

Preparedness of Mathematics Teachers in Transforming the Teaching and Learning of Secondary School Mathematics, a Case of Tigania East District, Kenya

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Abstract

This study aimed at investigating the current level of mathematics' teacher preparedness in using technology for teaching. Teacher preparedness was measured in terms of use of available ICT resources and relevant teacher training levels. The study was carried out in Tigania East District in the year 2011 during which there were 30 registered secondary schools. The design selected was descriptive survey. The study used various instruments to collect data, namely; Mathematics teachers' questionnaires, interview schedule and observation guide. The researcher used simple random sampling technique to select 30% of the mathematics teachers to constitute the sample size. Report revealed that there was a variety of ICT resources in secondary schools in Tigania East District. It was noted that 66.9% of schools in the district had support structures such as electricity and generators. The study further showed that teachers did not use the ICT resources that were available as they lacked knowledge on appropriate usage. The lack of pre-service and in-service training was sighted as a major limitation. The study concluded that mathematics teachers in Tigania East District were unprepared to embrace ICT and to use it for transforming the learning of mathematics. This conclusion was made because they lacked relevant training and enthusiasm, and were found not to use the available ICT resources. The study recommends a retraining of Mathematics teachers through INSETs on how technology should be applied to improve the teaching of Mathematics. The study also recommends improvement of staffing of Mathematics teachers who are trained to use ICT since many schools were seen to have shortage of these teachers.

Keywords and Abbreviations

1. Preparedness
2. ICT- Information Communication Technologies
3. SMASSE- Strengthening of Mathematics and Science in Secondary Education, in Kenya
4. INSET- In Service Training
5. Technology

1. Introduction

1.1 Background to the Study and Related Literature

Mathematics is one of the core subjects in the secondary school curriculum. Students in Kenyan secondary schools are required to do a minimum of seven subjects at KCSE level. Out of these seven, mathematics is one of the three compulsory subjects, besides English and Kiswahili. Cockcroft report (1982) notes that "mathematics is only one of the many subjects which are included in the school curriculum, yet there is greater pressure for children to succeed at mathematics....This suggests that mathematics is in some way thought to be of special importance" (P4). This causes the great pressure that teachers experience in teaching mathematics. Further pressure comes in during selection of courses. Most colleges in Kenya require a certain minimum grade in mathematics before a student is enrolled into any course.

Orton and Frobisher (1996:1) notes that "The importance of mathematics is emphasized when future employment of a child is being considered. The subject is used as a filter or hurdle possibly more often than any other subjects. Normally, a mathematics examination pass at an appropriate level is demanded before entry to a particular profession or occupation can even be considered – whether any mathematics is required in the performance of the job or not."

This use of mathematics as a filter at different levels makes the teaching and learning of the subject demanding as the teachers and learners are not relaxed to enjoy the subject.

Pressure to succeed and to pass examinations makes it hard for learners to be at ease with the subject matter, to develop a state of mind which is receptive to the idea that mathematics can be enjoyable and need not generate anxiety and panic. Pressure also makes it difficult for teachers of mathematics at any level to aim at teaching for the enjoyment of learning and achieving effective teaching of mathematics rather than for future examination success.

Introduction of Information and Communication Technologies (ICT) into the teaching process has been recommended with the aim of improving the teaching and learning of mathematics. According to Pelgrum and Plomp (2002) "investments in Information and Communication Technology (ICT) have increased in recent years, with the perception that increased student use of computers and other electronic forms of media may have a positive impact on students' achievement"(p.15). The use of electronic media in the process of teaching mathematics is hoped to improve the learning environment depending on how well the teachers are prepared to use these resources. The use of ICTs on its own may not improve the teaching of mathematics if the teacher is not properly prepared to use these resources in the appropriate ways.

In the Principles and Standards of School Mathematics the National Council of Teachers of Mathematics (NCTM) identified the "Technology Principle" as one of six principles of high quality mathematics education (NCTM, 2000). This principle states: "Technology is essential in teaching and learning mathematics; it influences the mathematics that is taught and enhances students' learning" (p.24). This implies that technology influences the teaching methodology applied by the mathematics teachers. The situation in the teaching of mathematics using ICT in Kenya should be established, to find out if this principle is applied in the day to day teaching or not. There is widespread agreement that mathematics teachers, not technological tools, are the key change agents to bringing about reform in mathematics teaching with technology (Kaput, 1992; NCTM 1999, 2000). Teachers therefore should be in control of the available ICT resources and be able to manipulate them to enhance their teaching.

The meaning of information technology varies from time to time depending on who is defining it and the purpose for which the ICT resources are used. A description of ICT today encompasses a wide range of technologies that include radio, television, mobile phones, internet, video, compact disks (CD), compact disks read only memory (CDROM) players, personal organizers, programmable as well as remote operated computers (Ohara 2004: 1X). Initially ICT revolved around the computers only but currently, computers are only a component of ICT. National curriculum on ICT in mathematics states that ICT can stimulate whole-class activities and influence the way particular topics, such as equations and formulae are approached in the classroom. Usually practical activities and individual student's work need to take place alongside work with ICT. This ensures that students are fully engaged during the mathematics lessons.

