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Integrating Information Communication Technology in Mathematics at Secondary Level: A Study of Three Selected Secondary Schools in Chilubi District of Northern Province

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Abstract- The purpose of this study was to explore the various challenges and opportunities influencing integration of ICT in teaching and learning Mathematics in secondary schools in Chilubi District. The study sought to: Determine the levels of ICT integration in teaching and learning Mathematics; identify the challenges and opportunities of ICT use in teaching and learning Mathematics; and identify best pedagogical practices used in teaching Mathematics using ICT. The study adopted Rogers's diffusion theory, whereby the user or adopter is critical in the whole process. The study also adopted a descriptive survey research design hence data was largely descriptive in nature. Three instruments were used to determine the results in the study: teachers and student questionnaires, a structured interview schedule for the deputy heads of department and an observation checklist. The study was carried out in three public secondary schools in Chilubi District.The schools included Chaba Day,Matipa day and Chilubi mainland boarding school. The study adopted purposive sampling to select teachers, while simple random sampling to select schools, head of departments and Grade nine students. The sample comprised of two thousand seven hundred and seven five (2775) respondents. The sample of the study included three secondary schools, twelve Mathematics teachers, two hundred and seventy five (275) grade twelve students and three heads of Mathematics department. Data analysis was done using Statistical Package for Social Sciences (SPSS) version 20, which involved the use of percentages and frequency tables. The findings indicated that there were low levels of ICT integration; Mathematics teachers are not well prepared to integrate ICT in teaching Mathematics.

Keywords:Integration and Communication Technology,Learning,Levels of integration and innovations.

I. INTRODUCTION

The fast rate of globalization has put Zambia as a nation into establishing high standard of means of educating her citizens to meet the global standard.To meet this global standard Zambian citizens need to be Information and Communication Technology (ICT) compliant.Information and communication Technology which emerged in the 21st century are those modern communication system which are used in transferring information . However,there are several benefits of using ICT in teaching and learning Mathematics. ICT has the potential to transform the nature of education; improving teacher's design work, enhancing the roles of students and teachers in the learning process and helping to create a collaborative learning environment (Amuko, Miheso and Ndethiu, (2015)).As a result, the integrating of ICT in teaching and learning is high on the educational reform agenda of developed and developing countries. For developing countries, ICT can be seen as a way to merge and even leapfrog into a globalizing, technological world. In spite of this, the use of ICT for teaching is limited at best (Peeraer and Van Petegem, (2011).

The Gachathi report (2016), noted that, the 7-4-2-3 system of education lacked the capacity and flexibility to respond to the changing aspiration of individual Zambians and the labour market needs in terms of new skills, new technologies and the attitude to work (Wanjohi 2011)). Integration of ICT in teaching and learning Mathematics in the Zambian secondary schools, prepares learners, to be able to meet Zambia's labour market demand. ICT has the potential to improve the educational system to a great extent. However, developing countries are far from reaping these benefits because of certain challenges such as administration support, teacher's confidence and competence (Khan ,Hossain, Hasan and Clement (2012)).In Zambia, policy makers continue to introduce strategies for ICT, with the intention of increasing its use in schools. Such strategies are likely to have effect on the school level factors, such as time and technical support (Kipsoi, Chang'ach and Sang, (2012)). Time is an important element in the integration of ICT into teaching and learning. Strategic planning is crucial especially when it comes to offering teachers quality professional training for technical support. However, the success of ICT integration in schools depends on school managers, who will make ICT access possible and ensure effective removal of obstacles that hinder successful of integration of technology in teaching and learning environments (Kipsoi, Chang'ach and Sang, (2012)). Positive attitudes towards computer use by school teachers are important for effective integration of the technology in the school curriculum and also for pedagogical practices (Amuko, Miheso and Ndethiu, (2015)).A teacher's belief can be a major barrier to ICT integration. Some teachers have a negative belief about the use of ICT in teaching Mathematics because of their own negative experiences such as anxiety and stress. The process of integrating ICT into Mathematics' teaching is directly affected by teachers' belief and attitude towards using computers as a tool for teaching and learning Mathematics (Güven, Çakiroğlu and Akkan, (2009)).Teachers who have a positive attitude towards ICT easily adopt and integrate ICT into their teaching.

Statement of the Problem

Integration of Information Communication and Technology is very important in the teaching and learning of Mathematics. Integration of ICT in the zambian secondary curriculum provides opportunities to change the way teaching and learning occurs.ICT in schools plays an important role in the pedagogical, cultural, social and administrative sectors.

ICT plays an integral part in any country's development plan. Through its Vision 2030 plan,Zambai has heavily factored in the use and integration of ICT in the education system. Despite the fact that the government of Zambia has put up measures to improve the quality of education being offered in secondary schools,ICT is not adequately utilized by teachers in their Mathematics lessons because of the various factors which hinder them. Buabeng-Andoh (2012) and Kipsoi et al (2012), recently conducted studies in developing countries.

Their research established that some of these challenges experienced can be eliminated. It is in this light that schools in the recent past have been keen to invest in ICT infrastructure to facilitate ICT use and integration. In Zambia, limited research has been carried out to determine factors that contribute to access and use of ICT, especially in Mathematics. There is need for secondary schools in Zambia to invest in the effective use of ICT in teaching and learning of Mathematics.

Purpose of the Study

The purpose of the study was to investigate integration of ICT in Mathematics teaching and learning in secondary schools and provide information that can be used by policy makers, curriculum developers and implementers, school managers, and the society on the importance of using ICT effectively in teaching and learning Mathematics.

Objectives of the Study

- To determine the levels of ICT integration in teaching and learning Mathematics.
- To identify the challenges and opportunities to ICT use in teaching and learning Mathematics.
- To determine pedagogical practices in teaching Mathematics using ICT.

Research Questions

- What are the levels of ICT integration in teaching and learning Mathematics?
- What challenges and opportunities hinder the use of ICT in teaching and learning Mathematics?
- Which pedagogical practices are used in teaching Mathematics using ICT?

Significance of the Study

The study may enable Mathematics teachers to become better instructors in the subjects, through the use of ICTs infrastructures that might be available to them. The study may also, benefit educational planners and policy makers to make appropriate decisions in integration of ICT in teaching and learning Mathematics; also it might increase efficiency in their training and selection of Mathematics teachers; and encourage teachers to have more interest towards, integration of ICT in Mathematics.

Assumptions of the Study

The researcher assumed that all sampled teachers had knowledge on how to integrate ICT in their Mathematics teaching. Most of the schools had enough ICT facilities to accommodate the entire class during a Mathematics lesson. All students in the schools had access to ICT facilities that are readily or easily available in the school.

Scope of the Study

The study was focused in one subject area, Mathematics and it was conducted in only those schools that had computers laboratories and computers. It was conducted in secondary schools in Nairobi County, because the county has schools which have better ICT infrastructures.

Limitations

Moreover,getting information from prominent institutions is also a challenge as getting their valuable time to fill the questionnaires proved to be difficult. However,this was mitigated by exerting patience and also persuading them to fill in as this would end up benefiting their organisation in a big and huge way and a country at large.

Delimitation of the study

The study will focus exclusively on rural public Secondary schools,excluding urban primary schools and it is also focused in chilubi district.It is also focusing on the level 0f intergrating ict into mathematics.

Theoretical Framework

The study adopted Rogers diffusion theory, (Granovetter, (2005)).Which states that, integration of ICT in Mathematics education is a technological innovation. Rogers asserts that implementation of an innovation is just one phase of a five stage process of diffusion of communication channels over time among the members of a social system (i.e., Mathematics learning environment). His theory further argues that potential adopters of a technology progress over time through five stages in the diffusion process (Mathematics learning

process). First, the Mathematics teachers and learners must learn about the innovation (knowledge); second, they must be persuaded of the value of the innovation (persuasion); third, they must decide to adoptit in teaching and learning Mathematics (decision);fourth,the innovation must be implemented by the Mathematics teachers (implementation); and finally, the decision of using ICT in teaching and learning Mathematics must be reaffirmed or rejected (confirmation) because Mathematics teachers and learners are critical in the whole process (teaching and learning Mathematics using ICT).

Conceptual Framework

The conceptual framework in Figure 1.1 shows various possible causes that hinder Mathematics teachers from integrating ICT in their Mathematics classroom successfully.

Independent variable Intervening variable Dependent variable

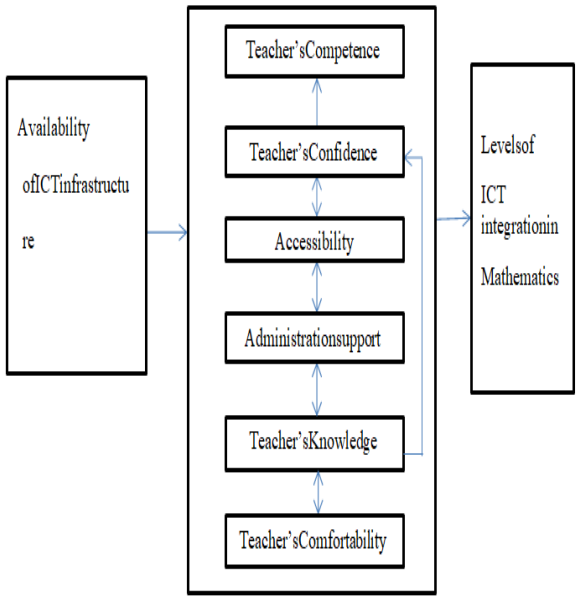

Figure 1: A Conceptual Framework of Integration of ICT in Teaching and Learning Mathematics and School and Teacher Related Factors.

Teachers' comfortability is defined by their attitude and belief. A teacher's attitude may have negative or positive impact on the levels of ICT integration in teachingand learning Mathematics.Teacher's comfortability is influenced by her/him knowledge. Teacher knowledge is defined by pedagogical knowledge and skills on the use of ICT Infrastructure that are available for use. Administration support has effect on both teacher knowledge and accessibility of ICT infrastructure.If the teacher knowledge is limited,the teacher willavoid accessingthe ICT infrastructure. Teachers with low confidence may have a higher expectation of technical faults occurring if they were to use ICT and as a result, they may avoid using it. A teacher who lacks confidence will not effectively teach Mathematics using ICT infrastructure.The outcome depends on the intervening variables of accessibility, competence, confidence, administration, teacher's knowledge and teacher's comfortability.

II. LITERATURE REVIEW

Integration of ICT in Education

ICT integration in education does not mean that ICT is added as an additional subject in the curricula and that we limit ourselves to the learning and teaching of some software packages. Sadik (2008) defines integration of technology into learning as curricula utilizing authentic tasks that intentionally and actively help learners to construct their own meanings from thinking about experiences and allows for more interdisciplinary project-based instruction. Integration is defined not by the amount or type of technology used, but by how and why it is used (Sadik, (2008)). Meaningful integration of technology in Mathematics Education is achieved when students are able to select technology tools to help them obtain information in a timely manner, analyse and synthesize the information and present it professionally (Sadik, (2008)). Teachers integrate technology into teaching and learning of Mathematics for a variety of reasons such as: promoting student engagement, teaching 21st century skills, best teaching practice, to stay current, for hands-on interactive learning, to vary instructional methods, to perform labs and demonstrations, and for research and communication (Hechter, Phyfe and Vermette, (2012)) .

