad schools. They argued that the availability of ICT resources such the Internet, e-libraries, DSTV services, Smart boards, and the fact that teachers were trained to use these ICTs across all subject areas at the Nepad schools enabled students to post high KCSE mean scores compared to non-Nepad schools. Internet connectivity for non-Nepad schools was through mobile phone providers while Nepad schools relied on the V-SAT, which contributed significantly on how teachers applied technology in teaching and learning in both school contexts. Students in this study indicated that the availability of computers mostly affected their use of the computer laboratory. The study also found that 100 percent of Nepad schools students used ICT for educational research compared to only 34 percent of non-Nepad school students.

Consistent findings were reported by Ango'ndi (2013) who found that teachers indicated inadequate ICT resources as the reason they did not apply ICT in their lessons. Similar findings were reported by Chigona and Chigona (2010) in study where teachers' indicated that they had an insufficient number of computers to enable them to integrate ICT in their lessons.

Knowledge of ICT

In Vietnam, Peeraer and Petegem (2011) found that word processing and the internet were the mostly used ICT applications. On the other side emailing for communicating with students, ICT integration into the subjects, and classroom management software were rarely used by teachers. A replica study by Rastogi and Malhotra (2012) in India found that teachers were mostly proficient in word processing and Internet skills. Peeraer and Petegem (2011) found that teachers who were confident in internet skills applied technology more in their teaching.

However, Lau and Sim (2008) found that most Malaysian teachers used technology daily for instructional purposes and occasionally for professional development and communication. Encouraging findings indicated that teaching courseware was the most widely used ICT application on a weekly basis followed by the Internet. The study found that teachers were not competent in statistical tools and other subject specific software. These findings indicated that limited knowledge in other ICT applications inhibited teachers from using technology for graphical visualization and simulations.

These findings reveals that internet and word processing skills are most prevalent among teachers as opposed to subject-related ICT applications. This implies that limited ICT integration may be caused by lack of extensive knowledge related to classroom instruction.

ICT Training

Technology training has been found to be related to how teachers integrate ICT in their teaching. Ayere, Odera, and Agak (2010) in study that sought to compare the impact ICT in Nepad (New Partnership for Africa's Development) project and the non-Nepad schools in Kenya, found that teachers from Nepad benefited more in ICT training through peer training concept compared to teachers from the non-Nepad schools who almost all indicated they used personal resources to train themselves. Similarly, Chigona and Chigona (2010) found that teachers had low levels of ICT literacy because of limited ICT training and this resulted in not using ICT in their teaching. In their study, Lau and Sim (2008) found that teachers indicated they had limited training on ICT. Teachers indicated that school-based professional development and ICT seminars and conferences as the best channels for them to improve their ICT skills. Computer competency increased with the number of hours of training with teachers who had more than 20 hours of ICT training being most competent. Although teachers were confident about their ICT skills and ICT training was found to be related to ICT usage that implied that teachers were looking forward to more training. Such findings are also supported in a study conducted in Kenya by Ango'ndi (2013) who found that teachers indicated they had no enough knowledge of ICT and the time allocated them was not adequate to acquire the skills that would help them apply technology in the classroom. These findings suggest that teachers from developing countries are not adequately trained to apply technology in their classroom practice.

School Supports

Schools where technical support is available, curriculum is aligned with ICT needs, the school principal and leadership encourage teachers to use technology, and teachers have access to ICT resources are most likely to apply technology in their instruction. However, when this is not the case may abandon the intention to use ICT in the instruction. In Malaysia, Lau and Sim (2008) indicated that lack of technical support top as the barrier that hindered teachers to use ICT. In Kenya, Ayere, et. Al (2010) found that both Nepad (New

Partnership for African Development) and non-Nepad schools did not have technical support staff and that influenced how teachers used the computer lab to support students' learning. Additionally, the study found that regulations from the ICT department and school rules, and funders of ICT project in schools had been established, which implied that teachers resulted in fear of technology due to exclusion policies. Similar findings were reported in South Africa by Chigona and Chigona (2010) found that teachers could not access to the computer labs due to the Khanya project rules which deprived teachers from certain content areas from using their facilities. In addition technical support was also lacking and therefore teachers could not use the computer lab. In Kenya, Ango'ndi (2013) pointed that teachers had not used ICT in their teaching because they were denied access to the computer labs by the school principal and computer department to an extent of being accused of vandalizing computers for the school. This made them to stick to their old teacher approaches where ICT was not used. In this study, teachers also indicated that school curriculum was examination oriented and so there was not time to waste on ICT as the syllabus had to be completed on time. Furthermore, ICT was only a medium of instruction and not examinable and so ICT integration was up to teachers' discretion.

