PRE-SERVICE PREPARATION OF MATHEMATICS TEACHERS FOR SECONDARY SCHOOLS: A STUDY OF THE PERCEPTION OF THE MATHEMATICS TEACHERS IN KONOIN SUB COUNTY, BOMET COUNTY, KENYA.

BY

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DECLARATION

Declaration by the Candidate

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ABSTRACT

Performance in mathematics has become a matter of concern to stakeholders in education and even the general public .Various factors have been attributed to this, one of them being the quality of the teacher's teaching the subject. The quality of mathematics teachers has been questioned on the grounds that mathematics teachers display Poor understanding of basic mathematics concepts, are unable to solve some mathematical problems given by students ,are skipping some topics and performing poorly in teaching skills. Mathematics teacher preparation has been blamed for this, with allegations that the training programme is inadequate leading to unsatisfactory performance by the mathematics teachers. This study, therefore, sought to investigate secondary school mathematics teachers' perception on their pre-service training. The study was conducted in Konoin sub county of Bomet County, Kenya. The study examined the teachers' perceptions on the relevance of the subject content, the teaching methodology course units taught, the micro teaching and the teaching practice in preparing them to teach in secondary schools. The study was guided by Pedagogical content knowledge model as espoused by education spsychologist Lee Shulman (1987). The study adopted a descriptive survey design. Stratified sampling was used in categorizing the schools into county, sub county and private. Simple random sampling was used to select the schools from where the HOD participated in the study. Data was collected using questionnaires, interview schedule and document analysis. Statistical Package for Social Sciences (SPSS) computer programme was used to analyze the data. The analyzed data was presented as percentage frequencies and in tables. The research findings revealed that the mathematics content offered in the teacher training institutions is inadequate and largely irrelevant to the needs of the secondary school mathematics teachers. The general teaching methodology courses are adequate but the teaching methodology on the mathematics subject is not adequate. Micro teaching is well organized and helped the teachers practice all the teaching skills that they learned during the lectures and prepare them well for teaching practice. The teaching practice is appropriate but the number of times the trainees are supervised and the supervisor- trainee interaction is wanting. Basing on the findings, the researcher recommended that departments of mathematics in the universities should review their curriculum to make the content more relevant and adequate to the secondary school teachers needs, more time should be allocated to the subject methodology in mathematics, subject content should be taught concurrently with its methodology and finally more attention should be given to the supervision process and particularly the discussion of feedback during the teaching practice. Commission of University Education should also devise a way of ensuring that all teacher training institutions and particularly universities offer the same curricula in terms of the course content for the same subjects to ensure uniformity in the quality of their products (teachers). These recommendations are hoped to be useful to the Mathematics and Education Departments of teacher training institutions in improving the relevance of their programmes and Ministry of Education in formulating policies regarding teacher education. Educators, parents, and other stakeholders can use the findings to learn more about the teaching subject.

DEDICATION

This thesis is dedicated to my Mum Esther Koech, my loving husband Elijah Cheruiyot and my children Melvin ,Sandra, Alexander, Sharline, Aaron and Joyline for their support during my study.

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LIST OF ABBREVIATIONS

SMASSE - Strengthening of Mathematics and Sciences in Secondary Education

KCSE- Kenya Certificate of Secondary Education

HOD- Head of Department

CTTC - Central Teachers Training College.

HM- Head Master

MOE- Ministry of Education

NCTM- National Council of Teachers of Mathematics

HEA- Higher Education Authority

JAB- Joint Admissions Board

PCK- Pedagogical Content Knowledge

UNESCO- United Nations Educational, Scientific and Cultural Organization

ITT- Initial Teacher Training

BA - Bachelor of Arts

BED - Bachelor of Education

BSC - Bachelor of Science

OECD - Organization for Economics and Corporation Development.

KSTC - Kenya Science Teachers College.

TP- Teaching Practice.

KIE- Kenya Institute of Education

KNEC- Kenya National Examination Council

MOE- Ministry of Education

GOK- Government of Kenya

CHAPTER ONE

INTRODUCTION TO THE STUDY

1 .0 Introduction

This chapter gives the background of the study, statement of the problem, purpose of the study, objectives of the study, research questions, and significance of the study, rationale, scope, limitations, and assumptions of the study as well as theoretical framework.

1.1 Background of the Study

Mathematics education has gained significant momentum as a national priority and important focus of school reform (National Mathematics Advisory Panel, 2008). In the United States, student achievement in mathematics, although improving (Slavin, Lake, & Groff, 2009), remains alarmingly low in comparison with other subjects.

Like many other African countries, Kenya wishes to industrialize by the year 2020. For this dream to come true, performance in mathematics and sciences must be improved. However, from the Kenya National Examination Council reports in the table 1.1, the current performance in mathematics, it is low. Improving performance in mathematics in Kenya is of paramount importance not only for industrialization but for producing citizens who are scientifically empowered, (Njoroge 2004).

Similarly, mathematics in Kenya is a core subject and a critical filter to career choices. The government of Kenya recognizes the role played by mathematics in the realization of the Vision to become a globally competitive and prosperous country by 2030, (Silvester, 2010). The various attempts that have been made to improve

mathematics performance have been reflected in the amount of resources channeled towards enhancing the teaching and learning of mathematics at all levels of the education system. These include providing schools with qualified mathematics teachers, improving their remuneration and terms of service and the most recent of them being the institutionalization of the in-service education and training of mathematics and science teachers through the Strengthening of Mathematics and Science in Secondary Education (SMASSE) Project, (MOE, 2005).

Despite all these efforts by the government, Mathematics performance is still poor. The analysis of Kenya Certificate of Secondary education (KCSE) performance in mathematics for 2006-2009 indicates that performance has constantly been below average.