Levels of Integration of ICT in Teaching and Learning Mathematics

The role of technology in teaching and learning is very versatile. Classification and analysis of the roles is necessary to integrate technology meaningfully. The importance in this field is the relationship between the use of technology and the teaching aims which will be achieved as well as the influence of technology on the teachers beliefs in their work (Barzel and Drijvers, (2009)). In Zambia ICT is increasingly being applied in teaching and learning in almost all the subjects being offered in secondary education (Gikonyo, (2012)). Mathematical knowledge, mathematical rules and mathematical practices are inextricably linked, and this connection can be strengthened by the use of technologies in teaching and learning Mathematics. (Olive, Makar, Hoyos, Kor, Koshelera and Strä/sser,(2010)). Learning with useful integration tools can lead to a functional understanding of mathematical concepts, as well as develop a broader understanding of the nature of Mathematics (Varughese, (2012)). Technology enhances efficiency of mathematical thought and enables learners to make conjectures and immediately test them in a Mathematics learning environment.It also offers multiple mathematical representations that enhance generality of mathematical concepts and provide opportunity for counter example, unlike in a paper and pencil environment (Ogwel, (2008)).

Mathematics educators are primarily concerned with using technology to aid in instruction (for example, computers, calculators, software) and to facilitate student learning. Technology educators, on the other hand, are focused on how to use Mathematics to understand, use, and design different technologies (Merrill, Reece and Daugherty,(2010)).Mathematics educators appear to see technology as a tool in service to solving Mathematical problems; technology educators appear to see Mathematics as a tool in service to solving technological problems (Merrill, Reece and Daugherty, (2010)).

The use of ICT in the Mathematics classroom has long been a topic for consideration by Mathematics educators. Some examples of ICT use in Mathematics include: portable graphic and scientific calculators and computerized graphing, specialised software, programmable toys or floor robots, spread sheets and databases (Mishra and Koehler, 2006). As discussed by UNESCO, (2007), for successful integration of ICT into the Mathematics curriculum, it is essential to have knowledge of the existing software that is used by Mathematics teachers. They highlighted that one of the major problems is that the educational software is often isolated and not integrated with the textbooks that many facilitators use. Moreover, many ICT applications are poorly attuned at the curriculum.Nobre, Amado and Carreira(2012),emphasized that the spread-sheet is a powerful tool in Mathematical problem solving and particularly in the development of algebraic thinking embedded in problem solving activities. They further stated that one of the gains of connecting algebraic thinking and the use of spread sheets is the creation of a significant environment to induce learners into algebraic language that facilitates the construction of algebraic concepts, especially concerning working with functional relations, sequences and recursive procedures (Nobre, Amado and Carreira (2012)).

Computers in Assisted Learning in Mathematics

Computers can transform the logical-mathematical thought of a computer programmer to interesting interactive video games (Varghese, (2012)).

Despite the mandate that accompanies ICT education policy documents that computer technology be integrated intothe range of courses in the secondary Mathematics key learning areas, there is evidence to suggest that computers are not widely integrated into Australian and USA secondary Mathematics classrooms (Hudson andPorter, (2010)). In the findings of Ottenbreit-Leftwich, Glazewski, Newby, andErtmer, (2010) and Khambari, Moses, andLuan, (2009) it is highlighted that teachers use computers; to perform administration tasks rather than integration tasks. Examples of administration tasks are encoding lesson plans schemes of work, record of work covered, preparing examinations and surfing the Internet for visual aids. Despite teachers' increasing knowledge of, and familiarity with, technology and

there being infrastructure to support it, many Mathematics facilitators are still not effectively integrating technology into their teaching (Hudson andPorter, (2010)).

Graphic Calculators in Teaching and Learning Mathematics

A calculator is a device for performing mathematical calculations; it is an electronic device that can be held in the hand(Bowker,Hennessy, Dawes and Deaney,(2009)). Lucas and Cady (2012)supported the notion that the calculator is an essential element in the teaching and learning of Mathematics; functional use means that it will be used only in activities such as computation,drill and practice and checking paper and pencil work. They further asserted that teachers can use calculators to provide activities that help learners develop their mathematical understanding about concepts such as place value, the meaning of operations and estimation, and it iseach classroom facilitator's responsibility to select appropriate activities and times for using calculators for instructions.

In addition, Barzel and Drijvers (2009) stated that in most approaches to Mathematics learners acquire arithmetic skills and knowledge before learning algebra. The step from arithmetic to algebra is influenced by the use of graphic calculators. The use of calculators increases students' confidence in the accuracy of their graphs, and thus enables them to work with less dependence on the facilitator and fostering students independence (but without reference to peer exchange) and (Bowker, Hennessy, Dawes and Deaney, (2009), and Pierce and Ball, (2009)). Similarly, Ruthven, Deaneyand Hennessy, (2009)indicated that Mathematics facilitators considered the calculator as a valuable tool for checking learners' sketches or manipulation, relating to the theme of supporting processes of checking. However, some teachers expressed concern about limitations of calculators graphing in respect of the frequent need to adjust the graphing window and to interpret approximate co-ordinate values, so qualifying the perceived contribution of this technology to an ideal of focusing on overarching issues and accentuating important features(Bowker, Hennessy, Dawes and Deaney, (2009))

Students in the United Kingdom use graphic calculators to solve equations in their exams. However, there is a limitation in that this technique leads to just one approximated solutions and additional reasoning or re-applying the procedure is needed to find other solutions or to be sure that all solutions have been found, (Ruthven,Deaney and Hennessy,(2009)). In North America graphic calculators are used primarily to generate patterns of graphic images; most commonly by learners themselves; through a guided-discovery approach which, some teachers have reported, has been made possible only through use of the technology,(Ruthven, Deaney andHennessy, (2009)). The reasons why facilitators use graphing technology are relatedprincipally to saving lesson time and generating more examples,increasing instructional variety and enhancing learner motivation, (Ruthven, Deaney and Hennessy,(2009)). The graphing software is generally preferred over graphic calculators (Bowker, Hennessy, Dawes and Deaney, (2009)). Calculators need to be used effectively in order to enhance learners understanding; specifically, calculators should help facilitators develop deeper Mathematical understanding and notreplace that understanding (Masalski, (2005)).

Mobile Phones in Teaching and Learning Mathematics

M-learning is the process of learning with assistance from a mobile, wireless device. L Calkins (2009) recognized that learning environments that integrate mobile technology, rather than limiting learners to a traditional linear flow of information from the educator, encourage learners to participate throughout the educational process.Calkins (2009) further said that wireless technology can be utilized as a tutor, supplying software applications to learners in an effort to generate higher quality studying habits on the go. Smartphones can also act as a tutee, as students learn to program their devices to better assist their efforts in education, simultaneously building technical skills necessary for the future.Mobile devices are used as effective tools in educational settings as well, allowing for more efficient collection and analysis of information, leading to a

more meaningful and enlightening educational experience (Calkins (2009)).

In the UNESCO (2011) report, the Nokia mobile company have presented mobile learning programmes and services, such as Nokia mobile Mathematics and Nokia educationdelivery.They are used in both formal and informal learning environments to bring better access and better quality content to classrooms and outside school learning. These services offer interactive learning experience for students and as a possibility to use learners' social network for peer-support by combining social media application and learning.
In France,mobile phones have banned in schools because of the potential cancer risk caused by radiation from using mobile phones (Miles and Singal, (2010)). Research shared from Canada describes the following challenges for mobile learning: small screen and keyboards; facilitators not knowing how to design and develop mobile instructional learning materials; negative facilitator perceptions of mobile learning; not enough mobile learning instructional materials; and no standard for mobile learninginstructional materials. It could be argued that most of these factors do not only apply to Canada but are universally applicable (UNESCO, (2011)) report.

The use of mobile phones in education is less expensive compared to the use of computers and other technologies that are widely used in education. Research relating to this subject matter is necessary for the successful integration and adoption of mobile technology into the classroom environment of tomorrow, because veryfew studies have focused on mobile phone learning. This gap prompted the study.

Challenges and Opportunities Influencing Integration of ICT in Teaching and Learning Mathematics

Seffrin,Panzan and Ruth(2008)define a barrier as a neventor condition that hinders the adoption decision. Hudson and Porter (2010) observe that Mathematics teachers are also faced with inhibiting challenges or barriers to computer use. For this reason, there have been several studies which have specifically focused on secondary Mathematics teaching. Bennison and Goos (2010) and Amuko, Miheso and Ndethiu, (2015), describe two types of barriers, currently hampering the integrated use of technology by teachers:- external (first order) barriers and internal (second order) barriers.
Amuko, Miheso and Ndethiu, (2015), observe that policy makers in Zambia continue to introduce strategies for ICT, with the intention of increasing its use in secondary schools. These strategies are likely to have an effect on the school level factors. The teacher level obstacles are more difficult for policy makers to tackle as it is the teachers themselves who need to bring about the required changes in their own attitude and approach to ICT. Amuko, Miheso and Ndethiu, (2015), in their research findings stated that,the main factor in front of Mathematics integration process is the gap between the curriculum's expectations and teachers' beliefs. However, they suggested that, the integration of ICT into the Mathematics classroom depends on individual teachers as well as the schools' contextual factors.

Teacher Related Challenges in Teaching and Learning Mathematics

Teacher related, challenges impact on fundamental change and are typically rooted in teachers' core beliefs and are therefore the most significant and resistant to change (Amuko,Miheso and Ndethiu(2015)).Teacher related factors refer to teacher comfortability, teacher confidence and teacher competence. Research indicates that lack of teacher confidence prevents teachers from using ICT in their teaching (Amuko,Miheso and Ndethiu,(2015)).They also indicated that limitation in teachers ICT knowledge makes them feel anxious about using ICT in the classroom and thus not confident to use it in their teaching (Amuko,Miheso and Ndethiu, (2015)).

Younger teachers had higher confidence levels and were more positive towards ICT in education than senior teachers.The less experienced and the veteran teachers were positive about ICT in education compared with the highly experienced teachers who were mainly more negative (Afshari,

Bakar, Luan, Samah and Fooi, (2009)). In addition they further indicated that female student users, compared with male counterparts, are inclined to hold negative reactions to computers and such differences may have resulted in the different ways of using computers. As discussed by Davis, Klawe, Nyhus and Sullivan (2008) computer use and expertise have been associated with masculinity, and therefore, gender socialization serves to act negatively on female ICT interactions. They further indicated that boys aged 13-16 had already acquired a gender stereotyped view of computer users. Boys in general receive more support from teachers, stakeholders and parents, and are more likely to be the main ICT user at home than girls are.