Kenyan secondary schools have embraced the use of ICT in the teaching of mathematics. This is observed as almost all secondary schools are currently using calculators besides other resources during mathematics lessons. In the year 2002, the Kenyan government approved a policy on calculator use for all secondary school mathematics students. This policy has since been implemented with the aim of making the subject less complicated and to help students in mathematics so as to concentrate on conceptualizing ideas. Schools have further invested in computers and other technologies such as the radio, television and video. Further the rural electrification program has made it possible for most schools to use these ICT resources. Having put the necessary policies into place and provided the necessary infrastructure, the preparedness of teachers who are to embrace the policies and the use of these resources should be addressed to ensure the successful teaching of mathematics. For teachers to be effective, they need to understand the fundamental principles that underlie school mathematics so that they can teach it to the diverse groups of students as a coherent, reasoned activity.

The challenge however, lies with the teachers in the implementation of ICT in teaching and learning of mathematics. Teachers are faced with major decisions on how to present the information, which ICT resource to use, which content to teach using which ICT resource and also how to plan for the standard 40 minutes lesson time. According to Bingimlas (2008) the major barriers when teaching using ICT are lack of confidence, lack of competence and lack of access to resources. This discourages teachers from even attempting to use ICT in mathematics lessons. Teachers believe in being well prepared before going to teach. If a teacher wants to use ICT in teaching mathematics but feels incompetent in the use of ICT, he/she will shy off from using it. This therefore calls for preparation of teachers to enable them embrace the available ICTs for teaching mathematics.

The educators not only need the ICT resources but also need to know what to do with it and at what point and content to use ICT. The search for an appropriate method of teaching mathematics so as to improve the process of learning mathematics has led to the use of ICT resources. The introduction of ICT has been faced with several challenges but most commonly noted challenge to the implementation of ICT is the lack of confidence and preparedness for the educators. A study by Lehtinen (1999) based on the challenges faced in teaching and the use of new technologies in instruction in Lahti polytechnic in Finland gives the reasons for teachers' reluctance to experiment with ICT in instruction as usually lack of time, lack of computer know-how and lack of pedagogical support. All in all, the teachers at the faculty of technology may have been reluctant to offer online courses, because they simply did not know how to teach on the net. There was technical support available, but obviously that was not enough. A recent study based on the Kenyan system of education Ogwel, (2008), on the integration of ICT in mathematics education gives the challenges of integrating ICT as; lack of curriculum coherence, poor articulation within the education system, inadequate teacher preparation and professional development. Is this likely to be the case in many learning institutions in Tigania East District?

1.2 Statement of the Problem

A study by Kanja(2001:70) on mathematics education in Kenya states that performance on mathematics concepts is poor, the quality of teaching is poor and that most students said that classroom environment is harsh and unfriendly. In the face of this situation Kanja recommended that mathematics teachers need to understand and implement good teaching skills and that information communication technology be incorporated into the teaching. Tigania East District was formed in 2009, during which the overall KCSE mean for the district was 4.72 while the mean for the mathematics subject was 2.64. During the following year, 2010, the overall district mean was 5.26 while the mean for mathematics was 2.998. From this trend, mathematics in the district is one of the subjects that were below the average mean for the district. Due to this, the researcher, found it necessary to establish what was being done to improve the teaching of mathematics in the district. Various studies including (Papert, 1987; Voogt&Pelgrum, 2005; Watson, 2004) have recommended ICT as a solution to improve the teaching of Mathematics. In accordance to this, many programs such as, the NEPAD (New Partnership for African Development), computer for schools Kenya (CFSK) and the ICT trust fund have been started to fund information technology in secondary schools of Tigania East district with an emphasis on computerization. The rural electrification program has been put in place to ensure secondary schools in rural areas have access to electricity in order to ensure that use of ICT resources is possible. Despite this government support, the teaching of mathematics has remained poor. Since ICT resources have been available to secondary schools, it means the real solution had yet to be established. It was the intention of this study to find out if teachers are prepared to embrace these ICT resources and how these resources are being used in teaching of mathematics. The purpose of this study was to establish the preparedness of mathematics teachers to embrace ICT in the teaching of mathematics in terms of training, perceptions and the use of ICT resources

1.3 Objectives

The objectives of this study were;

- a) To establish the teacher's use of ICT resources available for teaching mathematics in secondary schools within Tigania East District.
- b) To establish teachers' ICT training, in readiness for teaching mathematics.

1.4 Research Questions

- a) Do mathematics teachers use the available ICT resources for teaching mathematics in the secondary schools within Tigania East District?
- b) Are teachers trained to use the available resources?
- c) What training do the teachers have?