Conceptual Model

The conceptual model for this study was developed based on the modification of Mumtaz (2000) model that distinguishes institutional, resources, and teachers as the main factors that influence technology adoption. In our study we investigated the availability usage technology resources, teachers' familiarity of ICT, training, and the perceived barriers to ICT use.

Research Questions

The objective of the current study was to examine the extent of use in mathematics teaching in Kenya secondary schools. The following research questions guided this examination:

1. What ICTs do mathematics teachers have access to and what is their familiarity level, and frequency of use?
2. What is the extent ICT training for mathematics teachers?
3. What are the perceived barriers to ICT integration in mathematics teaching?

Research Design

The study applied a cross-sectional survey research design to collect quantitative data. Researchers using survey research design to collect data at one point in time from a sample selected to describe some larger population (Babbie, 1990). Thus, the survey research design was used to collect data from a sample of mathematics teachers in Kenya on the extent of ICT use in mathematics teaching.

Population and Sample

The population for this study consisted of mathematics teachers in the public secondary schools in the Republic of Kenya from Nairobi County and Nyandarua County. I selected the sample for this study using random sampling procedures. Forty secondary schools were selected where 135 mathematics teachers were asked to complete survey questionnaires. About demographics, 61.7% of teachers surveyed was male and 38.3% female, 57.4% are younger than 40 years old, 34.6 are between 41 and 50 years, and only 7.9% are over 50 years old.

Some relevant data about them is that 56% are largely from urban community schools, 26% from suburban, and 17.3% from rural schools. About 21.2% work in national schools, 45% work in county schools, and 33.6% work in district or community schools. Concerning the level of education and teaching position, most

ISSN No. 2454-6186 | DOI: 10.47772/IJRISS |Volume VII Issue VI June 2023

of them have a bachelor´s degree only (63%) and 71.8% are TSC employees. About the experience, 53% have less than ten years of teaching experience and 47% more than ten, and finally 68.3% of teachers surveyed are teaching to class with above 40 students, and 62.6% in schools where the principal is a math or science major. About 94.4 have access to the Internet, 77% have a computer lab at their school, and 94.4% have no computers in the classrooms.

Survey Instrument

The survey instrument consisted of 28 questions categorized into three sections. The first section (section A) asked mathematics teachers how often they integrated ICT and their ICT innovation decision processes. Section B consisted mainly of questions related to factors that influenced them to integrate ICT in the classroom, and section C consisted of socio-demographic questions. The Likert-type items were tested for reliability and all had a Cronbach alpha greater than 0.70. Cronbach's Alpha values of 0.70 and above indicates that all the variable indices dimensions demonstrate acceptable internal consistency (Adeniran, 2019).

The survey questionnaires were delivered to the schools and the teachers were asked to complete. The questionnaires were collected a few days later from each school. This process ensured a high response rate above 80% (Babbie, 1990). Data analysis involved descriptive statistics using SPSS.

RESULTS AND DISCUSSIONS

Availability, familiarity, and Uses of ICT

According to Fig. 1, teachers in this study reported that accessibility of ICTs at their schools were Microsoft Word, PowerPoint and Excel (65.3%) Graphing Calculators (15%), Dynamic Statistics Software (7.2%), Dynamic Geometry Software (13.7%) and Computer Algebra Systems (20.5%), the Internet (60.9%), and smart boards (21.1%). Additionally, 77% of them have access to a computer on computer labs, 5.6% have a computer in the classroom, and 33.9% have technical support. This findings indicate that majority of the teachers have access to productivity software but lack of mathematical software.