Teachers' computer competence is a major predictor of integrating ICT in teaching. Evidence suggests that majorityof teachers who reported negative or neutral attitude towards the integration of ICT into teaching and learning Mathematics processes lacked knowledge and skills that would allow them to make an "informed decision" (Amuko, Miheso and Ndethiu, (2015)). A study conducted by Agyei and Voogt (2012) in Ghana among student teachers and practicing teachers Mathematics teachers, reported low levels of technology integration levels as a result of low competencies and access levels of technology. Successful integration of ICT in teaching is related to teachers' competence andattitudes towards the use of modern technology in their teaching and learning Mathematics (Amuko, Miheso and Ndethiu, (2015)).

Positive attitudes towards ICTs use by school teachers are important to ensure the integration of the technology is effectively carried out in the school curriculum and also during teaching and learning. Teachers' attitudes are influenced by their perception of the usefulness of ICT, their behaviour intentions and pedagogical aspects. Teachers' attitudes towards using ICT in teaching and learning are also influenced by several factors(Amuko,Miheso and Ndethiu,(2015)). Factors that can influence the teacher attitude towards ICT include ICT related knowledge and skills, and motivation to use ICT. Teacher age and teaching experience cannot be influenced or changed (Afshari, et al.,(2009)). In addition Jimoyiannis, Tsiotakis, Roussinos and Siorenta, (2013) found that across a number of subject specialties including mathematics, teachers' post-training beliefs about the role of ICT in education were influenced by their gender, age, and teaching experience. In general, male facilitators held a more positive attitude towards ICT in education while female facilitators held a more neutral or negative attitude. Teachers' attitudes and beliefs influence successful integration of ICT into teaching Mathematics (Keengwe, Onchwari and Wachira, (2008)).

Amuko, Miheso and Ndethiu, (2015), stated that, in teaching and learning of Mathematics, teachers' belief about Mathematics learning with or without using technology is considered to be important because it could influence teaching and learning, and Mathematics curriculum reform. At the classroom level, teachers' beliefs can accelerate or slow down curriculum reforms as teachers' beliefs are resistant to change and play a role in teaching practices. Findings from a study done in Zambia by (Amuko, Miheso and Ndethiu, (2015)), has shown that teachers who begin using ICT in their teaching, initially believe that technologies creates more work for them. In addition, theyalso found that, Mathematics teachers have negative beliefs about using computers in Mathematics teaching because of negative experiences; however, they expressed that these beliefs can be changed with in- service and out-of-service courses focusing on long-term constructivist approach. They further stated that, when teachers have the environments providing social support and enough technological substructures, their beliefs can change in the course of time and they can design a more constructivist learning environment.

Teachers adopting constructivist educational beliefs are more willing to adopt student-centred approaches and other innovative instructional approaches, while teachers adopting traditional beliefs are more likely to adopt teacher-centred instructional practices. The way teachers integrate computers into their classroom instruction seems to

be strongly mediated by their belief systems (Sang,Valcke,van Braak, Tondeur and Zhu, (2011)). Moreover, the process of integrating computers into Mathematics teaching is directly affected by teachers' beliefs about using computers as a tool for teaching and learning Mathematics. Cultural perceptions such as school cultures and social cultural factors need to be considered as an important element in the implementation of ICT and culture may play an important role influencing how teachers relate their beliefs to ICT use (Sang et al., (2011)).

School Related Challenges in Teaching and Learning Mathematics

School related challenges refer to inadequate provision of resources such as infrastructure, support, trainings and time. In Kenya, teachers rated lack of time as one of the most problematic factor to technology utilization in schools. They further said that mastering technology requires time (Amuko, Miheso and Ndethui, (2015)). 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. The effect is that facilitators will be discouraged from using computers because of fear of equipment failure since no one would give them technical support in case there is technical problem (Amuko, Miheso and Ndethui, (2015)).

Yilmaz (2011) assessed technology integration processes in the Turkish education system and reported that it is important to provide schools with hardware and internet connections. In addition, it is also crucial to provide schools with technical support with regard to repair and maintenance for the continued use of ICTs in the schools. Peeraer and Van Petegem,(2011) and Kukali (2013) claimed that issues surrounding computer hardware were the most serious factors affecting implementation. Teachers reported that computers were not reliable enough. They further found that,lack of Mathematics educationals of had a negative effect on their using ICT in their classrooms.

A study by researchers like Hamzah (2007) and Khambari, Moses and Luan (2009), Mathematics teachers in Sarawak, Malaysia, indicates that insufficient time, limited knowledge on how to use ICT in class and lack of technical support have prevented them from using it. For instance, Lim and Pannen, (2012) mentioned that lack of funding and staff support incase study from Indonesia; Lack of instructional software and funds, are major factors to ICT utilization in Jordanian school settings. Similarly,in a study conducted in Jordan by Al-Senaidi, Lin and Poirot (2009),lack of institutional support and lack of time were the major hurdles to ICT utilization in secondary education. Dionys (2012) from Cambodia addresses the lack of digital resources and infrastructure (for example, the unstable electricity support) for technology integration in teacher training centres. Buabeng-Andoh (2012) asserts that while Jordanian schools were fully equipped with ICT infrastructure; there will be always some teachers who resist the change or disbelieve in ICT benefits.

Professional development is necessary for teachers to enable them to effectively use technology to improve student learning. Staff development should be collaboratively created, based on faculty input and school needs.It must prepare teachers to use ICT effectively. This training should not consist merely of short workshops or training, which is not enough to build proper knowledge and skills (Khan ,Hossain, Hasanand Clement (2012)).There are not enough training opportunities for teachers in the use of ICT in class room environments.Current training programmes do not include enough time for them to become comfortable with the software, nor does it include support to help them trouble shoot during the early implementation stages and the training experience is not tailored to their needs. Teacher training and continued, on- going relevant professional development is essential if benefits from investments in ICTs are to be maximized. Teachers remain central to the learning process (Bingimlas, (2009)and Kukali, (2013).

Lack of training and insufficient technology facilities are significant factors that influence effectiveness of technology. Having the latest technology,

knowledge, enough training, proper time management and support from the community, are among factors that prevent teachers from using ICT in class (Ayub,Bakarand Ismail (2012)). A study, in New Zealand and Australia conducted by Hudson and Porter (2010) and Amuko, Miheso and Ndethiu, (2015), in Kenya found that, one of the barriers that Mathematics teachers identified in failing to adopt the use of computers in the classroom, is the lack of computer use is due to lack of experience, lack of adequate professional training and lack of professional support in the use of computers in Mathematics instruction. Successful use of technology for the benefit of children depends on the knowledge of teachers and their confidence and competence in using technology (Amuko, Miheso and Ndethiu, (2015)). The above scholar position is that teachers need to learn how to use technology; they also need to learn how to apply the technology to teaching and learning Mathematics.

Pedagogical Practices in Integration of ICT in Teaching and Learning Mathematics

Pedagogy is focused on teachers' instructional practices and knowledge of the curriculum and the development of applications within their disciplines that make effective use of ICTs to support and extend teaching and learning Mathematics (Girgin, Kurt and Odabasi, (2011)). Pedagogical content knowledge refers to planning and implementing instruction of authentic Mathematical tasks to foster students' learning process. Planning requires teachers' high order thinking skills and creation of new Self-Regulated Learning (SRL)-stimulating components in pedagogical contexts (Zohar and Schwartzer, (2005)).

- **Syfers(2010)proposed three types of Mathematics curricular system models:**

content focused, pedagogically focused, and learner-centred. He further maintains that the Mathematics curriculum model comprises different pedagogical strategies, inter alia collaborative learning, problem-based learning and direct representation, in which ICT can act as a learning tool. In addition,Hoyles and Lagrange (2009) argued that a wide variety of ICTs can mediate interaction, but it is how these ICTs are used to support collaborative practices that make the difference in teaching and learning Mathematics. The use of ICTs to support collaborative learning practices requires new ways of learning and teaching and a new mind set about to do Mathematics.

Dionys (2012), in outlining his ideas about TPACK, concludes by highlighting the challenges of teachers' attitude change towards instructional approaches. Parkay, Stanford and Gougeon (2010) incorporate inquiry based learning in teacher education courses, strengthening the pedagogical foundation for technology integration at secondary school level. Lim and Pannen (2012) linked ICT competence and pedagogical consideration when evaluating teacher education programs. However, deeply rooted beliefs can prove to be hard to detect and unless deep changes are effected, the programs may teach skills and knowledge but still fail to produce the necessary shift to pedagogy (Lim and Chai 2008) . Using ICTs effectively requires teachers to have a wide repertoire of teaching approaches to call upon. Teachers must be proficient in using ICT not only to support their professional productivity and development, but mainly, to effectively integrate ICT into instruction and learning. Effective teacher preparation is an important factor for successful integration and sustainability of ICT in Mathematics education (Jimoyiannis, Tsiotakis, Roussinos and Siorenta, (2013)).

Technology proficiency is not a strong predictor of technology integration and those successful educational applications of ICT depend upon proficiency in the instructional methods in Mathematics education (Girgin, Kurt and Odabasi, (2011)). Most ICT teacher professional development initiatives a tend to focus on technological aspects (i.e., how to use various tools) while pedagogical and instructional issues (i.e., why and how to use those tools to enhance learning) are often taken for granted. As a consequence, the application of ICT in school settings has been driven more by the accordance of technology rather than by the demands of pedagogy and didactics of the particular subject matter (Amuko, (2015)). Training

and the typical content of technological instruction for facilitators are also reported as limited to computer literacy,focusing on fundamental computer operation and standard applications rather than preparation on how to use technology as a pedagogical tool (Scheg, (2014)) .

Teachers in developing countries such as Kenya do not have much opportunity for professional development after initial teacher preparation (Otienoh, (2010)). ICT integration in education in Kenya appears to indicate limited knowledge on the quantity and quality of research in the area of pedagogical integration of ICT in education(Gikonyo,(2012)).However,Tsai and chai,(2012) observed that research efforts have been devoted to exploring teachers' Technological Pedagogical Content Knowledge (TPACK). The TPACK framework, addresses the issues related to ICT integration from a knowledge perspective (Chai et al., (2011)).

Boaler (2013) found that the most frequently adopted activities by Mathematics teachers in her research study were exercises to practise skills or procedures, facilitators discovering Mathematics concepts and principles.She further reports that teachers reported to value a more traditionally oriented curriculum, as compared to Mathematics curriculum goals that focused on lifelong learning and connectedness. There is a need for clear education policy regarding teacher professional development courses and seminars that are focused on pedagogical practices on ICT.

III. RESEARCH METHODOLOGY

The study adopted a descriptive survey research design. A descriptive survey research design, finds out a phenomenon or characteristic associated with a subject population (Schindler and Cooper, (2003)). The main objective of descriptive survey research design is to give a description of the situation as it is (Malhotra, (1996)). The design is useful in both collecting qualitative and quantitative data. (Schindler and Cooper (2003)).It further describes this method ofstudy based on a univariate question or hypothesis where it seeks to determine or state the existence of relationships between variables and characteristics of variables such as form, distribution, by attempting to answer the how, where, what and who questions. For this study these variables included ICT infrastructure, levels of ICT integration in teaching and learning Mathematics and teachers and students related challenges.