2. Methodology

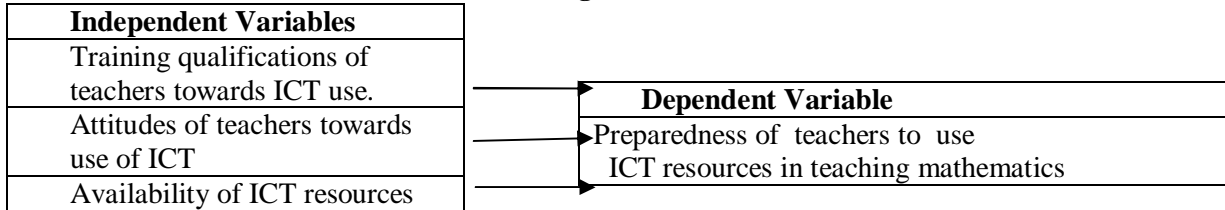
2.1 Research Design

The intention of the researcher in this study was to collect a wide range of opinions on the preparedness of teachers of mathematics towards the use of ICT for instruction. The design adopted for this study was descriptive survey. By adopting this design, the subjects were observed making no attempt to change their behavior or conditions. This design was selected since no intervention was done to modify the subject's conditions.

2.2 Variables

In this study, the dependent variable was the preparedness of teachers to use ICTs in teaching mathematics in Tigania East district. The independent variables were the attitudes of teachers towards use of ICTs; the training levels of teachers of mathematics on the use of ICTs in teaching and the availability of ICTs in secondary schools in the locale of the study. An illustration of these variables is shown on figure 3.1

Figure 2.1 Variables



The arrow used (\rightarrow) means leading to.

In figure 2.1 the independent variables are among a wide range of factors that affect the mathematics' teacher's utilization of ICT during Mathematics lessons in Kenya today. The preparedness of the mathematics teachers to embrace and use ICT in this study was the dependent variable. The independent variables include; teacher qualifications in ICT, attitude of the teachers towards ICT and the availability of ICT resources.

2.3 Location of the Study

The study was carried out in Tigania East District of Meru County. The district is approximately 700 square kilometers in size with a total of 29 public secondary schools and 1 private secondary school. The district's headquarter is located around 25km from Meru towards Maua. This district was chosen because it is a newly formed district from the larger Meru District, in which there is a wave of ICT development in most Secondary schools. Tigania East being a newly formed district, not much research had been done by the time of this study to establish reasons for its poor performance in national examinations.

2.4 Target Population

The target population for this study comprised of the 100 mathematics teachers from Tigania East District. Since schools keep on recruiting new teachers while others retire or go on transfer to other schools and districts, the study focused on the Mathematics teachers as at January 2011, when the data was being collected.

2.5 Sampling Procedure and Sample Size

2.5.1 Sampling Procedure

The sampling of the subjects for this study was done at three levels. The researcher first sampled Tigania East District through purposive sampling; secondly, secondary schools in the district were sampled through simple random sampling and then teachers who provided data for the study were sampled through purposive sampling.

2.5.2 Sample Size

A sample of 9 schools out of the possible 30 schools was selected and it was seen to have the required 27 teachers. This was believed to be adequate for the study since the schools are from the same region hence a high degree of homogeneity. To obtain the sample, the researcher used Tippet random tables. The researcher first sampled schools in Tigania East District and then sampled teachers who provided data for the study.

2.6 Research Instruments

The researcher used teachers of mathematics questionnaires for the 27 teachers and interview schedule for 9 of the selected mathematics teachers to establish relevant information on teacher's attitudes, teacher qualifications among other factors. These 9 mathematics teachers were each a representative of his/her school. A questionnaire for the school principals was used to complement the information given by the teachers. Further, an observation schedule was used to examine the kind of ICT equipment available in various schools in Tigania East District and how they are used. The researcher therefore obtained quantitative data since the study was non experimental in nature. The use of various instruments to obtain the data was meant to ensure reliability by triangulation.

3. Data Analysis, Presentation & Discussion

3.1 Availability and use of ICT Resources for Teaching Mathematics

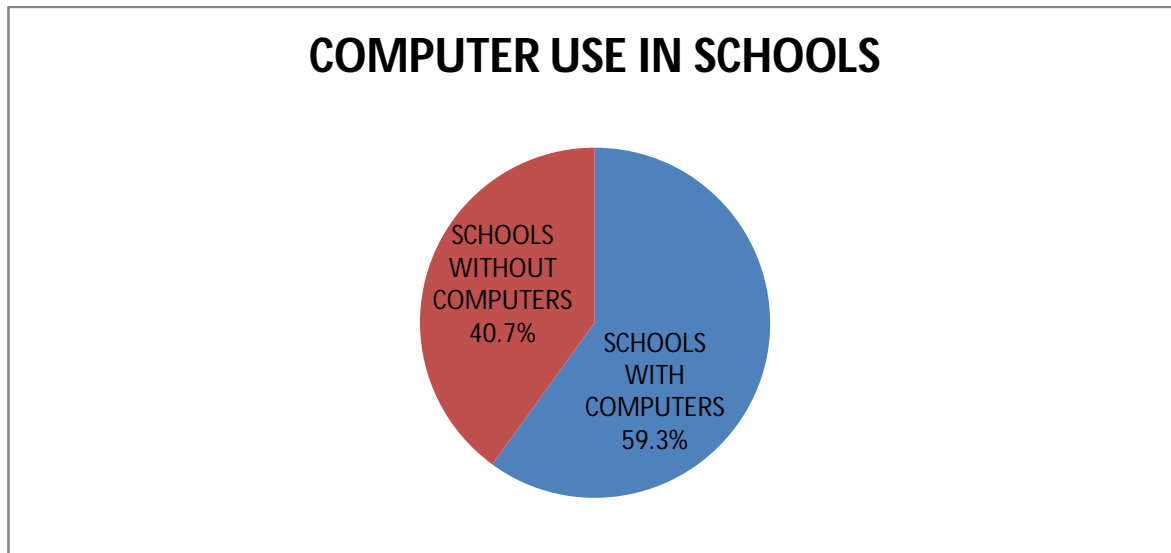
The first objective of this study sought to find out the mathematics teachers utilization of available ICT resources in their schools. To fulfill this objective, the study first established the available ICT resources. This was done through the questionnaire and later verified by use of the observation schedule. Secondly, the researcher went ahead to find out if and how the resources found in the secondary schools were being used in the teaching process. This was also sort through the questionnaires and the observation schedule. The researcher also interviewed one mathematics teacher in each of the sampled schools to supplement the findings from the questionnaires and the observation schedule. The figure 4.1 shows the findings that the researcher obtained from the secondary schools of Tigania East District.