Table 1.1 National Mathematics Performance From 2006-2009

YEAR	**2006**	**2007**	**2008**	**2009**
MEANMARK (In %)	**18.83**	**19.42**	**21.01**	**20.87**

(Source: KNEC REPORTS OF 2007 & 2009)

This implies that there could be other reasons which are contributing to this poor performance. This then calls for the need to research on other factors that are likely to be causing the problem. A study done in Guyana revealed that despite mathematics undoubtedly having universal application to life and being an essential tool in science, technology, economics, business, commerce and a course of computer design and functioning, there is a general tendency for people to shy away from

studying mathematics for various reasons. Some feel that it is too difficult while others do not see its practical connection to everyday life.

The argument is that this could be attributed to the way mathematics is taught; that is, taught in too much of an abstraction. The suggestion is that teachers should help students to see how these abstract concepts are related or could be applied to real and practical situations. Makokha (2009) blamed the dismal performance of students in the KCSE to the quality of teaching in our secondary schools. Makokha noted that teachers place little emphasis on practical instructions and students have little opportunity to develop technical competencies or problem solving skills.

Kagotho (2009) on the other hand noted that, although teachers are the most influential resource in the school, their effectiveness in the recent times has been of great concern. Other findings have also shown that teachers use teacher- centered approaches in presenting their lessons in the classrooms as students remain passive, (Wambui, 2005).

However, this researcher feels that for the performance in mathematics to improve, teachers of mathematics need not only to be good mathematicians but also must possess good pedagogical skills as well because teaching this subject is a special task and not like many other subjects in the school curriculum where the teachers can just dictate to the students what is written in the text books. Apart from the pedagogical skills, mathematics teachers also need to have a good mastery and understanding of the mathematics content for teaching. This view is supported by other Mathematics educators such as Ball and Bass(2000) who posit that knowing mathematics for

teaching demands a kind of depth and details that goes well beyond what is needed to carry out the algorithm reliably.

The debate on teacher education has gained a lot of importance as teacher quality is more and more being identified as crucial to student outcomes. It is now acknowledged that quality teaching is fundamental to achieve higher student learning, as it is the single most important school variable influencing student achievement more significantly than other factors, such as class size, (Organization for Economics and Corporation Development, (OECD, 2005).

Gustafsson (2003) notes that there is a positive relationship between teacher training and students academic performance. Sifuna (1986) further asserts that academic performance is a predictor of teaching effectiveness. This inevitably calls for a well trained teaching force as Kiragu in Nanjankululu (2010) notes that the challenge of meeting manpower needs in education has shifted to issues of quality in graduate teacher education. Darling-Hammond (2005) also noted that the most direct and effective way of raising educational quality is to modify teacher education and recruitment, combined with the development of means to improve the knowledge and the pedagogical skills of the teachers that are being trained.

Beecher Report (OHMS,1949), commented that most important in any education programme is the teacher, wherever there are good teachers, there are good schools regardless of the kind of buildings or equipments since good teachers will soon improve buildings and equipments. Though this report is old, other education commissions that followed like the Ominde commission (Republic of Kenya, 1964), Gachathi commission (Republic of Kenya, 1976) and Kamunge Report (Republic of

Kenya, 1988) have supported this report by making recommendations on the need to have well trained and competent teaching force.

Various studies have however questioned the adequacy of pre-service training in preparing teachers for the classroom demands. In 1995, in Ireland, The White Paper "Charting our Education Future" noted that some disputes have been expressed as to the adequacy of pre-service teacher training programme in preparing graduates for a career in teaching. It recommended a systematic review of all types of second level education by Higher Education Authority (HEA) which would guide future decisions for teacher education (White Paper, 1995 pg 124). This situation may be currently the case in Kenya.

This study then seeks to investigate the pre-service preparation of mathematics teachers for secondary schools in Kenya by studying the perceptions of mathematics teachers in Konoin Sub County, Bomet County, Kenya.

1.2 Statement of the Problem

There is a widespread interest in improving the level of mathematics performance in schools. This is because Mathematics is one of the core subjects in secondary school curriculum. Similarly, performance in the subject is crucial for the students' admission to scientific and technological based professions. However, there has been a persistent poor performance in this subject nationally compared to other subjects in the secondary school curriculum as revealed by the Kenya Certificate of Secondary Education Examination results. This may deny many students access to competitive professions which could stimulate the realization of the envisaged Vision 2030.

According to Romari (2004) performance in mathematics has been generally poor. Njoroge (2004) also decries the performance in mathematics despite the fact that it is one of the key subjects expected to turn Kenya into an industrialized country by the year 2020. The government of Kenya has put in a lot of efforts in an attempt to improve performance in the subjects. This has been reflected in the amount of resources channeled towards enhancing the teaching and learning of mathematics at all levels, providing schools with qualified Mathematics teachers, improving their remuneration and terms of service and institutionalization of in-service education and training of mathematics and science teachers through SMASSE (MOE2005). Despite all these efforts by the government, mathematics performance is still dismal.

Similarly, various researchers have studied various factors influencing performance in mathematics for example: Teaching approaches (Matseshe, 2005; Muhenga, 2006; Ouko, 2007; Too, 2004), Availability of resources (Too, 1996), Pupil's capacity to use mathematical terminologies (Rotich, 2007), Student's attitudes towards the subject (Ngugi, 2006), Impact of SMASSE project (Langat, 2009; Muchira, 2009) and use of scientific calculators (Masibo, 2007). Despite various recommendations from these studies, performance in mathematics has not improved significantly.