- **Variables**

The dependent variables included the use of ICT in teaching and learning Mathematics, the independent variables included integrated ICT infrastructures. The intervening variables included the teacher knowledge and confidence, teacher competence, teacher comfortability (attitude and belief) accessibility, and administrative support.

- **Location of the Study**

The study was carried out in Chilubi mainland of Northern Province. The researcher chose this area because it has a good number of schools that have well equipped computer laboratories , solar power and computer literacy class is compulsory for all Form one.

- **Target Population**

Population defines the whole set of objects or events under investigation about which we wish to make inferences (Schindler and Cooper, (2003)). The target population of this study comprised the three government secondary schools, a total number of two hundred seventy five (275) grade 9 students,thirty head of Mathematics department(30) and twelve Mathematics teachers (12) as shown in Table 3.1.Target population refers to all members of a target/specified set of elements. The study was conducted in government secondary schools because government schools have the highest number of students.Chilubi mainland has a total of eight government secondary schools.

Table 3.1:The Sampling Gri

Sampling Grid			
Target population		Sample	Percentage
Schools	8	3	38 %
Mathematics Teachers	40	12	30%
Students	2775	275	10%
Heads of Mathematics department	8	3	38%
Total	2831	293	116%

Sampling Techniques and Sample Size

- Schools Sample

Simple random sampling was used to select three government secondary schools out of the eight secondary schools in Chilubi mainland. This constituted 38% of the target population, which was the recommended sample size. Gay, (1992) acknowledges that, the minimum acceptable sample of survey is between 10% and 40% for a small population. Simple random sampling was used because it involves giving a number to every subject or member accessible population, placing the numbers in a container and then picking any number at random.

- Teachers Sample

Purposive sampling was used to select twelve Mathematics teachers out of the fourty grade 9 Mathematics teachers available in the selected schools. Purposive sampling was used, so as to enable the researcher to make a judgment that was to provide the best information to achieve the objectives of the study (Kumar, (2005)). The study used purposive sampling because the researcher was interested in finding out challenges and opportunities in integration of ICT in teaching and learning Mathematics, identifying levels of ICT integration in teaching and learning Mathematics and identifying pedagogical practices in teaching Mathematics.

- Students Sample

Simple random sampling was used to select two hundred and seventy five (275) out of the two thousand, seven hundred and seventy five form three students (2775).This constituted 10% of the target population, which was the recommended sample size. (Gay, (1992)) acknowledges that, the minimum acceptable sample of survey is between 10% and 40% for a small population. Simple random sampling was used because it involves giving a number to every subject or member of the accessible population, placing the numbers in a container and then picking any number at random. The study used grade 9 students because, the researcher assumed that all grade 9 students were computer literate and also according to the Zambian secondary school national curriculum that states that grade 9 students should have basic computer software.

- Heads of Department Sample

Simple random sampling was used to select three head of Mathematics Department out of the eight heads of Mathematics departments. The number of Mathematics heads of department constituted 38% of the target population, which was the recommended sample size, according to Gay, (1992) who acknowledges that the minimum acceptable sample of survey is between 10% and 40% for a small population. Simple random sampling was used because it provides a sample

that is highly representative of the population being studied.

Research Instruments

Data for this study was collected using an observation checklist, a structured interview schedule, and a questionnaire that was developed by the researcher on the basis of research objectives. Structured questions are objective. Unstructured questions were used because they provided more information as the respondents expressed their thoughts freely (Saunders, Lewis and Thornhill, (2005)).

Teachers Questionnaire

The teachers' questionnaire (see Appendix A) was appropriate for the study because of its ability to collect a large amount of information in reasonable time space,which allowed measurements for or against factors influencing successful integration of ICT in teaching and learning of Mathematics. A questionnaire is a research tool comprising a number of questions soliciting specific responses from subjects concerning the given field of the study. The questionnaire contained both open and closed-ended questions.Open ended questions allowed the respondent to provide answers freely they choose without having to select from the concrete option.The close-ended questions were used to allow the respondent to provide a unique or anticipated opinion on the study. The questionnaire did not request any personal information such as respondent name or contact details. It was divided into several sections that highlighted general information about the respondent in relation to the study.

Students Questionnaire

The students' questionnaire (see Appendix B) was appropriate to the study as it offered an effective way of collecting information on the use of ICT in teaching and learningMathematics.The students' questionnaire contained closed-ended questions which enabled the researcher to categorize respondents into groups based on the options they had selected and open-ended questions which provided the researcher with an opportunity to gain insight to all the opinions concerning the study.

Interview Schedule for Head of Departments

Interviews involved the researcher raising questions relevant to the study objectives. The study adopted a structured interview schedule; it enabled the interviewer and the respondent to have freedom in the process of interaction to reveal emotions, opinion and attitude. There searcher used an interview schedule to investigate issues in an in-depth way to discover how teachers and learners think and feel about their levels integration of ICT,challenges and opportunities influencing successfu lintegration of ICT in teaching and learning Mathematics; and pedagogical practices in teaching and learning Mathematics.

Observation Checklist

Observation is an activity of a living being, such as human, which is necessary in order to give knowledge of the environment through the senses which often later involve the recording of data via the use of scientific instruments. The observation checklist included coded items on the condition of the items. Observation checklist enabled the researcher to obtain first-hand information on the ICT facilities in the schools to find out the level of integration of ICT in teaching and learning Mathematics in the schools.

Pilot Study

A pilot study was carried out in one of the government secondary schools in Chilubi mainland that was not involved in the main study, in order to develop and test reliability of the research instruments. This was done to determine the validity and reliability of the questionnaire and the interview schedule on the study. The researcher administered questionnaires to 10% of grade students. The researcher further interviewed the head of Mathematics department.

Validity of the Study

Validity is the degree to which a test measures; what it is supposed to measure. All assessment of validity was subjected to opinions based on the judgment of researchers and experts (Best, (2005)). The researcher used a pilot questionnaire to assess its clarity as well as improve the items. According, to Best (2005), content validity of an instrument is

improved through the researcher's judgment. However validity in the study was concerned with the evaluation of levels challenge sand opportunities influencing integration of ICT in teaching and learning Mathematics, using a field test.

Reliability of the Study

Reliability is the degree to which a test consistently measures whatever it measures. Reliability is therefore used to focus on the degree to which empirical indicators of theoretical concepts are stable or consistent across two or more attempts to measure them. Cronbach's alpha α coefficient was used by the researcher to measure internal consistency of the study, in the survey instruments, to gauge their reliability. A reliability of 0.770 was achieved on the teachers' questionnaires and 0.705 on students questionnaire; this showed that the MTQ and SQ were fit for the study.

Cronbach's is defined as

$$\alpha = \frac{K}{K-1}\left(1 - \frac{\sum_{i=1}^{K}\sigma_{Y_i}^2}{\sigma_X^2}\right)_{34}$$

Where

σ_X^2 is the variance of the observed total test scores, and

$\sigma_{Y_i}^2$ the variance of componenti for the current sample of persons.If the items are scored 0 and 1, a shortcut formula is

$$\alpha = \frac{K}{K-1}\left(1 - \frac{\sum_{i=1}^{K}P_iQ_i}{\sigma_X^2}\right)$$

Where

P_i is the proportion scoring 1 on item i, and

$$P_iQ_i = 1 - P_i$$

Data Collection Procedures

Logical and ethical issues were considered in collection of the data required for the study.

Ethical Consideration

The study maintained ethical standards. Certain ethical issues were addressed in conducting the study.Considerations of these ethical issues were necessary for the purpose of ensuring the privacy of the participants. Among the significant ethical issues that were considered in the research process were consent, confidentiality and anonymity. The researcher was required to relay the importance and objectives ofthe study, including the aim and purpose of the study, in order to ensure consent of the selected participants. By explaining the importance of the study, the respondent was able to answer questions as required.

Logistical Consideration

The researcher was given permission by the University Dmi St.Eugen,to proceed with the study after the proposal had been approved. The researcher presented a permission from the School to have research carried out.Collective administration was employed during the research when issuing questionnaires to students and teachers. The researcher made an appointment with the Deputy Head teacher on when to conduct an interview with the Mathematics Head of Department in the school. The same day the researcher conducted the interviews, and also filled the study observation check list by going round the school computer laboratory to confirm infrastructure available in the school.

Data Analysis

The data analysis was guided by the research questions of the study. The data collected were coded by assigning numbers systematically to the response's from the (MTQ and SQ), observation schedule and the interview schedule. Data analysis procedures involved both qualitative and quantitative data. Data code sheets were created from these instruments and then keyed into the statistical package for social sciences (SPSS) computer package for easier and more accurate analysis. Most ofthe questions generated quantitative data which were measured at the nominal scale. Qualitative data were grouped into similar themes in line with the researchquestions. Quantitative data were analysed using descriptive

statistics like frequencies, mean and percentage (Amuko, Miheso, Ndethui, (2015)).

IV. DATA ANALYSIS AND DISCUSSION

Background Information of the Respondents

Respondents to the items used in this analysis included form three student, Mathematics teachers and Mathematics heads of department. Gender, age and experience were included to provide information on their background characteristics.

Teachers Background Information

Teachers were required to indicate their gender, age and teaching experience as a source of their background information. This was to establish their experience, age and gender.

Figure 4.1 reveals that 58.3% of the respondents were aged 22-29 and above and most of the Mathematics teachers were found in this category. Thirty three point threeper cent(33.3%)of the teachers were between the ages of 35-39 years, 8.3%of the Mathematics teachers were above the ages of 40 years. The findings indicated that younger teachers were more responsive in using ICTs facilities than older teachers. This coincides with the claims of Jimoyiannis, Tsiotakis, Roussinos and Siorenta, (2013) that younger teachers had higher confidence levels and were more positive towards ICT in education than senior teachers.

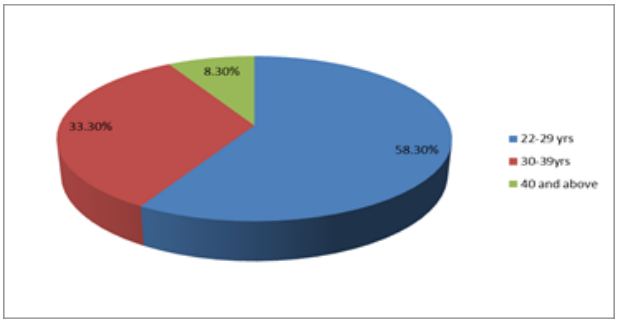

Figure 1:Teachers'Age

Figure 4.2 shows that 16.7% of the Mathematics teachers were male and 83.3% of the Mathematics teachers were female. These results suggest that Mathematics teaching in Zambian secondary schools is done mainly by female teachers. Findings contradict Jimoyiannis,Tsiotakis,Roussinos and Siorenta(2013)that stated, male teachers held a more positive attitude towards ICT in education while female teachers held a more neutral or negative attitude.