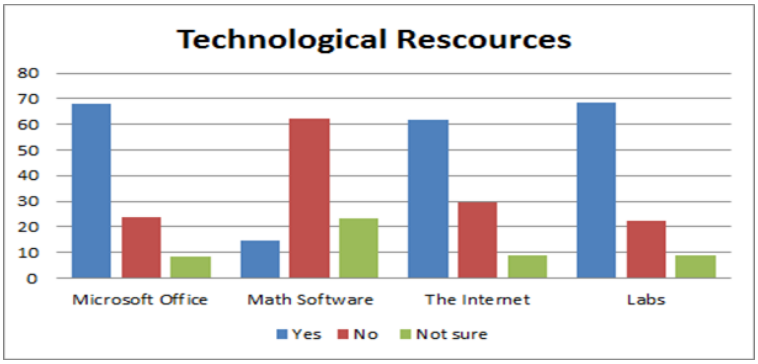

Fig. 1: Availability of technological resources in mathematics teaching

Source: Data

According to Fig. 2 consider themselves to have familiarity of ICT in the following categories: average (33.3%), advanced and expert (31%) skills of Word processors; average (25%) and 24.4% advanced and expert (24.4%) skills of PowerPoint; average (32.9%) and advanced and expert (23.7%) skills of Excel. However, the results show that teachers are not familiar with mathematics software, for example: 10.6% have average skills and 9.7% have advanced and expert skills of Graphics Calculators; 8.1% have average skills and 6.6% have advanced and expert skills for Dynamic and Statistics Software; 5.8% have average and 5% advanced and expert skills of Dynamic Geometric Software; and finally 5.7% are average users and

advanced and expert users of Computer Algebra Systems. And additionally we found that just 21% say that have accessibility to interactive whiteboards and 23% know how to use it. In average, 30% of the teachers reported they were unfamiliar with most ICT compared to only 23.7% who said they were expert or advanced users.

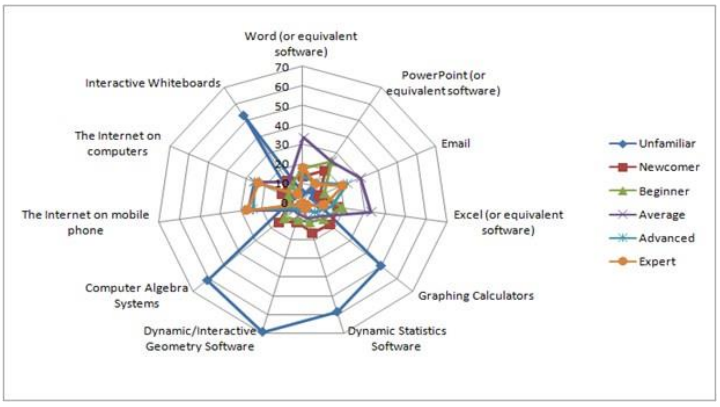

Fig. 2: Mathematics Teachers' percentage of familiarity of ICT

Source: Data

Fig. 3 shows frequency of use of technology by mathematics teachers. The usage differed significantly among different ICTs they have access to. For example, 57.6% never use word processor, 23.2% use few times in a term, 19.2% use it daily or weekly; on PowerPoint, 58.2% never use it, 29.5% use it few times a term, and 12.3% use it weekly or daily; on excel 61.7% never use, 25% use it few times a term, and 12.4% use it weekly or daily. Graphing calculators 76.7% never use, 8.3% once a term, and 16.1% use it weekly or daily. Dynamic statistics, 91.4% never use, 4.2% use it few times in a term, and 3.5% use it weekly or daily. Dynamic geometry software 85.1% never use it, 9.9% few times a term, and 7.5% weekly or daily; CAS 78.5% never use it, 16.5% few times a term, 4.9% weekly or daily. On smart board, 82.6 never use it, 10.8% few times a term, 6.7% weekly or daily. Respect to internet connectivity, of all teachers, 94.4% have access to internet but the 43.8% report never use internet, the 14% once or twice a term, 9.1% once or twice a month, 9.9% once or twice a week, 9.9% 3 or 4 times a week and finally 13.2% daily. Then more than 56% of teachers that have internet access, use it on different frequencies. Another important data is that 78.2% of teachers consider themselves average, advanced and expert users of internet on mobile phone and 75.2% average, advanced and expert users of internet on computer.