Teachers have been mainly blamed for this poor performance. KNEC (2000-2006) examination reports, cited in Okioma (2010), attributed the poor performance in mathematics to superficial content coverage or outright failure by teachers to teach certain topics or use of poor teaching methods. Fieter, Vonk and Akker (2001) lay blame of poor teaching on inadequate programmes for teacher preparation which leads to their unsatisfactory performance. The preparation of teachers has therefore

been an issue of concern. Sessional Paper No.6 of 1988(G.O.K, 1988), The Master Plan of Education and Training 1997-2010(G.O.K, 1998) and Sessional Paper No.1 of 2005(G.O.K, 2005) on Policy Framework for Education Training and Research in Kenya in the 21st Century have all called for investigation into the teacher education programmes and proposed their restructuring to enable trainees to acquire sufficient content mastery and pedagogy.

This study then sought to investigate the pre-service preparation of mathematics teachers for secondary school in Kenya by seeking the perceptions of the teachers in Konoin Sub County, Bomet County, Kenya.

1.3 Purpose of the study

The purpose of this study was to investigate the perception of mathematics teachers in Konoin Sub County on the preparation of mathematics teachers for secondary schools during their pre service training.

1.4 Objectives of the study

1. To find out the perception of mathematics teachers on the relevance of Mathematics subject content learned during their pre-service training to the secondary school teaching.
2. To establish the mathematics teachers' perceptions on the suitability of the teaching methodology courses in preparing them for teaching.
3. To establish the perceptions of mathematics teachers towards the effectiveness of micro teaching in preparing them for teaching practice.
4. To establish the teachers' perceptions about the role of teaching practice in preparing them to teach in secondary schools.

1.5 Research Questions

1 What is the mathematics teachers' perception about the relevance of the mathematics subject content learned during their pre-service training to the secondary school teaching?

2. What are the teachers' perceptions towards the suitability of the teaching methodology courses in preparing them for teaching?

3 What are the perceptions of mathematics teachers towards the effectiveness of micro teaching in preparing them for teaching practice?

4. What are the teachers' perceptions about the role of teaching practice in preparing them to teach in secondary schools?

1.6 Assumptions of the study

The study was based on the following assumptions

1. That all secondary school Mathematics teachers in Kenya went through a similar curriculum for their pre-service training.
2. That trained mathematics teachers are currently teaching the subject.
3. That all the teachers were adequately trained to teach the subject.

1.7 Scope and limitations of the study

1.7.1 Scope

Scope is the description of the boundary of the research in terms of content, sample size, geographical and theoretical framework. This study sought to find out the perception of mathematics teachers of their pre-service training in preparing them to teach in secondary school. This study was conducted in Konoin Sub County in Bomet County, Kenya .The research was conducted between September and November of 2012. All the schools in the district were used in the study. However, 11 heads of

departments (30% of all the HODs) were sampled for the study as Kothari (2008), state that (10-30%) is adequate representative sample of the entire population. Mathematics teachers from all the schools in the district were used in the study.

1.7.2 Limitations of study

There were limited local researches on pre-service teacher preparation for the teaching of mathematics in secondary schools. This affected the literature review of the study. However, to overcome this limitation, the researcher relied on various studies done on pre-service preparation of teachers for other subject like Biology. The researcher also utilized the available literature on the teaching of mathematics in other countries.

When conducting the study there was concern that the respondents may not give correct information on sensitive issues of teacher training. The researcher addressed this limitation by assuring them of confidentiality of the given information. The researcher was also limited by the number of research instruments since the researcher used only three research instruments. This limits the quantity and quality of data collected. However, the researcher was still able to get valid and reliable results because the research instruments were standardized and validated.

1.8 Justification of the study

Exploration of available readings highlights that research on pre-service teacher education in Kenya and on teachers' views about their pre-service education, particularly with respect to secondary school mathematics education, is limited. The limitation of research that is available on teacher education is manifold. First, much of the research is foreign and is geared towards looking at specific areas of teacher

education and not as teachers' opinions of their preparation for teaching or aspects of their development as teachers. Second, most of the available foreign research is focused on primary teacher education, (Burke, 1997;, Killeavy, 2001, & Prundy, 2006). Similarly, studies relating to secondary education are predominantly focused on in-service training of teachers, (Leonard & O'Doherty, 1998 & Killeavy, 2001).

Local researches that have been done on pre-service training are few and looked at pre-service training of teachers in general and not the training of mathematics teachers, for example Nanjankululu (2010). Okioma (2010) also did a research on pre-service training of biology teachers for secondary schools. The studies mentioned above are on teacher education in general and none on mathematics teacher education. Various concerns have been raised on lack of researches on pre-service training of teachers.

The OECD report "Teachers Matter; Attracting Developing and Retaining Effective Teachers", has commented on lack of existing research on pre-service teachers education in many of the OECD countries and states that "in many countries there are extensive research gaps concerning teachers, their preparation and their work careers. The report asserts that research of this nature is highly important for improving and refining the knowledge base for teacher policy and is also imperative as a means of introducing new and more up to date information into schools and to ensure that teachers connect more actively with relevant knowledge as it comes to light, (OECD, 2005).

Heinz (2008) has also expressed the same concern that in the last decade growing awareness has been observed in educational cycles as to the lack of high quality studies which analyze the way teachers think about educational issues and their ability to apply foundational knowledge to practical problems of teaching and technology.

This then calls for the need to research on the practicing mathematics teachers perceptions of their pre-service teacher education. This study therefore sought to establish the perception of Mathematics teachers of their pre-service training in preparing them to teach in secondary schools.

1.9 Significance of the Study

The study will be of great significance to the following various parties in different way.

1. It will assist the Departments of mathematics in teacher training institutions in modifying their programmes to ensure more relevance to the current practical needs of the classrooms and the society.
2. The Kenya Institute of Curriculum Development can use the recommendations in designing a more relevant curriculum for training the secondary school mathematics teachers.
3. The Ministry of Education can use it in formulating policies regarding teacher training programmes in general.
4. It will provide valuable sources of information from which educators; policy makers, parents and other stakeholders can learn more about the teaching subject.