Table 3.1: A Summary of the Available Resources in Secondary Schools and their Utilization

ICT RESOURCE	Percentage Of Schools with ICT resources	Percentage of Schools using ICT resources
Computers and printers	59.3	26.7
Television and video	51.8	0
Radio	40.7	0
Calculators	100	90

Among the observed secondary schools, 16 secondary schools out of the sampled 27, that is 59.3% were found to have computers and printers whereas 40.7% had no computers at all. Among these 16 schools that have computers, 5 of them (35% of the schools) have computers that are shared in a class of 40 students in the ratio of 1:3 students for every computer. Others have 1 or 2 computers which are mostly used for office uses. The availability of computers in these schools is shown on a chart on figure 3.1

Figure 3.1: Availability of Computers in Secondary Schools



3.2 Utilization of Computer and Printers

Having seen that 59.3% of secondary schools had computers, the researcher went ahead to establish how this resource is used. Out of the teachers who filled the questionnaires, only 26.7% use computers frequently for general use. This includes printing assignments, typing exams and recording student’s results. Teachers reported to use word processing frequently are 6.7% of all the respondents. Other computer packages such as spreadsheets, PowerPoint, graphical presentation among others are not used at all by secondary school mathematics teachers. Some minor percentage 4% use the internet for references and source information.

This is shown on figure 3.1 which showed that despite a relatively high percentage of schools having computers, mathematics teachers do not maximize the use computers to enhance their teaching. The computer is a rich teaching resource that can be used in almost every area in the teaching of mathematics.

Table 3.1: Computer Uses by the Mathematics Teachers

COMPUTER PACKAGE	PERCENTAGE
Computer for general use	26.7%
Word processing	6.7%
Internet	4%
Spreadsheets	0%
Power point	0%
Graphical presentation	0%

Computer packages such as graphical presentations would be useful in the topics such as Trigonometry (ii) taught in Form Three class. In this topic, the teachers could demonstrate the Cosine, Sine and Tangent curves, while students observe. Further, in the topic of graphic solutions the teacher would demonstrate how solutions of simultaneous equations are obtained. A learner is enabled to visualize the roots of equations as well as maxima and minima points in a curve. Simulations on the other hand would be useful in topics such as 3 Dimensional Geometry. The teacher would demonstrate various planes, angle between planes and also show skew lines.

Radio is another ICT resource that was found in secondary schools in Tigania East District. The research established that 40.7% of secondary schools had radios while the remaining 59.3% did not have this resource. However these radios are only used by clubs for entertainment. No mathematics teacher used radio lessons or even taped lessons in teaching the subject. Similarly, the research found out that 51.8% of secondary schools had television and video or DVD, while 48.2% did not have. It also established that mathematics teachers do not use the TV as a teaching resource. In fact teachers did not know if and how the TV would be used as a teaching resource. The most common resource that was found in every school was calculator. All the secondary schools which were 27 in number out of the sampled 27 schools (100%) in the district had calculators for teachers and most individual students in Form 3 classes (99%) had a calculator for use during Mathematics lessons. In the topic of approximation and use of calculators in form 3 mathematics, the learner is required to be able to “State the functions of the features of a calculator, and use calculator in various computations” KIE Mathematics syllabus.

The researcher sought to know how many calculators each of the sampled schools had and who provided the calculators for students and teachers. It was observed that most schools that is 25 out of the 27 sampled schools which is 92.6% of schools bought calculators for their mathematics teachers but students had their calculators provided by parents. During the observation of mathematics lessons, the researcher observed that the teacher activity using a calculator was mainly demonstration and computations while the students also used the calculators for their computations. The few schools that had not bought calculators for their mathematics teachers, it was noted that the teachers had bought on their own or borrowed a calculator from students during the mathematics lessons.