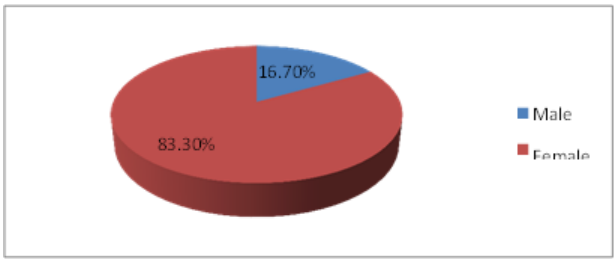

Figure 2:Teachers Gender

Figure 4.3 shows that 25% of the respondent had 1-2 years teaching experience in using ICT, 16.7% had 3-4 years, while 58.3% had 5 years and above teaching experience in using of ICT. This shows that Mathematics teachers have been using ICT in teaching Mathematics in their lessons for at most 5 years.This coincides with the findings of Jimoyiannis, Tsiotakis, Roussinos and Siorenta, (2013),that less experienced and the veteran teachers were positive about ICT in education compared to the highly experienced teachers, who were mainly more negative.

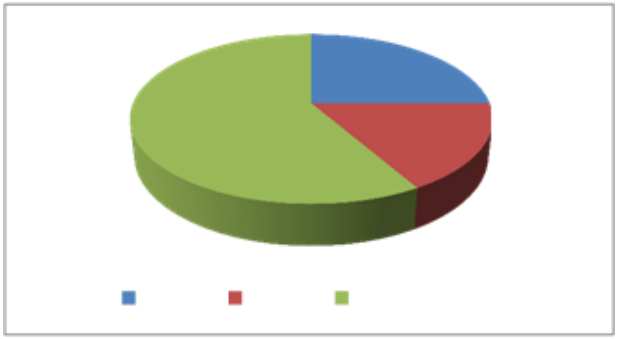

Figure 3:Teachers Experience in Using Computers

4.1.2 Students Background Information

According to (Afshari, etal., (2009)) female student users, compared withmale students, are more inclined to hold negative reactions to computers and such differences may have resulted in the different ways of using computers. Computer use and expertise have been associated with masculinity, and therefore, gender socialization serves to act negatively on female computer interactions. They further indicated that boys aged

13-16 had already acquired a gender stereotyped view of computer users. Generally, Boys receive more support from teachers and parents,and are more likely to be the main computer uses at home than girls. Students were required to indicate their age and gender as a source of their background information as represented on Figure 4.4 and 4.5 respectively.

Figure 4.4 shows that most the students were aged 17 years representing 77.7% of the total student respondents, followed by 16 years and 18 years who were equalwith at least 8.2%, finally, 19 years were the least with 6%. The study indicates that most of the students were 17 years.

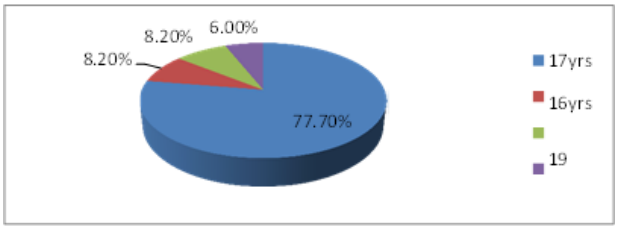

Figure 4: Students Age

Figure 4.5, shows that 58.7%of the students were male while 41.7% were female.

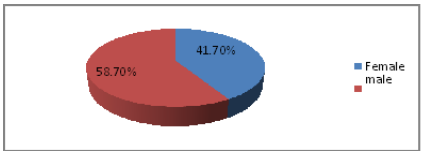

Figure 5: Students Gender

Levels of ICT Integration in Teaching and Learning Mathematics

ICT knowledge and skills level of Mathematics teachers determine effective curriculum delivery. The study sought to find out levels of ICT integration in teaching and learning Mathematics. From Table 4.1, it can be observed that 66% of the respondents strongly agreed that the schools had adequate mathematics software packages.

In addition, up to 58% of the respondents disagreed that that Mathematics teachers have adequate skills and knowledge to integrate ICT in Mathematics. On access to online information during Mathematics lessons, 42% of the respondents agreed that they could access online information. Forty one per cent (41%) of the respondents agreed to have extensively used computers and calculators in teaching Mathematics.Respondents were however neutral to the use of computer applications such as word, spreadsheet and internet.Fifty per cent (50%) of the respondent strongly disagreed that ICT should be a stand-alone subject and should not be used in Mathematics classes. The finding reveals that levels of technology in pedagogy in Mathematics education at secondary level are still wanting and not up-to-date.Teachers should have positive attitude towards ICT infrastructure in their teaching.This coincides with (Buabeng-Andoh, (2012) and Amuko, Miheso and Ndethiu, (2015)) statement that, positive attitudes towards computer use by school teachers are important to ensure the integration of the technology is effectively carried out in the school curriculum and also during teaching and learning.

Table4.1:Levels of ICT Integration inTeaching and Learning Mathematics

	Responses%			
Levels of ICT Integration in Teaching and Learning Mathematics	S/A 1	A 2	D 3	S/D 4
a) My school has adequate Mathematics software packages.	66	08	17	9
b)Mathematics teachers have skills and knowledge to integrate ICT in mathematics teaching.	09	33	-	58
c) Teachers can access online information	25	42	25	-

during mathematics lessons.				
d) Mathematics teachers use computers and calculators extensively in their teaching.	34	41	25	-
e) Teachers use applications such as word processing, spreadsheets and the internet during Mathematics lessons.	25	25	25	25
f)ICTshould beast and-alone subject and not used in Mathematics classes.	09	16	25	50

Useof ICTon teaching and Learning Mathematics

The study sought to find out if learning with ICT has an influence on understanding of ideas and concepts in Mathematics class.

From figure 4.6, findings indicates that, 38.7% of the students strongly agreed that ICT has an influence on their understanding of Mathematics; while 27.5% of the students indicated that they agreed that ICT assisted them to understand Mathematics better. However, 33.8% of the students were of the opinion that ICT has no influence on their understanding of Mathematics.

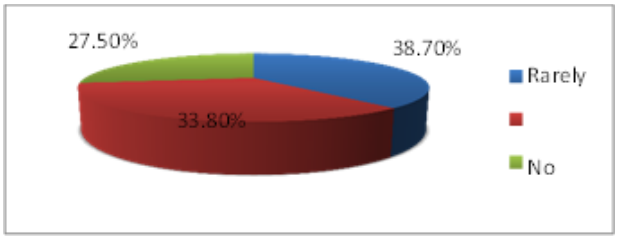

Figure 6:Influence of ICT on Understanding Mathematics

Use of Calculators

Calculators are considered to be valuable tools in checking students' manipulations during a Mathematics lesson. This study was interested in finding out how frequently students used calculators in learning Mathematics.

As shown in Figure 4.7, the study found that, 74% of the students use calculators frequently in their Mathematics learning, while 9% of the students do not use calculators frequently while learning Mathematics.

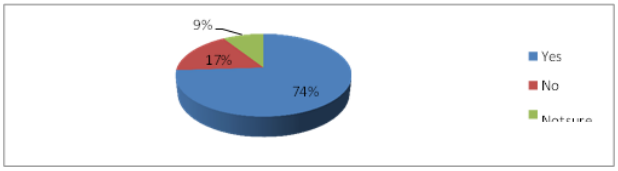

Figure 7:Uses of Calculators

Challenges and Opportunities Influencing Integration of ICT in Teaching and Learning Mathematics

ICTs infrastructures, training and seminars are costly and financial plans areessential for secondary schools to catch up with rapid changes and improvement in hardware, software and networks (Amuko, Miheso and Ndethiu 2015)). This study finding indicated that, the contributing opportunities and challenges which influenced integration of ICT in teaching and learning Mathematics from the respondents. The findings are presented in Table 4.2.

Notably, 41% of the respondents agreed that Mathematics teacher's lacked technical support in regards to ICT integration.Forty two per cent (42%) of the respondents strongly agreed that the current Mathematics curriculum does not allow enough time to integrate ICT in teaching. Forty two per cent (42%) of the respondents strongly disagreed that schools are not interested in integrating ICT in the Mathematics curriculum, because they lack competent and confident teachers. From the interview schedule 41.5% of the heads of departments mentioned that teachers in their schools haven't fully embraced the use of ICT in teaching Mathematics due to limited resources and lack of confidence (Amuko, Miheso and Ndethiu

(2015)). Forty sixper cent (46%) of the respondents agreed that Mathematics teachers lacked training opportunity for ICT integration and knowledge acquisition in teaching and learning Mathematics. In addition, Mathematics teachers' lack of support from the school administration was agreed by 46% of the respondents. Lack of ICT skills and knowledge in Mathematics was agreed by 45% of the respondents. Finally, 41% of the respondents indicated that there was lack of adequate ICT infrastructure in teaching and learning Mathematics (Amuko,Miheso and Ndethiu (2015)).Findings reveal that Mathematics facilitators are not adequately prepared to handle technology infrastructure's in Mathematics lessons. This is because the current training programmes do not include enough time for them to become comfortable with the software, nor does it includes support to help them troubleshoot during the early implementation stages and the training experience is not tailored to their needs (Watson, (1999).

Table 2:Challenges and Opportunities of ICT Use in Mathematics

	Responses%			
Challenges and Opportunities in Integration of ICT in Teaching and Learning Mathematics	S/A	A	D	S/D
a) Mathematics teachers lack technical support regarding ICT integration.	17	41	17	25
b) There is inadequate time to integrate ICT in teaching Mathematics curriculum.	42	16	-	42
c) Schools are not interested in integrating ICT in Mathematics curriculum because they lack competent and confident teachers.	08	09	42	41
d) Lack of training opportunities for ICT integration in teaching and learning Mathematics.	18	46	18	18
e) Mathematics teachers lack of ICT skills and knowledge.	18	45	09	28
f) Mathematics teachers lack support from the school administration.	18	46	27	18
g) Mathematics teachers lack experience in using computers.	09	46	27	18
h) Inadequate ICT infrastructure for teaching and learning Mathematics.	41	16	34	08

Challenges in Learning both Mathematics Content and Computer Technology

Difficulties in the use of ICTs and Mathematics software are related to the weakness of a teacher's knowledge about what technologies are available and how they can be used during learning Mathematics. This was to establish the challenges in learning both Mathematics content and computer technology (Amuko, Miheso and Ndethui, (2015))..

The major challenge students experienced was lack of technical know-how and support while learning Mathematics with ICT, it was mentioned by 43.5% of the students. This result indicates that students were willing to use ICT but lacked technical support from the teachers. Learning with ICT was not brain storming and this affected their way of thinking and reasoning was mentioned by 23.4% of the learners, they further indicated that when using ICT in learning, it only gave them one answer (Amuko, Miheso and Ndethui, (2015)).