1.10 Theoretical Framework

This study was guided by Pedagogical Content Knowledge (PCK) model espoused by education psychologist Lee Shulman (1987). Shulman advances the view that the

teacher's professional knowledge draws from sources of knowledge that can be identified. These are: content knowledge, pedagogical knowledge and pedagogical content knowledge amongst others like knowledge of the curriculum, knowledge of learners and knowledge of educational context, settings and governance.

1.10 .1 Content Knowledge

Content knowledge, is the "what" of teaching or the subject-matter knowledge. This kind of knowledge is different for the different subjects taught in the school and is required by the teachers in order to teach their respective subjects effectively in the classroom. It is the amount and the organization of knowledge of subject matter per-se in the mind of a teacher. To teach mathematics effectively teachers must have a good mastery of substantive and syntactic structures of Mathematics. They must not only be capable of telling students the accepted facts ,concepts and principles of different branches of mathematics but they must be able to explain to students why a particular principle is worth knowing and how it relates to other principles within the same branch and across other branches of mathematics.

1.10.2 Pedagogical Knowledge

Pedagogical knowledge includes the 'how' of teaching generally acquired through education course work and experiences in the schools. Pedagogical knowledge comes from three sources.

- **The discipline perspective**: This is based on breadth and the depth of content knowledge i.e. understanding of the organization of concepts and principles in the discipline (basic to the subject matter to be taught) and the strategies the discipline uses to enable the learners understand those concepts and processes as well as the use of that knowledge and its application in daily life.

- **The learner perspective**: This concerns the rich factual knowledge base with many interconnections such as knowledge of analogies, similes, examples and metaphors by which to explain the subject matter to the pupils; as well as knowledge of learners' pre-conceptions, experience in everyday life and difficulties that are commonly experienced by pupils that may help teachers to effectively guide their learners. The pupil perspective calls for the kind of teaching that puts the learner in the center of the learning process, recognizing the learners current understandings and the pre-conceptions that may affect learning(Driver,1995).The learner's day to day experiences should be used to develop new scientific understanding.
- **The general methodology perspective**: This concerns the knowledge of and insight into the different ways in which topics can be taught and the pros and cons of each approach. (Shulman,1987) The general methodology perspective will require that a mathematics teacher become conversant with the various methods of teaching and the advantages and disadvantages of various methods employed

1.10.3 Pedagogical content knowledge

In Shulman's view pedagogical content knowledge is a form of practical knowledge that is used by teachers to guide their actions in a highly contextualized classroom setting. This form of practical knowledge among other things entails (a) knowledge of how to structure and represent academic content for direct teaching to students (b) knowledge of the common conceptions, misconceptions, and difficulties that students encounter when learning a particular content (c) knowledge of the specific teaching strategies that can be used to address students learning needs in particular classroom circumstances.

Pedagogical Content Knowledge represents a blending of content and pedagogy into an understanding of how particular aspects of subject matter are organized, adapted and represented for instruction. Shulman argued that having knowledge of subject matter and general pedagogical strategies were not sufficient for capturing the knowledge of good teachers .He argues that if teachers were to be successful they would have to confront both content and pedagogy simultaneously by embodying the aspects of content most germane to its teach ability.(Shulman 1986). At the heart of PCK is the manner in which subject matter is transformed for teaching. PCK is the most important element, which makes the process of pedagogical reasoning and action possible.

Shulman (1986, 1987, and 1992) created a Model of Pedagogical Reasoning, which comprises a cycle of several activities that a teacher should complete for good teaching: comprehension, transformation, instruction, evaluation, reflection, and new comprehension.

Comprehension To teach is to first understand purposes, subject matter structures, and ideas within and outside the discipline. Teachers need to understand what they teach and, when possible, to understand it in several ways. Comprehension of purpose is very important. We engage in teaching to achieve the following educational purposes:

- To help students gain literacy
- To enable students to use and enjoy their learning experiences
- To enhance students' responsibility to become caring people
- To teach students to believe and respect others, to contribute to the well-being of their community

- To give students the opportunity to learn how to inquire and discover new information
- To help students develop broader understandings of new information
- To help students develop the skills and values they will need to function in a free and just society, (Shulman, 1992).

Transformation The key to distinguishing the knowledge base of teaching lies at the intersection of content and pedagogy in the teacher's capacity to transform content knowledge into forms that are pedagogically powerful and yet adaptive to the variety of student abilities and backgrounds. Comprehended ideas must be transformed in some manner if they are to be taught. Transformations require some combination or ordering of the following processes:

1. *Preparation* (of the given text material), which includes the process of critical interpretation
2. *Representation* of the ideas in the form of new analogies and metaphors (Teachers' knowledge, including the way they speak about teaching, not only includes references to what teachers "should" do, it also includes presenting the material by using figurative language and metaphors, (Glatthorn, 1990).
3. *Instructional selections* from among an array of teaching methods and models
4. *Adaptation* of student materials and activities to reflect the characteristics of student learning styles
5. *Tailoring the adaptations* to the specific students in the classroom

Glatthorn (1990) described this as the process of fitting the represented material to the characteristics of the students. The teacher must consider the relevant aspects of students' ability, gender, language, culture, motivations, or prior knowledge and skills that will affect their responses to different forms of presentations and representations.

Instruction Comprising the variety of teaching acts, instruction includes many of the most crucial aspects of pedagogy: management, presentations, interactions, group work, discipline, humor, questioning, and discovery and inquiry instruction.

Evaluation Teachers need to think about testing and evaluation as an extension of instruction, not as separate from the instructional process. The evaluation process includes checking for understanding and misunderstanding during interactive teaching as well as testing students' understanding at the end of lessons or units. It also involves evaluating one's own performance and adjusting for different circumstances.