The objective one of this study sought to find out the mathematics teachers utilization of available ICT resources in their schools. Having realized that 59.3% of schools had computers but only 26.7% of the mathematics teachers used the computers implied that there was a problem that needed to be addressed. On probing the teachers further on what the 26.7 % using computers did with the resource, it was found that they used computers only for general purposes. Mathematics teachers did not use the computers for simulations, graphical presentations internet in their teaching. These teachers did not know what these computer packages were and how they could be used in the teaching of mathematics.

Despite there being 51.8% of schools with television and video, no teacher used them for teaching mathematics. Teachers viewed this resource as one for student’s entertainment during their leisure time. Radios were also available but no mathematics teacher was seen to be using it for teaching.

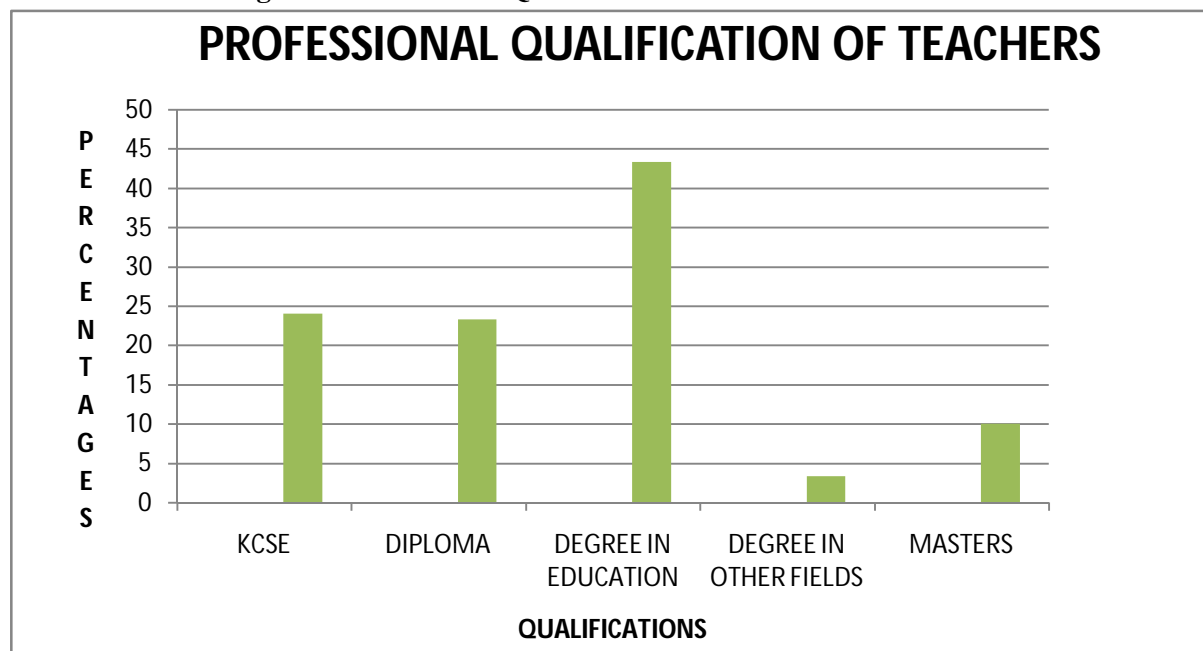
Access to equipment, both hardware and software is critical to the successful use of ICT resources in education. Pollard (2005) rightly notes that the quality of learning is directly affected by adequate provision of resources. We cannot look at teacher preparedness to use ICT without addressing the availability of resources.

The mathematics teachers can only be said to be prepared to embrace ICT if the resource is available and the teacher can explore its usefulness. There was expected to be a basic ICT resource common in every school, however some schools had a variety of resources which could help to improve the teaching of mathematics. As Van Damme(2003) states“ICTwhich is the acronym for information and communication technology can be defined as: “combination of computer, video and telecommunication technologies, as observed in the use of multimedia computers and networks and also services which are based on them”. These are the sort of resources the study set out to look for in various secondary schools in Tigania East District. Van Damme, defines ICT resources that can be used for teaching as all multimedia but we notice from the data obtained through the study that teachers do not consider resources such as radio and TV as ICT resources that can enhance their teaching. In a broad perspective, ICT encompasses all multimedia including mobile phones.

3.3 Teacher Training Levels

The study set out to establish the professional qualifications of mathematics teachers and their ICT training in relation to information technology. This was used to meet the second objective of study which was “to establish teachers’ ICT training in readiness for teaching mathematics”. The findings were as shown on figure 3.2 and 3.3Teachers entrusted with the duty to teach mathematics in secondary schools in Tigania East District have the academic qualifications shown in the bar graph on chart 4.3. It was noticed that most secondary school mathematics teachers 43.3% had a Bachelors degree in education while another group 23.3% had diploma in education. Another smaller group of teachers (7%) had or were in the process of pursuing a Masters degree. 27.3% of mathematics teachers in secondary schools in Tigania East District however as observed, were not trained to teach the subject.