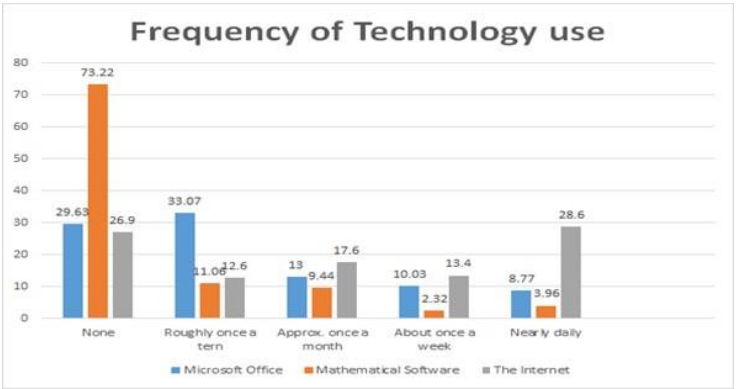

Fig. 3: Frequency of computer use

Source: Data

Overall, the findings indicates that the Internet is the most widely used ICT beginning on daily basis, weekly, monthly and on a school term basis although lack of Internet access one of the main barriers to the

incorporation of ICT (Hennessy et al., 2010, p.42; Adomi & Kpangbam, 2010, p.4). Internet usage may be explained by a large number of teachers who own cell phones (81.4%) and laptop computer (58.6%). However, there is also a significant proportion of teachers 43.8% who do not use the Internet. Internet accessibility is followed by Microsoft office applications, and mathematical software came last. The results tell us that Microsoft Office is the most widely available ICT at schools 65.3%, followed by the Internet at 60.9%, and lastly mathematical software at 19.4%.

On experts and advanced users of ICTs, Internet on mobile phone leads, followed by Internet on computer, email, word processor, and PowerPoint, all mathematics software came last with more than 50% of the mathematics teachers indicating they were unfamiliar with each of them. These results explains why mathematical software are barely used throughout the school term among the teachers in this study with an average of 82.86 who never use them.

The results indicated that a high proportion of usage of ICT in mathematics teaching occurs once or twice a term with other times indicating low usage or no usage. Consistently, other results from this study revealed that almost half of the respondents (45.9%) in this study used ICT for classroom purposes between 0 and 1 hour in a week.

In sum, mathematics teachers have no adequate accessibility of ICT for mathematics teaching, and Microsoft Word and the Internet are the most widely available ICT. Most teachers are not familiar with ICT software as well, however, most of them are familiar with Microsoft and the Internet, particularly internet on mobile phone. The usage of mathematics software is also very low compared to usage of the Internet and Microsoft office tools. In fact, 70.6% of teachers have never used ICT in mathematics teaching. This may be explained by the limited availability and unfamiliarity of mathematics ICTs may be the reason why teachers are not using them.

Training of ICT

In Fig. 4 below, teachers report that 23.6% of them never received, 30.1% trained once a term, and 16.2% received in other different frequencies (either daily, weekly, or once a month); 32.5% never received training for use PowerPoint, and 35.8% once a term, and 31.7% received in different frequencies; 32.8% never received training for Excel, 33.6% once a term, and 33.7% received in other different frequencies; Graphing calculators 65.8% has never received any training, 9.9% once a term, and 24.3% received training in different frequencies. Dynamic statistics, 80.7% never received training, 8.8% once a term, and 10.5% only at different frequencies. Dynamic geometry software 76.1% never received training, 11.5% once a term, 12.4% at different frequencies. On the computer algebra systems (CAS) 70.5% never received training, 11.6% once a term, and 27.9% at different frequencies. On smart board, 73% have never received training, 13.5% once a term, and 13.5% at other different frequencies. Lastly, 26.9% has never received Internet training, 12.6% once a term, and 55.6% at other different frequencies.