Reflection This process includes reviewing, reconstructing, reenacting, and critically analyzing one's own teaching abilities and then grouping these reflected explanations into evidence of changes that need to be made to become a better teacher. This is what a teacher does when he or she looks back at the teaching and learning that has occurred–reconstructs, reenacts, and recaptures the events, the emotions, and the accomplishments. Lucas (as cited in Ornstein, Thomas & Lasley, 2000) argued that reflection is an important part of professional development. All teachers must learn to observe outcomes and determine the reasons for success or failure. Through reflection, teachers focus on their concerns, come to better understand their own teaching behavior, and help themselves or colleagues improve as teachers. Through reflective practices in a group setting, teachers learn to listen carefully to each other, which also give them insight into their own work, (Ornstein et al., 2000).

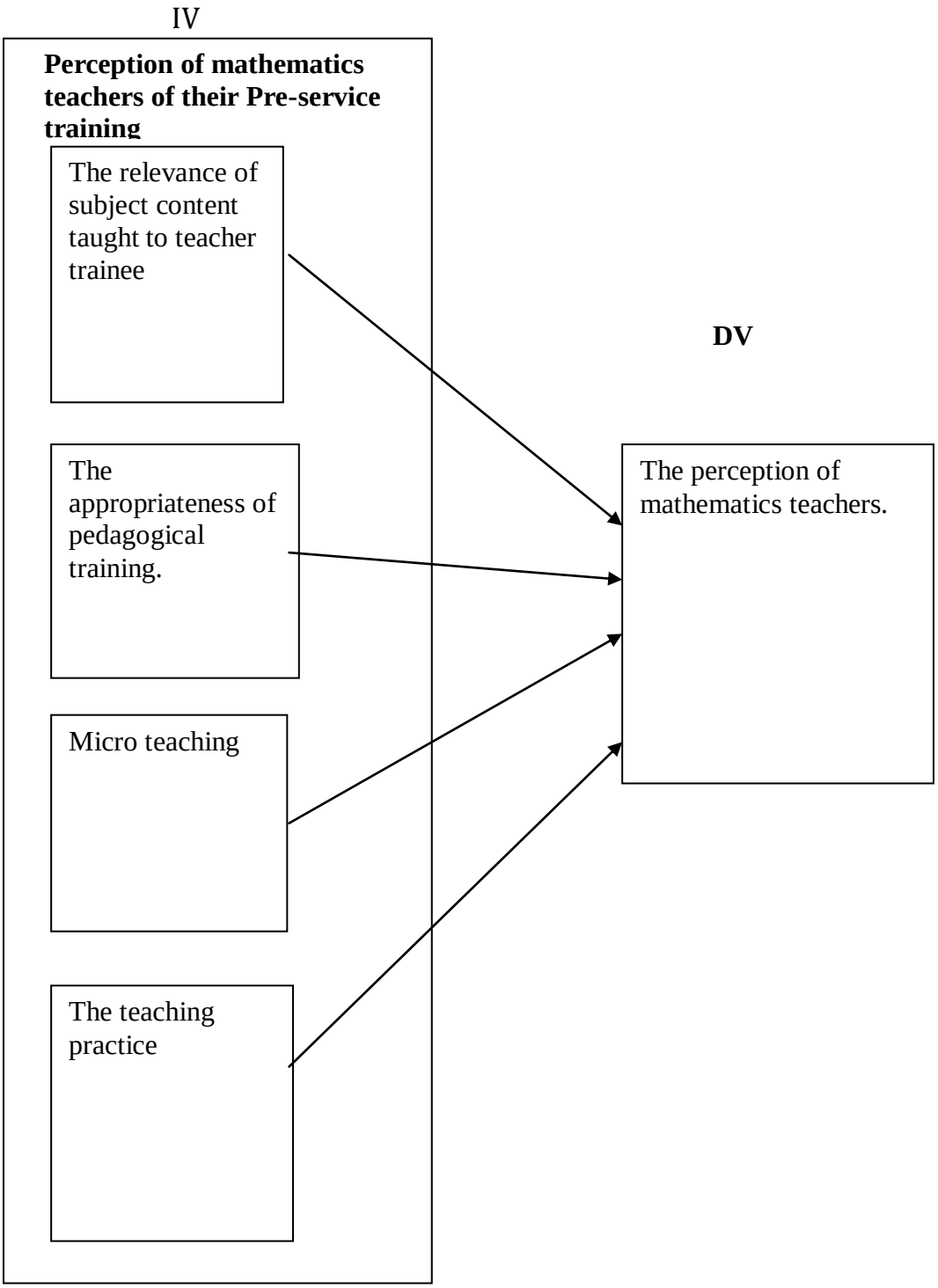
New Comprehension Through acts of teaching that are "reasoned" and "reasonable," the teacher achieves new comprehension of the educational purposes, the subjects taught, the students, and the processes of pedagogy themselves, (Brodsky, 1986).

Acquiring this sophisticated knowledge and developing a practice that is different from what teachers themselves experienced as students, requires learning opportunities for teachers that are more powerful than simply reading and talking about new pedagogical ideas (Ball & Cohen, 1999). Teachers learn best by studying, by doing and reflecting, by collaborating with other teachers, by looking closely at students and their work, and by sharing what they see.