Figure 3:2: Academic Qualifications of the Mathematics Teachers



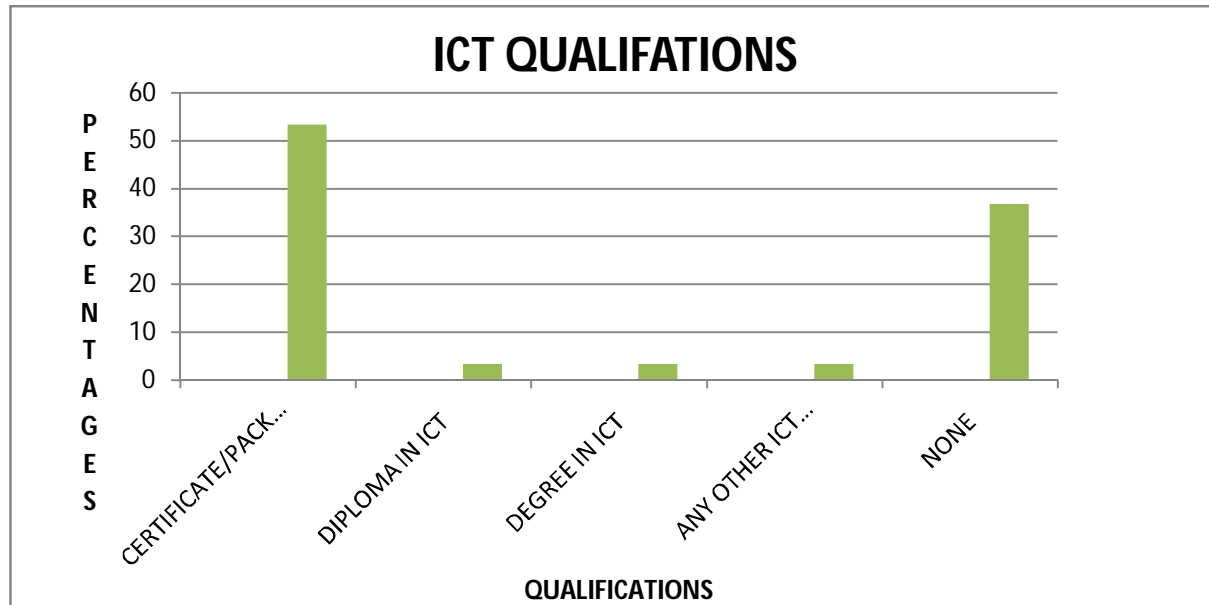
It implies that the aspects of teaching Mathematics using various ICT resources could only be done by 73% of the teachers since the untrained teachers lacked knowhow on the relevant use of resources, in relation to teaching methodology. These untrained teachers were not professionally trained to teach mathematics, this implied that providing them with necessary ICT resources was unlikely to change their teaching style and methodology.

The study further looked at the ICT qualifications of mathematics teachers in the district and the findings were as shown on figure 3.3. It was further observed that some 63.7% of mathematics teachers have some sort of training in the use of ICT. The remaining 36.3% have no training related to the use of ICT. The ICT training ranged from a certificate in computer packages (which is what most of the teachers- 53.3% had) to a diploma in IT.

To establish teacher preparedness, the study sought to find out the type of induction courses available for mathematics teachers to use ICT in the teaching mathematics. The mathematics teachers were asked if they had undergone any training to enable them use calculators for teaching mathematics.

The findings were that 100% of the respondents said they had not been trained so they faced problems such as explaining the functions of various keys on the calculators and calculators were breaking down easily due to mishandling by the students. Further, this research found out that 50% of teachers who are in schools that have ICT resources such as computers had no idea what to do in using the available resources during mathematics lessons.

Figure 3.3: ICT Qualifications of the Mathematics Teachers



It was alarming to learn that due to the high shortage of teachers, mathematics in 27.3% schools was taught by form four leavers who only hold KCSE certificates. These teachers lack professional training on any teaching methodology so the use of ICT as a teaching resource is not even considered. The lack of academic training limits their flexibility to emerging issues, as Makau (1989) notes "...education disposes the beneficiary to readily adopt to change... hence academic qualifications are a facilitating factor in the implementation of any education program" p.68. This explains the high percentage of teachers not using the available ICT resources as observed in table 3.1. It is clear that some teachers not only lack ICT related training but also lack professional training. On doing a cross tabulation it was found that 90% mathematics teachers who had a certificate in computer packages used computers for general purposes such as typing assignments, referring to internet for information and databases. It was noticed that those teachers with some sort of IT training were more likely to use ICT resources.

Teachers with no IT training at all seemed to shy off from the use of any ICT resources. These teachers lacked the knowhow on what to do with the available resources. This is because they received no related pre service training and also after joining the service, they were not trained appropriately. The researcher sought to know if teachers were inducted into the use of calculators but 100% mathematics teachers said that they only received a directive requiring form 3 students to buy calculators. This resource was found to be frequently used in mathematics lessons. During the lesson observation, the researcher observed that the calculator was used by both the teachers and students for computation purposes. It is only in the Form three topic of 'Approximation and use of calculator' where teachers used demonstration method to show learners the functions of various keys of the calculator. Even in the schools that had enough computers, teachers only typed exams and used it to store important information such as the students' marks. Generally, no teacher used the resources for delivery of content or simulations.