In addition, 9.7% indicated that most of the computers hang and this caused students to overcrowd on one computer while, 6.7% indicated electricity was a challenge because it caused power surge,rendering computers useless and also in convenienced their learning, 16.7% mentioned that they experienced no challenge since they never used computers during Mathematics lessons.This shows that there are some students who cannot access computers at all or they cannot operate computers due to negative attitude towards ICT infrastructure (Amuko, Miheso and Ndethui, (2015)).

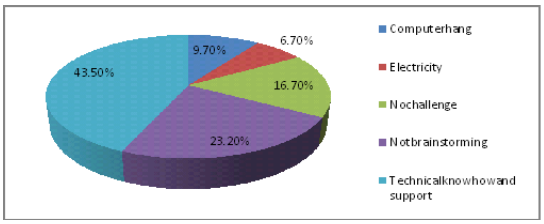

Figure 8 :Challenges in using ICT in Learning both Mathematics Content and Technology

Use of the Internet in Performingof Mathematics Task

Students have general ICT skills; however,they do not get the same advantage while using online resources, during their Mathematics lessons. This study was interested in finding out if the use of internet contributes to their learning and performance of Mathematics task.

Figure 4.9 indicates that 24.2% of the students did not have any idea because they never used the internet during Mathematics lesson. This shows that the students did not have access to the internet. Twenty one point two (21.2%) mentioned that internet assisted them in getting formulae which they were not familiar with while 40.9% mentioned that the internet made their understanding easier, while the use of internet to search for questions and application in Mathematics was mentioned by 13.8% of the students. The study revealed that most students have access to the internet during Mathematics lessons.

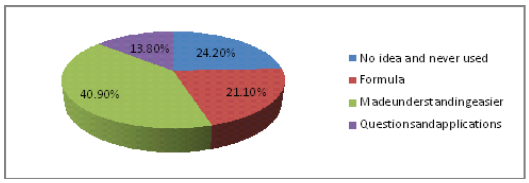

Figure 9: Use of Internet in Performing MathematicsTask

ICT Facilities for Learning Mathematics

The effective use of ICT in teaching and learning Mathematics motivates both the learners and the teachers (Amuko, Miheso and Ndethiu, (2015)). This study sought to identify the conditions of ICT facilities for learning Mathematics in the schools as shown in Figure 4.10 below.

The study revealed that 22.3% of the students considered that utility of ICT facilities in the school were excellent, while 44.2% of the students indicated that the utilityof ICT facilities was good. Finally, 33.5% of the students rated the use of ICT facilities in their school as poor. The study revealed that most secondary schools used ICT facilities during Mathematics lessons.

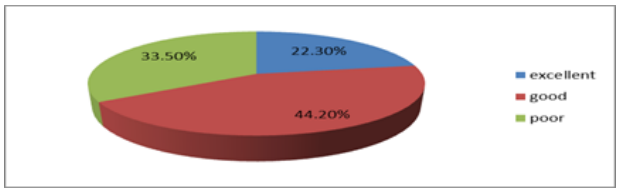

Figure 10:ICT Facilities for Learning Mathematics

Availability of Mathematics software

Training enables teachers to acquire knowledge and skills on how to use Mathematics software effectively (Amuko, Miheso and Ndethiu, (2015)). This study sought to find out from learners whether their Mathematics teachers used Mathematics software effectively.

Figure 4.11 indicates that 57.2% of the students were of the opinion that Mathematics teachers did not use Mathematics software effectively during Mathematics lessons. This is an indication that teachers lacked knowledge on howto use Mathematics software.

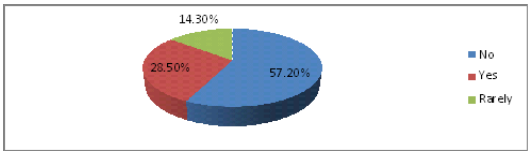

Figure 11:Availability of Mathematics software

Adequate ICT Infrastructure

Effective teaching and learning Mathematics using ICT is determined bythe availability of ICT infrastructure in the schools. The study was interested to find out from the students if their schools had adequate ICT infrastructure as shown in Figure 4.12below.The establishment for ICT use and integration in Mathematics education in secondary schools requires renovation and innovation of ICTs infrastructures because of its newness. The study on adequacy of ICT resources in integrating ICT tools in teaching and learning of Mathematics as shown on Figure 4.12 revealed that 26.8% of the students agreed that they had very large computer labs with very many functional computers that could cater for students needs in the school. Seventy three point two (73.2%) of the students indicated that there were inadequate ICT infrastructures in their schools, the reasons given included the following:The calculators that they were using didn't belong to the school, but they were their own personal belongings. Computers were not enough and majority of the ones available were not in use due to technical problems causing them to use the functional ones in shifts. Students had to overcrowded on one computer making learning difficult for them (it affected their concentration). They also lacked smart boards and projectors; and most of the computers were not connected to the internet (Amuko, Miheso and Ndethiu, (2015)).

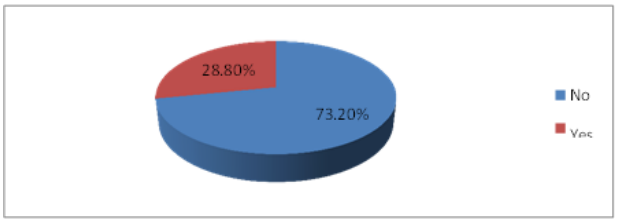

Figure 12:Adequate ICT infrastructure

Pedagogical Practices in Teaching and Learning Mathematics

Teacher education enables teachers to earn knowledge and skills in ICT use and integration. This was of central importance to his study as it identified pedagogical practices in teaching and learning Mathematics from the respondents.

According to Table 4.3, 64% of the respondents strongly agreed that, Mathematics teachers can choose technologies that enhance what they teach,how they teach and what students learn. In addition, 64% of the respondents strongly agreed that they could provide leadership in helping others to coordinate the use of Mathematics content, technologies, and teaching approaches in their schools. Those schools should come up with ways to agree by 73% of the respondents. Thirty six (36%) of the respondents agreed that there was inadequate Mathematics pedagogical focus in ICT preparation programmes, while 54% of the respondents agreed thatMathematics teachers lacked pedagogical and content knowledge about ways to integrate ICT in Mathematics lessons. This reveals that there were a variety of ICT infrastructures that were available for use and teachers were willing to use but due to lack of proper training on their use, they were unable to use them effectively. Using technology effectively requires teachers to have a wide repertoire of teaching approaches to call upon. Teachers must be proficient in using ICT not only tosupport their professional productivity and development, but mainly, to effectively integrate ICT into instruction and learning. Effective teacher preparation educationis an important factor for successful integration and sustainability of ICT in (Amuko, (2015)).

Table.3:Pedagogical practices in Teaching and Learning Mathematics

	Responses%			
Pedagogical Practices in Teaching and Learning Mathematics	S/A	A	D	S/A
a) Mathematics teachers can choose technologies that enhance what they teach,how they teach and what students learn.	64	36	-	-
b) I can provide leadership in helping others to coordinate the use of Mathematics content,technologies, and teaching approaches at my school.	64	36	-	-
c) Schools should set up incentives programmes to encourage and facilitate the pedagogical integration of ICT.	73	09	18	-
d) There is inadequate Mathematics pedagogical focus in ICT preparation programmes.	27	37	18	18
e) Mathematics teachers lack pedagogical and content knowledge about ways to integrate ICT in Mathematics lessons.	09	55	18	18

Time for Learning Mathematical and the Computer Technology

With regard to whether there was adequate time for learning both technology and Mathematics content, majority (60.2%) of the students agreed withreasons given including there beingenough time to use ICT when learning Mathematics, that is, during their free study time they could use computers to explore more ideas on how to perform Mathematics task.Thirty nine percent (39.8)said,there was not adequate time,because they could not multi task at the same time, they were not used to explanation done by the computers using projectors, the explanation done using the projectors took them a lot of time to internalize, and they were used to chalk and board.

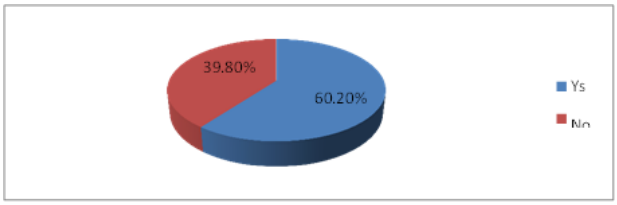

Figure 13:Time for Learning Mathematics and the Computer Technology

Opportunities of Learning Mathematics with ICT

In co-operate learning,the role of the teacher is to support students in every aspect of their learning.Figure4.14 shows that 59.5% of the students indicated that there were opportunities to co-operate with other learners during Mathematics lessons with assistance of ICT, reasons including that they were able to understand Mathematics concepts well and, exchange ideas and also that

there were individual benefits such as high concentration span during Mathematics discussions.Forty point five (40.5%) of the students said no, there was no opportunity to cooperate with other learners giving reasons including that some learners have difficulties in operating some of the ICT infrastructures, while others lacked knowledge on how to use the internet.

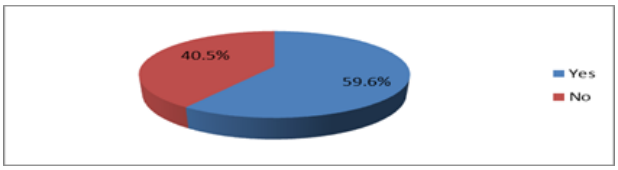

Figure 14: Opportunities of Learning Mathematics with ICT

Discussions of Findings

Levels of ICT Integration in Teaching and Learning Mathematics

Learning with useful integration tools can lead to functional understanding of Mathematical concepts as well as develop a broader understanding of the nature ofMathematics (Varghese, (2012)).This concedes with the student's findings where by, 27.5% of the respondents strongly agreed and 38.7% agreed that learning with ICT has an influence on their understanding of ideas and concepts in a Mathematics class.However,findings from the interview schedule indicated that 41.5%of the teachers haven't fully embraced theuse of ICT in the teaching Mathematics in addition, 33.3% of the teachers disagreed that they used applications such as word processing and spreadsheets while teaching Mathematics.According to Rogers's (2003) diffusion theory stage three, Mathematics teachers and learners must decide to adopt ICT in teaching and learning Mathematics. Teachers can use calculators to provide activities that help students develop their Mathematical understanding about concepts such as place value and, the meaning of operations and estimation, and it is each classroom teacher's responsibility to select appropriate activities and times for using calculator for instruction (Lucas and Cady, (2012)).

The calculator is an essential element in the teaching and learning of Mathematics. Functional use means that calculator use in activities such as computation, drill and practice and checking paper and pencil work (Lucas and Cady (2012)). Thirty four per cent (34%) of the respondent strongly agreed and 41% agreed that they used calculators extensively in their teaching.Seventy four per cent (74%) of the students were in agreement with the teachers that they frequently used calculators while learning Mathematics. This was confirmed by the observation schedule whereby 100% of the schools had scientific calculators.