This kind of learning cannot occur in college classrooms divorced from practice or in school classrooms divorced from knowledge about how to interpret practice. Good settings for teacher learning–in both colleges and schools–provide lots of opportunities for research and inquiry, for trying and testing, for talking about and evaluating the results of learning and teaching. The combination of theory and practice (Miller & Silvernail, 1994) occurs most productively when questions arise in the context of real students and work in progress and where research and disciplined inquiry are also at hand

This then implies that Mathematics teacher education programmes should seek to develop a much more thorough understanding of the subject matter than that which one achieves purely as a learner .It is the pedagogical content knowledge that will distinguish a professional teacher from any other practitioner. This will also require that teachers in training be presented with content and methodology from all these perspectives discussed above, simultaneously, drawing their examples and applications from daily life

1.11 Conceptual Framework



Source: Researchers own concept

Figure1.1: Conceptual Framework

Shulman's PCK model says that what is required to make a competent teacher is the subject matter knowledge, pedagogical knowledge and the pedagogical content knowledge. In this study, teacher training institutions must equip their mathematics teacher trainees with the mathematics subject content needed to implement the secondary school mathematics curriculum. The general teaching methodologies and media practical practiced during micro teaching are also a requirement to enlighten teachers on various approaches available for teaching (pedagogy).Subject specific and topic specific pedagogy where the subject content and their teaching methods are taught simultaneously and the same put to practice in the real classroom during teaching practice (pedagogical content knowledge) is also a very important recipe for a well prepared teacher. All these combined result in the production of a competent mathematics teacher.

1.12 Definition of Terms

Concurrent mode of teacher education : This is the preparation of a teacher ,having the teacher trainee study the subject he or she wishes to teach at the same time enroll for education courses right from their first year of study in a university or teachers college of education.

Consecutive mode of teacher education: This is the preparation to assume the teaching career that is given to the prospective teacher after completion of a course of study in their teaching subjects.

Pedagogy: This is the knowledge of and insight into the different ways topics can be taught and the pros and cons of each approach. According to this study, this term is used to mean different activities that are the teacher training on how to deliver content for example teaching methods, teaching practice and micro-teaching.

Pre-service preparation. This is the kind of training given to a prospective teacher in a teacher training institution before taking up the actual teaching in schools.

Student teacher: This is the one who is training in an institution to teach and who is posted to an institution, notably a secondary school for practice under professional supervision.

Teacher preparation: It is a planned effort to help the teacher trainee acquire knowledge and skills that will enable him perform the various roles of a teacher.

Teacher trainer: An experienced teacher who guides a prospective teacher(s) on the knowledge and skills required for prospective teaching.

Teaching practice supervisor: This is a university or college tutor, lecturer or professor charged with the responsibility of mentoring and assessing the student teacher's professional and instructional performance during the teaching practice.

Pedagogy courses- This comprises the general teaching methods course units Mathematics education course units, microteaching and teaching practice.

Micro teaching- According to Singh (1987), microteaching is a scaled down teaching encounter in which a teacher teachers a small unit to a group of 5 pupils for a small period of 5-20 minutes. The same definition is applied in the study.

Perception - According to Gregory, Richard and Zangwill (1987), perception is the organization, identification, and interpretation of sensory information in order to represent and understand the environment. In this study, the term has been used to mean the way in which one thinks about something or the impression one has about something

CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

This chapter reviews the general literature on the pre-service teacher training in Kenya, the pedagogical content needed for training teachers, the competence of mathematics teacher trainees, attitudes of mathematics teachers towards their work, the subject knowledge (content) needed for training mathematics teachers and teaching practice.

2.1 Evolution of pre-service teacher training in Kenya

According to Sifuna (1990) as cited in Nanjakululu (2010), teacher education in Kenya dates back to 1919 when the Phelps Stokes Commission Education Report of 1919 recommended that every mission society be encouraged to found its own training centres for primary school teachers maintained by the government grants. Sifuna (1990) further asserts that the Phelps Stokes Commission of 1924 also stressed the serious need for trained teachers. Kagumo College opened in 1944 to train primary school teachers. Training of teachers at degree level in east Africa as posited by Sifuna (1980) dates back to 1962 when it was started at Makerere University.

In Kenya a department of education was set up in 1966 which in 1970 became a faculty of education in Nairobi University where undergraduate in science and arts were taught. Earlier, a three year training course at Central Teachers Training College (CTTC) in Nairobi had been started in 1963 to supplement the small number of graduate teachers who were less than 100 at independence.

In 1966, Kenya Science Teachers College (KSTC) was established with Swedish aid to supplement the meager number of science teachers at that time. However since 1970's teacher education curriculum has remained rigid and narrow in nature and scope (Kafu, 2006). The curriculum has always emphasized training rather than preparation of teachers (Kafu, 2006). There has been no attempt to make it responsive to emerging trends in the society in general and education in particular, (Sr. Regina and Jacinta, 1995) as cited in Kafu (2006).Consequently it has continued to produce conservative and traditional school teachers who are pervasive to change, less creative and less innovative and unable to manage modern instructional and non instructional situations. Currently the quantity of trained teachers are far more than enough but the big question is how qualified are these teachers in efficiently and effectively executing the curriculum, (Nanjakululu, 2010).

2.2 Pre-service training of mathematics teachers for secondary schools.

Secondary school mathematics teachers are initially trained under Diploma in Education, Bachelor of Education and Bachelor of Arts or Bachelor of Science with a Post Graduate Diploma in Education. Currently those who initially trained under certificate programmes are furthering their studies by enrolling in diploma or degree programmes therefore qualifying to teach mathematics in the secondary schools. However most secondary school mathematics teachers train under bachelor of education(arts) ,bachelor of education (science), post graduate diploma in education and diploma in education programmes.

2.2.1 Bachelor of education degree programme

Bachelor of education mathematics course aims at producing a mathematics teacher who is equipped with methods and skills for teaching in secondary schools, primary and secondary teacher training colleges, ECDE teacher colleges, institutes and

polytechnics (Otunga,Odero &Barasa, 2011). The course content at this level has two major components: the mathematical content and the pedagogy. The mathematical content consist of the content of secondary school curriculum and advanced courses on some mathematics topics like calculus and analytic geometry, geometry and applied mathematics, probability and statistics, vector analysis, introduction to computers, ordinary differential equations and algebra.