It was noted that even teachers who were professionally trained had no training on how to apply ICT resources in their day to day teaching of mathematics. This confirms the argument of the Koech report of 1999 on Total Quality Education and Training (TQET) that "Although the content of teacher education in Kenya is fairly adequate, it is deficient in a number of areas, and would need to be revised with the view of revamping it and expanding it to address recently emerging issues such as computer science, information technology and the recent developments in communication technology"

It therefore would be necessary to revise the teacher training curriculum so that mathematics teachers are trained on how to use calculators and other ICT resources in their daily teaching. Proper training in the use of ICT would be the starting point in preparing teachers to use ICT in teaching mathematics.

4. Summary, Conclusions and Recommendations

Availability of ICT Resources

This study observed the following: First, all secondary schools in Tigania East district at the time of this study had some sort of ICT resource, calculators being the basic ICT resource in each secondary school. Since the introduction of calculators in secondary school mathematics curriculum, schools administrations have embarked on a supportive mission on provision of calculators to their teachers. Students on the other hand have had their parents buy for them calculators. Generally therefore all secondary school mathematics teachers have access to this ICT resource and can use it for teaching of the subject.

Secondly, more than 50% of secondary schools in the district had electricity. Other secondary schools which lacked electricity had a plan or were in the process of acquiring it through the rural electrification program. The presence of electricity makes it easy for schools to use ICT resources such as computers, printers, television, radio and projectors among others. This is because lack of power is a major limiting factor as these resources cannot operate without it.

In addition, 59.3% of secondary schools had computers and printers which had either been bought by the schools or provided by donors. Out of the schools with computers, only 0.05% had a centralized room where teachers could take students and present a lesson with students sharing computers such that each could access a screen. On average, the schools with many computers had a sharing ratio of 1:3. In other schools, computers were few and mostly reserved for office purposes.

Finally, other ICT resources such as television, video and radio were available in almost all secondary schools that had electricity. In all the schools that were found to have this resource, the quantities were 1 or 2 per school since they were meant for entertainment and not as a teaching or learning resource.

Utilization of Resources

In the case of calculators, although mathematics teachers said it can be used in a variety of topics such as statistics, trigonometry, binomial expansion among others, in real practical sense they did not use them for teaching. Having observed several lessons in various schools, it was established that the calculators were only reserved for computations except for the topic of “errors and use of calculators” which is taught at form 3 level. During this topic, the mathematics teacher demonstrates the functions of various keys on the calculator as learners practice. Once this topic has been taught, the teacher rarely carries a calculator to class.

Secondly, mathematics teachers said that a computer is a vital resource in teaching of mathematics in topics such as 3-dimensional geometry, statistics, and geometrical constructions where they proposed the use of computer simulations to help in better understanding concepts. However, on further questioning, teachers admitted that they did not use computers in their teaching mainly because it was not a priority.

Thirdly, mathematics teachers seemed to be aware that internet is a source of vital information and lesson content but they did not often refer to it. They claimed that the content from the text book is not even sufficiently covered within the available time.

Fourthly, the availability of television, video and radio did not seem to appeal the mathematics teachers in terms of utilization in mathematics lessons. The mathematics teachers agreed that the television and video could be used in the presentation of recorded lessons in areas that seem to challenge students such as geometrical constructions. However, the teachers did not use either of these resources in their teaching of mathematics.

Professional and Academic Qualification of the Respondents

With regard to professional qualifications, the researcher found out that 66.3% of the mathematics teachers in the district had been trained to teach mathematics either at degree level or diploma level. This category of mathematics teachers was well equipped to handle any mathematics concepts and also could present their lesson in an organized way.

Another 37% is that of untrained mathematics teachers; many secondary schools in Tigania East district seemed to be understaffed in terms of mathematics teachers so they employ any available teacher. This includes those with degree in other areas and form four leavers. A big percentage of those teachers handling the subject were KCSE certificate holders. Such a teacher is not qualified in terms of methodology of teaching and even in terms of content.

Mathematics Teachers' Qualifications in Relation to ICT

The study observed that the mathematics teachers lacked proper training in the use of ICT. It was observed that in the course of teacher training for both diploma and degree holders for mathematics teachers, the teachers were not exposed to training in the use of ICT as a teaching resource in the subject. Teachers with degree and diplomas found to have some sort of ICT training had attended computer colleges on their own for personal reasons other than the use for teaching. These teachers had certificate in computer packages and a few had diploma in information technology.

Among the mathematics teachers, who lacked professional training, 47% had some ICT qualifications such as certificate in computer packages and others had diploma in information technology. However, having ICT qualification but lacking professional training does not help in lesson delivery due to lack of methodology in pedagogy.

Availability of Induction Courses

The study observed that besides the lack of a good ICT training program in diploma and degree courses in the Kenyan colleges and universities, there is a further shortage of in-service programs in the same area. The study revealed that there is shortage in ICT training courses even after teachers have left colleges. The introduction of calculators in secondary school curriculum was not preceded by any form of training for the teachers on how to use the teaching resource.

Teachers who attended the SMASSE program successfully and went through the four cycle program said that there was nothing to learn on the application of ICT in their teaching. In addition, the few workshops mathematics teachers attend are mostly based on the performance of students in national exams and rarely are they based on teaching methodology.