From the observation checklist, teachers could adopt the use of mobile phones because they have a wide range of features. Mobile phones have calculators and could also function like desktop computers/ laptops. They have features such as Wi-fi and Bluetooth. These features could enable students to learn Mathematics through co-operative learning. Students and teachers can also discuss and share information with the aid of a Blue tooth. Students can access assignment or revision questions through the use of Wi-fi. The phone also has the capability of storing a large amount of data with the aid of a memory card.

Challenges and Opportunities in Integration of ICT in Teaching and Learning Mathematics

For successful integration of ICT into the Mathematics curriculum, it is essential to have knowledge of the existing software that is used by Mathematics teachers UNESCO (2007).One of the major problems is that the educational software is often isolated and not integrated with the textbooks that many teachers use (Kaffash, Kargiban, Kargiban andRamezani, (2010)). Findings indicated that 57.2% of the students did not agree that their Mathematics teachers used the Mathematics software effectively during Mathematics lesson. From the observation schedule, it was observed that half of the schools had Mathematics software which they had downloaded from search engines such as Google and Dog-pile.

From the research findings, 41% of the teachers indicated they lacked adequate ICT infrastructure in teaching and learning Mathematics.This coincides with the claims of Peeraer and Van Petegem, (2011)

and Kukali (2013) that surrounding computer hardware was the most serious factors affecting implementation. Teachers reported that computers were not enough for learning Mathematics. Forty one per cent (41%) agreed that Mathematics teacher's lacked technical support in regard to ICT integration. Similarly, 73.2% of the students indicated that there was an inadequate ICT infrastructure in their school and some were not functional forcing them, to use the functional ones in shifts.

Students had to overcrowd on one computer making learning difficult for them (it affected their concentration). In addition, 9.7% of the students indicated that most of the computers hang and this caused students to overcrowd on one computer. 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. 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 are technical problems (Amuko, Miheso and Ndethiu, (2015)). If teachers are discouraged to use ICT then, they are likely not have experience inusing them during teaching Mathematics and this was agreed by 46% of the respondents. This is due to lack of training opportunities on how to integrate ICT in their teaching as cited by 50% of the respondents. This coincides with the findings of Bingimlas (2009) and Kukali (2013), that there were not enough training opportunities for teachers on the use of ICT in classroom environment. Due to the short duration during training, most teachers don't acquire enough skills and knowledge to teach Mathematics using ICT as stated by 50% of the respondents. It will be very difficult for teachers who have not acquired adequate skill and knowledge, to teach Mathematics using ICT in the required time allocated in thetime table, Kukali, (2013) stated that mastering technology requires time. Notably, 42% of the respondents strongly agreed that Mathematics curriculum did not allow enough time to integrate ICT into their teaching. If teachers get support from the school administration,the challenges they are experiencing during integration of ICT will be minimal.

Pedagogical Practices in Teaching and Learning Mathematics

A wide variety of technologies can mediate interaction, but it is how these technologies are used to support collaborative practices that make the difference in teaching and learning. The use of technologies to support collaborative learning practices requires new ways of learning and teaching and a new mind set about what is to do Mathematics (Hoyles and Lagrange,(2009)).The findings in dicated that 64% strongly agreed that Mathematics teachers can choose technologies that enhance what they teach, how they teach and what students learn.

Most ICT teacher professional development initiatives tend to focus on technological aspects (i.e., how to use various tools) while pedagogical and instructional issues (i.e., whyand how to use those tools to enhance learning) are often taken for granted (Jimoyiannis et al., (2013)).Twenty seven (27%) of the respondents strongly agreed and 36% of the respondents agreed that there is inadequate Mathematics pedagogical focus in ICT preparations programmes. In addition, application of ICT in school settings has been driven more by technology rather than by the demands of pedagogy and didactics of the particular subject matter (Jimoyiannis et al., (2013)).

The findings should enlighten teachers, parents, students and all education stakeholders to ensure both teachers and learners develop a positive attitude toward ICT in teaching and learning Mathematics.ICT will boost Mathematics performance of the learners, if teachers will be given the opportunity and support from the community and educational stakeholders. Teachers should be well trained during their pre-service training. They should also be in-serviced at least after every two years at district level so as to ensure that all teachers have been trained. The training should be conducted during school holidays for at least two weeks. The government should invest heavilyin the ICT infrastructure, because ICT infrastructures motivate learners and when learners

are motivated they are in apposition to perform well in their studies. Lastly, ICT will enable the government of Kenya to achieve it Vision 2030 plan in the education sector.

V. SUMMARY AND CONCLUSIONS

Summary of the Findings

Findings indicated that there were low levels of ICT integration in teaching and learning Mathematics in secondary schools in Chilubi district, whereby three quarters of the respondents indicated that there was need to purchase Mathematics software which could be downloaded for free from search engines. The respondents were neutral on the use of application such as word processing, spreadsheets and the internet, this is an indication that computer applications are not widely used in Mathematics teaching and learning.Students were in agreement that learning with ICT has a great impact on their understanding of ideas and concepts during Mathematics lessons. Most schools relied on one form of ICT infrastructure calculators; this shows that there were low levels of ICT integration in teaching and learning Mathematics.

The study also identified the challenges and opportunities influencing the use of ICT in teachingand learning Mathematics. The study found that ICT infrastructures were limited in most of the schools and Mathematics teachers did not attend to seminars and frequent training programmes on how to use ICT in teaching and learning Mathematics. Most of the ICT infrastructures were not well maintained due to lackof technical support from a professional technician.

On pedagogical practices that are used in teaching and learning Mathematics, over a half of the teachers could choose technologies that enhance what they teach, and what students learn. However, majority of the teachers felt that they were not adequately prepared through ICT preparation programme to use ICT in teaching and learning Mathematics.

Conclusions

This study has resulted in three main conclusions as follows.First, based on the findings that ICT has a great impact on their understanding of ideas and concepts during Mathematics lessons, it is logical to conclude that teachers have come to appreciate the fact that ICT improves teaching and learning of Mathematics in secondary schools, but also motivates learners and teachers.Teachers will continue to use ICTs in their classrooms despite the many challenges affecting implementation of ICT in teaching and learning Mathematics.Most of the challenges that teachers face affect students understanding and knowledge. Second, the challenges facing teachers in their resourcefulness are many and affect them on both school and professional level. Third, based on pedagogical knowledge and practices, teachers are expected to develop their technological skills and knowledge and use ICTs in their classrooms. Pedagogical practices seem to be a challenge to teaching and learning of Mathematics in secondary schools and impact on traditional classroom practices.

REFERENCES

1. Afshari, M., Bakar, K. A., Luan, W. S., Samah, B. A., and Fooi, F. S. (2009). Factors Affecting Teachers' Use of Information and Communication Technology. Online Submission, 2(1), 77–104.
2. Agyei, D. D., andVoogt, J. (2012). Developing Technological Pedagogical Content Knowledge in Pre-Service Mathematics Teachers through Collaborative Design. Australasian Journal of Educational Technology, 28(4), 547–564.
3. Al-Senaidi, S., Lin, L., andPoirot, J. (2009). Barriers to Adopting Technology for Teaching and Learning in Oman. Computers and Education, 53(3), 575–590.
4. Amuko,S.,Miheso,M.,and Ndethiu,S.(2015).Opportunities and Challenges: Integration of ICT in Teaching and Learning Mathematics in SecondarySchools,Nairobi,Kenya.Journal of Education and Practice,24(6),1–6.
5. Amuko, S. (2015). Pedagogical Practices in Integration of ICT in Teaching and Learning Mathematics ,in Secondary Schools in Nairobi

County,Kenya.IOSRJournalofMathematics(IOSR-JM),11(5),20-23.
6. Alayyar, G. M., Fisser, P., and Voogt, J. (2012). Developing Technological Pedagogical Content Knowledge in Pre-Service Science Teachers: Support from Blended Learning. Australasian Journal of Educational Technology, 28(8), 1298–1316.
7. Ayub, A. F. M., Bakar, K. A., and Ismail, R. (2012). Relationships between School Support, School Facilities, ICT Culture and Mathematics Teachers'Attitudes towards ICT in Teaching and Learning. In The 5th International Conference on Research and Education in Mathematics:Icrem5(Vol.1450,Pp.196–200 Aip Publishing. Retrieved From http://Scitation.Aip.Org.
8. Balanskat,A.,Blamire, R.,and Kefala,S.(2006).TheICT Impact Report.A Review of Studies of ICT Impact on Schools in Europe. European Schoolnet. Education and Culture.[En Ligne], http://www.Insight. Eun. Org.
9. Barzel, B., and Drijvers, P. (2009). Matthias Zeller. Retrieved From Http://Edresources.Ti.Com.
10. Bektaş, S., Sadıkoğlu, F., Ibrahim, D., Kashman, A., Garrido, A., Karamanoglu,
11. M.,and Idrus ,R.M.(N.D.).(2012).International Scientific Committee.Retrieved From http://www.Studiomapi.It.
12. Best,J.(2005).Research in Education.NewYork:Prentice-HallInc.
13. Bennison, A., and Goos, M. (2010). Learning to Teach Mathematics with Technology: A Survey of Professional Development Needs, Experiences and Impacts. Mathematics Education Research Journal, 22(1), 31–56.
14. Bingimlas, K. A. (2009). Barriers to the Successful Integration of ICT in Teaching and Learning Environments: A Review of the Literature. Eurasia Journal of Mathematics, Science and Technology Education, 5(3). Retrieved from http://Search.Ebscohost.Com.
15. Bordbar, F. (2010). English Teachers' AttitudesToward Computer-Assisted Language Learning. International Journal of Language Studies, 4(3). Retrieved from http://Search.Ebscohost.Com.
16. Bowker, A., Hennessy, S., Dawes, M., andDeaney, R. (2009). Supporting ProfessionalDevelopmentforICTUseInMathematicsUsingTheT-MEDIA Multimedia Resource. Proceedings of the British Society for Research into Learning Mathematics, 29(1), 19–24.
17. Buabeng-Andoh, C. (2012). An Explorationof Teachers' Skills, Perceptions and Practices of ICT in Teaching and Learning in the Ghanaian Second-Cycle Schools. Contemporary Educational Technology, 3(1). Retrieved from http://Search.Ebscohost.Com.
18. Chai, C. S., Ling Koh, J. H., Tsai, C.-C., and Lee Wee Tan, L. (2011). Modelling Primary School Pre-Service Teachers' Technological Pedagogical Content Knowledge (TPACK) for Meaningful Learning with Information and Communication Technology (ICT). Computers & Education, 57(1), 1184– 1193.
19. Daugherty, J. L., Reese, G. C., andMerrill, C. (2010). Trajectories of Mathematics and Technology Education Pointing to Engineering Design. Journal of Technology Studies, 36(1). Retrieved from http://Search.Ebscohost.Com.
20. Dionys, D. (2012). Introduction of ICT and Multimedia into Cambodia's Teacher Training Centres. Australasian Journal of Educational Technology, 28(6), 1068–1073.
21. Drent, M., and Meelissen, M. (2008). Which Factors Obstruct or Stimulate Teacher Educators to Use ICT Innovatively? Computers and Education, 51(1), 187– 199.
22. Drijvers, P., Doorman, M., Boon, P., Reed, H., and Gravemeijer, K. (2010). The Teacher and the Tool: Instrumental Orchestrations in the Technology-Rich Mathematics Classroom. Educational Studies in Mathematics, 75(2), 213– 234.
23. Gao, P., Tan, S. C., Wang, L., Wong, A., and Choy, D. (2011). Self-Reflection
24. and Preservice Teachers' Technological Pedagogical Knowledge:Promoting
25. Earlier Adoption of Student-Centred Pedagogies.Australasian Journal of