Pedagogy is composed of general areas in education and special methods in teaching mathematics. There are also common university courses which include courses in communication skills, quantitative skills, development concepts, state society and development and entrepreneurship. Bachelor of education students are required to have a mean score of KCSE mean grade of C+ with a C in mathematics. All the students are required to take two teaching subjects.

Bachelor of education programmes are mainly offered by universities. Every university designs its own curriculum basing on its orientation. Each university design its own course code, course name, course units, number of hours per week, course duration, when the course will be offered during the degree programme, the objectives of the course, course description and the evaluation procedures. The Tables 2.1 and 2.2 give the mathematics content courses and pedagogy with general education courses offered by three different universities.

Table 2.1: Pedagogy and General University Courses offered by three Different Universities.

Pedagogy and General education Courses offered by university 1	Pedagogy and General education Courses offered by university 2	Pedagogy and General education Courses offered by university 3
1.Quantitative skills 1 2.Introduction to education 1 3.Communication skuills1 4.Communucation skills11 5. Development, concepts and application. 6.Quantitative skill 11 Introduction to Education11 7.General education psychology 8.General Methods of Teaching 9.Philosophy of education 10. State, Society and Development. 11. Introduction to teaching and school operations. 12. Education media practical and micro-teaching. 13.Curriculum development 14.Subjects special methods 15.Human Growth and Development 16. Educational measurement and evaluation. 17. School practice. 18.Sociology of education and Comparative Education 19.Enviromental Education 20.Educational Administration and Management 21. Human Behaviour and Learning. 22. Development project appraisal. .23.Education planning and economics of education. 24. Basic health and first aid. 25. Development project appraisal. 26. Advanced research and 27.Writing Skills.	1. communication skills1 2. History of education. 3.Introduction to psychology 4. Philosophy of education. 5. Communication skills 11. 6. Development philosophy 7. Statistical method in education. 8. Principle and theory of curriculum development. 9. Philosophy of learning. 10. General method and principle of teaching. 12. Education communication and technology 1. 13. Secondary school curriculum. 14. Introduction to computer application. 15. Education measurement and evaluation. 16Educational communication and technology. 17. General methods. 18. Principle of guiding and counseling 19. Mathematics subject methods. 20. Learning resource – 21. Comparative education. 22Education administration and management. 23. Health and physical education. 24. Education seminar. 25. Education planning in education. 26 Contemporary issues in education.	1.Introduction to psychology 2. Introduction to critical thinking. 3. Entrepreneurship. 4. History of education. 5. Development studies. 6. Communication skills. 7. HIV/Aids and drug abuse. 8. Environmental education. 9. Human growth and development. 10. Sociology of education. 11Educational psychology. 12. Curriculum development. 13. Educational technology. 14.Subject methods{mathematics1} 15. Philosophy of education. 16. Education, economics and planning. 17. Monetary theory and policy. 18. Sample surveys. 19. Comparative education and contemporary issues. 20. Educational administration.

Source: The university academic calendars of Nairobi University, Egerton University and Masinde Muliro University (The courses cannot be attached to the universities for the purposes of anonymity and ethical reasons.)

Table 2.2: Mathematics subject content Courses offered by three different universities for the bachelor of education degree programme

University1	University2	University3
1. Basic calculus1. 2. Geometry and elementary applied mathematics. 3.Calculus 11 4.Calculus and analytic geometry 5.Linear algebra 11 6.Vector analysis 7.Classical mechanics 8.Probability and statistics.1 9. Probability and statistics. 11 10.Real analysis1 11.Real analysis 11 12. Complex Analysis 13. Abstract algebra. 14. Numerical analysis1. 15. Advanced calculus. 16. Operations research1. 17. Rings and modules. 18. Estimation theory. 19.Partial differential equations	1.Basic mathematics 2. Geometry and linear algebra. 3. Calculus1. 4. Vectors and mechanics. 5. Quantitative techniques. 6. Calculus 11. 7. Probability and statistics 1 8. Linear algebra 1. 9. Probability and statistics 11. 10.Ordinary differential equations 1 11. Vector analysis. 12. Real analysis. 13. Complex analysis. 14. Numeral; analysis. 15.Partial differential equations 16. Topology. 17.Ordinary differential equations 11 18. Numerical methods.	1. Basic mathematics 2. Calculus1 3. Analytic geometry. 4. Calculus 11. 5. Calculus 111 5. Probability and statistics 1 6. Probability and statistics 11. 7.Ordinary differential equations 1 8. Probability and statistics 111. 9.Real analysis.1 10. Theory of estimation. 11. Time series analysis. 12. Design and analysis of experiments. .

Source: The university academic calendars of Nairobi University, Egerton University and Masinde Muliro University

2.2.2 Diploma in education programme.

Mathematics teachers in secondary school also train under diploma in education programme. The programme takes three years. The admission requirement is a C plain in KCSE with a C+ in the subject area of specialization. The mathematics programme at this level attempts to acquaint students with the content skills and methods for use in secondary schools. Trainees are offered a broad based curriculum which comprises two teaching subjects, and professional and support subjects.

Mathematics syllabus is divided into two: Content and Pedagogy areas. Mathematics content is supposed to consist of the content of secondary school curriculum and advanced courses on mathematics topics like Calculus, Geometry and Applied Mathematics, Probability and Statistics, and Algebra. Pedagogy is composed of two major areas: General pedagogy knowledge and Pedagogy content knowledge.