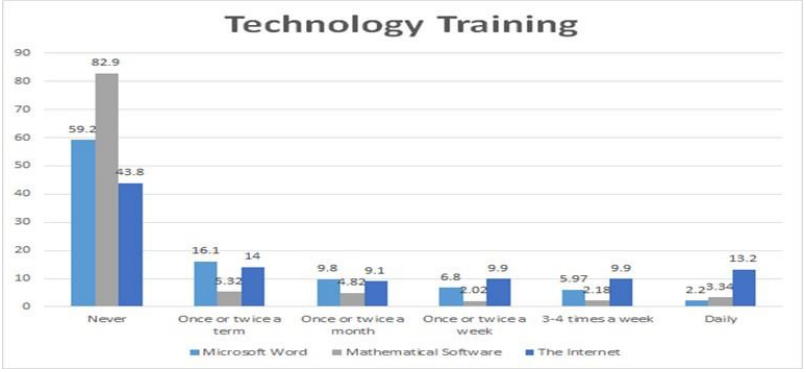

Fig. 4: Technology Training

Source: Data

The results indicate that most ICTs training have been focused more on use internet, word, and Excel and PowerPoint as opposed to training of mathematical software. The results indicated that teachers had more Internet training than any other ICT application. In fact, 34.6% received internet training on daily basis, implying that Internet skills may be self-taught. The next most significant training of ICT was on Microsoft office applications and it occurred once a term, implying that this training is related to the training teachers receive from the ministry of education during the holidays. However, there is minimal and limited training of ICT applications related to mathematics teaching such as indicated Hennessy, et. al. (2010, p. 49), who say that most ICT training is limited in availability and inconsistent in quality, and in this case no adequate. In fact between 75%-90% of mathematics teachers in this study reported they had never received training to use different mathematical software This finding reflects on the results that indicated that on average 58.26% of teachers indicated they were not familiar with ICT applications related to mathematics teaching, when compared to 5.9% of Microsoft word, 5.6% on Internet, and 8.1% for mobile internet.

Barriers of ICT Uses

On one hand, the results indicated that the greatest limitation they faced was lack of computerized mathematics book 68.1%, lack of computerized mathematics curriculum at 57.1%, lack of computerized classrooms 47.4%, and lack of hardware and software 45.8%. These results point towards lack of technology resources for math subject at the schools.

On the other hand, the teachers reported that indicated that they are limited by difficulties in keeping with ICT changes 23.1%, side effects of the Internet 23.7%, time to train on ICT 23.5%, and time to use ICT 26.7%. This result indicated low availability of ICT related to mathematics teaching.

In sum, we identified the greatest barriers to ICT use as follows: The first are the no computerized textbooks for mathematics, curricula the lack of a computerized mathematics curriculum, and the lack of support in classrooms or labs been the most significant considering the lack of technical support reported in another elements evaluated. The second are the lack of two technology-enhanced classrooms or labs, and lack of current hardware and software, and this coincide with lack of access to mathematical software mentioned before. The third are lack of necessary technical knowledge to use, lack of teaching knowledge specific to technology-enhanced environment and lack of models/examples of effective uses of technology but are not important barriers maybe because teachers learn to use by themselves or informally. And most teachers did not consider time for learn to use and use technology for mathematics lessons a significant barrier for ICT integration. Other point is that in agreement with teachers' perception, they do not consider negative effects of the internet on moralities and traditions of Kenyan people.

CONCLUSION AND RECOMMENDATIONS

The study concludes that Kenyan secondary mathematics teachers have no adequate access to technology resources for teaching mathematics, are not familiar with mathematical software, are not using technology in the classroom, and they have limited training on mathematical software. However, these teachers seem to have access to Microsoft office tools and the Internet on mobile phones and computers, which are also the ICTs they are mostly familiar with, use them frequently, and are trained on regularly.

According to Hennessy et al. (2010) teachers need basic ICT skills, and after that they also need to determine which applications have added value for learning in their subject area (p. 45). In this case mathematics teachers in this study appear to have deficiency in technology skills for teaching mathematics. This implies that even though teachers may have access to important basic tools for teaching, teachers still need effective training to learn which specific ICT tools to use for their subject and how to utilize the tools to augment their lessons (Adomi & Kpangbam, 2010, p. 138). This study reveals that without the use of

mathematical software in the classroom to teach and learn mathematics, students may not be adequately prepared to gain critical thinking skills needed for the achievement of the Kenya Vision 2030. Lastly, further research is required to establish the how Internet on mobile phones can be used by mathematics in the classroom teachers using mixed methodology.