26. Educational Technology, 27(6), 997–1013.
a. Gay,L.(1992).Education Research Competence for Analysis and Application.

b. Columbus: Charles Merill.
27. Gikonyo, N. W. M. (2012).Factors influencing university managers' participation in distance education: a case of public universities in Kenya (Doctoral dissertation, University of Nairobi, Kenya).
28. Girgin, U., Kurt, A. A., and Odabasi, F. (2011). Technology Integration Issues in a Special Education School in Turkey. Cypriot Journal of Educational Sciences, 6(1). Retrieved from http://Search.Ebscohost.Com.
29. Granovetter,M.(2005). The Impact of Social Structure on Economic Outcomes. The Journal of Economic Perspectives, 19(1), 33–50.
30. Güven, B., Çakiroğlu, Ü., andAkkan, Y. (2009). The Gap between Expectations and Reality: Integrating Computers into Mathematics Classrooms. Asia Pacific Education Review, 10(4), 505–515.
31. Hamzah, M. (2007). The Impact of Educational Change in Malaysian Smart Schools on Islamic Education Teachers and Students. University of Warwick. Retrieved from http://Wrap.Warwick.Ac.Uk.
32. Hechter, R. P., Phyfe, L. D., andVermette, L. A. (2012). Integrating Technology in Education: Moving the TPCK Framework Towards Practical Applications. Education Research & Perspectives, 39(1), 136–152.
33. Hoyles,C.,and Lagrange, J.-B. (2009).Mathematics Education and Technology: Rethinking the Terrain. Springer. Retrieved from http://Link.Springer.Com.
34. Hudson, R., andPorter, A. (2010). ICT Use to Improve Mathematics Learning in Secondary Schools. In ACEC2010: Digital Diversity. Conference Proceedings of the Australian Computers in Education Conference. Melbourne, Australia: ACEC. Retrieved from http://Acec2010.Acce.Edu.Au.
35. Ifenthaler, D., Isaias, P., Kinshuk, D. G. S., Spector, J. M., Angeli, C.,andValanides, N.,Schifter, C. C. (2012). Special Issue Articles. Journal of Educational Technology and Society, 15(1). Retrieved from http://Ifets.Info/Journals.
36. Jimoyiannis, A., Tsiotakis, P., Roussinos, D., andSiorenta, A. (2013). Preparing Teachers to Integrate Web 2.0 in School Practice: Toward a Framework for Pedagogy 2.0. Australasian Journal of Educational Technology, 29(2). Retrieved from http://www.Ascilite.Org.Au.
37. Kaffash, H. R., Kargiban, Z. A., Kargiban, S. A., andRamezani, M. T. (2010). A Close Look in to Role of ICT in Education. International Journal of Instruction, 3(2). Retrieved from http://Search.Ebscohost.Com.
38. Keengwe, J., Onchwari, G., andWachira, P. (2008). Computer Technology Integration and Student Learning: Barriers and Promise. Journal of Science Education and Technology, 17(6), 560–565.
39. Khambari,M.N.M.,Moses,P.,and Luan,W.S.(2009).Laptop Ownership and Use among Educators: Reflections from School Teachers in Malaysia. International Journal of Instruction,2(2). Retrieved From http://Search.Ebscohost.Com.
40. Khan, M., Hossain, S., Hasan, M., andClement, C. K. (2012). Barriers to the Introductionof ICT into Educationin Developing Countries:The Exampleof Bangladesh. International Journal of Instruction, 5(2). Retrieved from http://Search.Ebscohost.Com.
41. Kipsoi, E. J., Chang'ach, J. K., andSang, H. C. (2012). Challenges Facing Adoption of Information Communication Technology (ICT) in Educational Management in Schools in Kenya. Journal of Sociological Research, 3(1), Pages–18.
42. Kukali, A. N. (2013). Opportunities and Challenges for Use and Integration of Information Communication Technology in Management of Public Secondary Schools in Bungoma South District, Kenya. International Journal. Retrieved from http://www.Ijsr.Net.
43. Kumar,R.(2005).Research Methodology.AStep by Guide for Beginners'. London: SAGE.

44. Laborde, C., andSträ\S Ser, R. (2010). Place and Use of New Technology in the Teaching of Mathematics: ICMIActivities in the Past 25 Years. ZDM, 42(1), 121–133.
45. Lee, M.-H., and Tsai, C.-C. (2010).ExploringTeachers'PerceivedSelfEfficacy and
46. Technological Pedagogical Content Knowledge with Respect to Educational
47. Use of the World Wide Web. Instructional Science, 38(1), 1–21.
48. Light, G., Calkins, S., and Cox, R. (2009). Learning and Teaching in Higher Education: The Reflective Professional. Sage. Retrieved from http://Books.Google.Com
49. Lim, C. P., and Chai, C. S. (2008). Teachers' Pedagogical Beliefs and their Planning and Conduct of Computer-Mediated Classroom Lessons. British Journal of Educational Technology, 39(5), 807–828.
50. Lim, C. P., andPannen, P. (2012). Building the Capacity of Indonesian Education Universities for ICT in Pre-Service Teacher Education: A Case Study of a Strategic Planning Exercise. Australasian Journal of Educational Technology, 28(6), 1061–1067.
51. Lucas,K.K.,and Cady,J.A.(2012).Pedagogical Instruction with Calculators.
52. Teaching Children's Mathematics,18(6),384–389.
53. Malhotra,N.(1996).Marketing Research and Applied Orientation. London :Prentice Hall
54. Masalski, W. J. (2005).Technology-Supported Mathematics Learning Environments (Sixty-Seventh Yearbook)[2005 NCTM Year book (67th)]. National Council of Teachers of Mathematics. Retrieved from http://Eric.Ed.Gov.
55. Merrill, C., Reece, G., and Daugherty, J. (2010). Mathematics Education. (In PA Reed and JE LaPort (Eds).Research in technology Education,139-154)
56. Miles, S., and Singal, N. (2010). The Education for All and Inclusive Education Debate: Conflict, Contradiction or Opportunity? International Journal of Inclusive Education, 14(1), 1–15.
57. MinistryofEducation-Kenya.(2010).ICTGuidelinesforEducational
58. Institution,onIntegration,InfrastructureandAcquisition.ICTIntegration Team, 2010.
59. Mishra,P.,and Koehler,M.(2006).Technological Pedagogical Content Knowledge:A Framework for Teacher Knowledge. The Teachers College Record,108(6), 1017–1054.
60. Nobre, S., Amado, N., and Carreira, S. (2012). Solving a Contextual Problem with the Spreadsheet as an Environment for Algebraic Thinking Development. Teaching Mathematics and Its Applications, 31(1), 11–19.
61. Olive, J., Makar, K., Hoyos, V., Kor, L. K., Kosheleva, O., andSträ\S Ser, R. (2010). Mathematical Knowledge and Practices Resulting from Access to Digital Technologies. In Mathematics Education and Technology-Rethinking the Terrain(Pp.133–177). Springer.Retrieved from http://Link.Springer.Com.
62. Otienoh, R. O. (2010). The Issue of Large Classes in Kenya: The Need for Professional Support for Primary School Teachers in School Contexts. Journal of International Studies in Educational Administration, 38(2), 57– 72.
63. Ottenbreit-Leftwich, A. T., Glazewski, K. D., Newby, T. J., andErtmer, P. A. (2010). Teacher Value Beliefs Associated with Using Technology: Addressing Professional and Student Needs. Computers andEducation, 55(3), 1321–1335.
64. Orodho,J.(2005).ElementsofEducationandSocialScienceResearch Methods. Nairobi: Kanezja.
65. Parkay,F.W.,Stanford,B.H.,andGougeon,T.D.(2010).BecomingaTeacher.
66. Pearson/Merrill.Retrievedfromhttp://www-Fp.Pearsonhighered.Com.
67. Peeraer, J., andVan Petegem, P. (2011). ICT in Teacher Education in An Emerging Developing Country: Vietnam's Baseline Situation At The Start of "TheYear of ICT." Computers andEducation, 56(4), 974–982.
68. Pierce, R., and Ball, L. (2009). Perceptions that May Affect Teachers' Intention to Use Technology in Secondary Mathematics

Classes. Educational Studies in Mathematics, 71(3), 299–317.
69. Ruthven, K., Deaney, R., andHennessy, S. (2009). Using Graphing Software to TeachAboutAlgebraicForms: AStudyofTechnology-SupportedPracticein Secondary-School Mathematics. Educational Studies in Mathematics, 71(3), 279–297.
70. Sadik, A. (2008). Digital Storytelling: A Meaningful Technology-Integrated Approach for Engaged Student Learning. Educational Technology Research and Development, 56(4), 487–506.
71. Sang,G.,Valcke,M.,VanBraak,J.,Tondeur,J.,andZhu,C.(2011).PredictingICT Integration into Classroom Teaching in Chinese Primary Schools: Exploring the Complex Interplay of Teacher-Related Variables. Journal of Computer Assisted Learning, 27(2), 160–172.
72. Saunder,P.,Lewis,A.andThornhill,B.(2005).ResearchinBusinessStudent.
73. NewYork:PearsonEducation.
74. Scheg, A. G. (2014). Reforming Teacher Education for Online Pedagogy Development. IGI Global. Retrieved from http://Books.Google.Com.
75. Schindler, P.S.and Cooper, D.R.(2003). Business Research Methods. New York: Mcgraw-Hill.
76. Stigler, J. W., andHiebert, J. (2009). The Teaching Gap: Best Ideas from the World's Teachers for Improving Education in the Classroom. Simon and Schuster. Retrieved from http://Books.Google.Com.
77. Swan, W. (2010). Australia To 2050: Future Challenges. Retrieved From http://Hdl.Voced.Edu.Au/10707/155280.
78. Syfers, B. J. (2010). The Pedagogical Use of ICT in Grade Eight Natural Science Classes in South African Schools/Jerome Benjamin Syfers. Retrievedfrom http://Dspace.Nwu.Ac.Za.