Mathematics Teachers Preparedness to Embrace ICT

Preparedness of teachers to embrace ICT in teaching Mathematics in Tigania East District is implied from the above findings. The study established that schools in the district had a variety of resources but teachers were mostly seen to avoid these resources in their teaching. On considering the teacher's perceptions and attitudes towards ICT, it was seen that teachers portrayed a positive attitude and they seemed to view ICT as a solution to their teaching problems. Teachers felt incompetent to use these resources and hence shying away from using them.

Conclusion

Teacher preparedness was looked at in three aspects namely; utilization of available resources, teacher training and teacher attitudes towards ICT. The research established that there was a serious lack of both professional and ICT related training among mathematics teachers of secondary schools in Tigania East District. In utilization of resources, teachers were seen not to use the available resources exhaustively. Teacher attitudes towards ICT were generally positive which implies that the teachers perceive technology as an add-on that would improve the teaching of mathematics. Although teachers perceive ICT as a tool that would improve their teaching of mathematics, they did not make use of the resources in their schools. This directs the researcher to the conclusion that teachers are willing to embrace ICT in the teaching of mathematics but the lack of knowhow is the hindrance. This implies that teachers are not prepared to embrace ICT resources for teaching mathematics in secondary schools of Tigania East District.

Recommendations

This study revealed issues that led to the following recommendations.

1. That there should be a proper plan to in-service mathematics teachers regularly to move with the current times. There should be in-service courses to improve the teaching methodologies from time to time.

2. Mathematics teacher trainees should be oriented towards ICT use in teaching methods during the semesters when the units of the subject methods are taught.
3. Secondary schools administration should prioritize ICT which has been seen to improve the learning environment. Since most schools have electricity and generators, the schools should provide enough ICT resources for the teachers to use during lesson presentation.
4. Having noted a teacher shortage to the extent of having KCSE certificate holders as mathematics teachers, it is recommended that the Kenya government takes urgent measures to help in the provision of qualified teachers.
5. For schools with computer laboratories, it is recommended that the room is made accessible to all teachers so that those willing to prepare lessons have ample time to do it using the available resources.

References

- Bingimlas, A.K. (2008). Barriers of successful Integration of ICT in teaching and learning environments. *Eurasia journal of Mathematics and science and technology education* 2009 5(3), 235-245
- Cockroft, W. H. (1982). *Mathematics Counts. Report of the committee of inquiry into the teaching of mathematics in schools.* London: Her Majesty's stationery office.
- Demana, F. and Leitzel, J. (1988). "Establishing Fundamental Concepts Through Numerical Problem Solving." In A. Coxford and A. Shulte (eds.) *The Ideas of Algebra, K-12.* Reston (VA): NCTM,
- Demana, F. and Waits, B. (1990). "Enhancing Mathematics Teaching and Learning Through Technology." In T. Cooney (ed.) *Teaching and Learning Mathematics in the 1990s.* Reston (VA): NCTM.
- Kanja, C. Iwesaki H. Baba T. & Ueda A. (2001). Reform of Mathematics Education in Kenyan Secondary Schools. *Journal of International Development and Cooperation*, Vol.7, No.1, 2001, pp. 67-75
- Kaput, J. (1992). Linking representations in the symbol systems of Algebra. In S. Wagner (Ed.), *Research agenda for the teaching and learning mathematics.* Reston: National Council of Teachers of Mathematics.
- Lehtinen, E. Muukonen, H. and Ilomaki, L. (1999). Teachers information and communication technology (ICT) skills and practices of using ICT. *Journal of technology and Teacher Education.*
- NEPAD (2001a). *New Partnership for Africa's Development.* Accessed on March 12th, 2011.
- Makau, B.M. (1989). *Computer in Kenya's schools; a case study of an innovation in Kenya.* IDRC, Canada.
- National Council of Teachers of Mathematics (NCTM) (2000). *Principles and Standards for School Mathematics.* Reston, VA: Author.
- Ogwel, A. (2008). Integrating ICT in mathematics education; curricula challenges in the Kenyan system of education. A paper presented in the 1st regional conference on e-learning, Kenyatta University.
- Ohara, M. (2004). *ICT in the early years.* London, Antony Rowe Limited.
- Orton, A. and Frobisher, L. (1996). *Insights into teaching mathematics.* Continuum, London.
- Papert, S. (1987). *Computer criticism vs. technocentric thinking.* Educational Research. New York: basicbooks.
- Pelgrum, W. and Plomp, T. (1991). *The Use of Computers in Education worldwide. Results from the IEA 'Computers in Education' survey in 19 educational systems.* Oxford: Pergamon press
- Pollard et al (2005): *The reflective teacher: Effective and evidence-informed professional practice.* London, continuum publishers
- Van Damme, G. (2003). *ICT in Practice for Physical Education & Sports.*
<http://www.sports-media.org/Sporttapolisnewsletter5.Htm> accessed on July 20, 2009
- Voogt, J. and Pelgrum (2005). *ICT and curriculum change. Human Technology; an Interdisciplinary journal on Humans in ICT Environments,* Vol2, pp 157- 175