REFERENCES

1. Adeniran, A. O. (2019). Application of Likert scale's type and Cronbach's alpha analysis in an airport perception study. *Scholar Journal of Applied Sciences and Research*, *2*(4), 1-5.
2. Adomi, Esharenana E. and Kpangban, Emperor (2010) "Application of ICTs in Nigerian Secondary Schools". Library Philosophy and Practice (e-journal). Paper 345. http://digitalcommons.unl.edu/libphilprac/345
3. Alwy, A., & Schech, S. (2004). Ethnic Inequalities in Education in Kenya. *International Education Journal*, *5*(2), 266-274.
4. Ang'ondi, E. K. (2013, July). Teachers Attitudes and perceptions on the use of ICT in teaching and learning as observed by ICT champions. In *10th IFIP World Conference on Computers in Education, Torun*.
5. Ayere, M. A., Odera, F. Y., & Agak, J. O. (2010). E-learning in secondary Schools in Kenya: A Case of the NEPAD E-schools.
6. Babbie E. (1990). *Survey Research Methods*. Belmont; Wadsworth Publishing.
7. CEMASTEA, (2012).Secondary School Situational Analysis: A Paper Presented at Principals and Deputy
   Principals workshop on Supervision of ASEI-PDSI at School Level in Kenya.
8. Chigona, A., & Chigona, W. (2010). An investigation of factors affecting the use of ICT for teaching in the Western Cape schools.
9. Demiraslan, Y., & Usluel, Y. K. (2008). ICT integration processes in Turkish schools: Using activity theory to study issues and contradictions. *Australasian Journal of Educational Technology*, *24*(4).
10. Divaharan, S., & Ping, L. C. (2010). Secondary school socio-cultural context influencing ICT integration: A case study approach. *Australasian Journal of Educational Technology*, *26*(6).
11. Hennessy, S., Harrison, D., & Wamakote, L. (2010). Teacher factors influencing classroom use of ICT in Sub-Saharan Africa. *Itupale online journal of African studies*, *2*(1), 39-54.
12. Kinuthia, W. (2009). Educational development in Kenya and the role of information and communication technology. *International Journal of Education and development using ICT*, *5*(2).
13. KNBS, R. (2012). Kenya national bureau of statistics.
14. Kozma, R. B. (1994). A reply: Media and methods. *Educational Technology Research and Development*, *42*(3), 11-14.
15. Kozma, R. B., & Kozma, R. B. (2010). ICT policies and educational transformation. *Retrieved August , 10*, 2015.
16. Kumar, N., Rose, R. C., & D'Silva, J. L. (2008). Teachers' readiness to use technology in the classroom: An empirical study. *European Journal of Scientific Research*, *21*(4), 603-616.
17. Lau, B. T., & Sim, C. H. (2008). Exploring the extent of ICT adoption among secondary school teachers in Malaysia. *International Journal of Computing and ICT research*, *2*(2), 19-36.
18. 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.
19. National Council of Teachers of Mathematics. (2000). Principles and standards for school mathematics. Reston, VA: Author.
20. Ojiambo, P. C. (2007). *Educating Modern Kenyans: Dr. Geoffrey William Griffin and Starehe Boys-Centre and School. Ohio University.*
21. Peeraer, J., & Van Petegem, P. (2011). ICT in teacher education in an emerging developing country: Vietnam's baseline situation at the start of 'The Year of ICT'. *Computers & Education*, *56*(4), 974-982.

22. Rastogi, A., & Malhotra, S. (2012, March). Determinants of ICT pedagogy integration. In *Society for Information Technology & Teacher Education International Conference* (pp. 4285-4292). Association for the Advancement of Computing in Education (AACE).
23. Republic of Kenya (GOK), (1981). Second University in Kenya (Mackay Report) Nairobi; Government Printer.
24. The Republic of Kenya (2007). Kenya Vision 2030: Economic, Social and Political Pillars. Nairobi: The National Economic and Social Council of Kenya (NESC), Office of the President.
25. UNESCO (2008).”ICT Competency Control Standards for Teachers” Reviewed 05 Abril 2014 from http://www.eduteka.org/pdfdir/UNESCOEstandaresDocentes.pdf.
26. Wabuyele, L. C. (2003). Understanding Teachers? and administrators perceptions and experiences towards computer use in Kenyan classrooms: A case Study of two schools (Doctoral dissertation). Ohio University, Athens. Retrieved from http://etd.ohiolink.edu/view.cgi?acc_num=ohiou1071169942
27. Wims, P., & Lawler, M. (2007). Investing in ICTs in educational institutions in developing countries: An evaluation of their impact in Kenya. *International Journal of Education and Development using ICT*, *3*(1), 5-22.