Initially this programme was offered by public diploma teacher training colleges like the Kenya Science Teachers College, Kagumo Teachers College and Kenya Technical Training Institute. These institutions offered more less similar curricula. However at present, universities also offer diploma in education. This has led to a lot of variation in the names and number of courses offered in the programme. Table 2.3 and Table 2.4 gives a list of mathematics content courses and professional and support courses offered in two different diploma institutions

Table 2.3: Mathematics courses offered by two different institutions for the diploma in education

Diploma courses from a university.	**Diploma courses from a diploma college**
1. Number systems. 2. Probability and Statistics1 3.ProbabilityandStatistics11. 4. Analysis and calculus1. 5. Analysis and calculus11. 6.Trigonometry, Geometry and vectors1 7. Trigonometry, Geometry and vectors11. 8. Algebra. 9. Graphs of Basic curves and Polar coordinates. 10. Special methods in mathematics.	1.Number system 2.Inequalities and linear programming 3.Mathematical proofs and series 4.Permutation and combinations 5.Elementary probability and statistics 6.Vector geometry 7.Transformation geometry 8.Graphs of basic curves and polar coordinates 9. Cartesian geometry. 10.Analysis and calculus 11.Probability and statistics 12.Linear algebra and vector geometry 13.Numerical methods 14.Elementary mechanics 15.Algebraic structures 16.Further probability and statistics 17.Computing and data processing

Source: The University calendars of Moi University and Kenya Science Teachers Training College.

Table 2.4: Professional and support courses offered in two different diploma institutions.

Professional courses offered in a university to diploma in education students.	**Professional courses offered in a diploma institution.**
1. History of education. 2.Education ,communication and technology' 3. Communication Skills. 4. Foundations and principles of physical education. 5. Philosophy of Education. 6. Sociology and Comparative education. 7. Curriculum development. 8. Psychology of human growth, development and learning. 9. Environmental education. 10. Physical Education and sports. 11. Library studies and ICT in education. 12. Media practical and micro-teaching. 13. Methodology in physical education. 14.Guidance and counseling' 15. Education planning and management. 16. Research methods and project writing. 17. Fundamentals and principles of entrepreneurship. 18. Education measurement and evaluation. 19. Health, life skill and peace education. 20. Teaching practice.	1. Psychology of human growth and development. 2. Educational technology. 3. History of education. 4. Learning psychology. 5. Measurement and evaluation. 6. Philosophy of education.. 7. Curriculum development. 8. Guidance and counseling. 9. School administration. 10. Typing and book keeping. 11. Comparative education. 12. General methods of teaching. 13. Education technology. 14. Project. 15. Mental health.

Source: The University calendars of Moi University and Kenya Science Teachers Training College.

2.2.3 Secondary school mathematics curriculum

Mathematics in the secondary school curriculum is one of the compulsory subjects found in group one of the subjects' cluster. It is one of the major subjects as evident in the number of lessons it is allocated in a week, that is, 6lesson in forms 1 &2 and 7 lessons in forms 3& 4.Secondary mathematics aims at producing a person who will be numerate, orderly, logical, accurate and precise in thought. The person should be competent in appraising and utilizing mathematical skills in playing a positive role in the development of a modern society .The curriculum has been designed in a way that ensures continuity from primary mathematics ,broadens the basic skills already established, takes care of the needs of those learners who will leave the normal education at the end of the four year secondary cycle and prepares those learners who will pursue further studies in the subject and other related courses. The curriculum is guided by the following general objectives as given in the Kenya Institute of Education Syllabus, (KIE 2002).

By the end of the course, the learner should be able:

1. To develop a positive attitude towards learning mathematics.
2. To perform mathematical operations and manipulations with confidence, speed and accuracy.
3. To think and reason precisely, logically and critically in any given situation.
4. To develop investigative skills in mathematics.
5. To identify, concretize, symbolize and use mathematical relationships in everyday life.
6. To comprehend, analyze, synthesize, evaluate and make generalizations so as to solve mathematical problems.

7. To collect, organize, represent, analyze, interpret data and make conclusions and predictions from its results.
8. To apply mathematical knowledge and skills to familiar and unfamiliar situations.
9. To appreciate the role, value and use of mathematics in the society.
10. To develop willingness to work collaboratively.
11. To acquire knowledge and skills for further education and training.
12. To communicate mathematical ideas.

The curriculum has 68 topics spread across 4years as outlined in the Table 2.5

Table 2.5 Mathematics Topics in the Secondary School Curriculum.

Form 1	Form2	Form3	Form4
1.Natural numbers 2.Factors 3.Divisibility test 4.Greatest common divisor(GCD)/Highest common factor(HCF) 5.Least common multiple(LCM) 6.integers 7.Decimals 8.Squares and square roots 9.Algebraic expressions 10.Rates, Ratios, Percentages and proportions 11.Length 12.Area 13.Volume and capacity 14.Mass, density and Weight 15.Time 16.Linear equations 17.Commercial arithmetic1 18.Coordinates and graphs 19.Angles and plane figures 20.Geometrical constructions 21.Scale drawing 22.Common solids	1.Cubes and cube roots 2.Reciprocals 3.Indices and logarithms 4.Equations of straight lines 5.Reflection and congruence 6.Rotation 7.Similarity and enlargement 8.Pythagoras theorem 9.Trigonometry 10. Area of a triangle. 11. Area of quadrilaterals and other polygons. 12.Area of part of a circle 13.Surface area of solids 14.Volume of solids 15.Quadratic expressions and equations 16.Linear inequalities 17.Linear motion 18.Statistics 19.Angle properties of a circle 20.Vectors1	1.quadratic expressions and equations 11 2.Approximation and errors 3.Trigonometry 11 4.Surds 5.Further logarithms 6.Commercial arithmetic 11 7.Circles chords and tangents 8.Matrices 9.Formulae and variation 10.Sequence and series 11.Vectors11 12.Binomial expansion 13.Probability 14.Compound proportions and rates of work 15.Graphical methods	1.Matrices and transformation 2.Statistics 11 3.Loci 4.Trigonometry11 5.Three dimensional geometry 6.Longitudes and latitudes 7.Linear programming 8.Differentiation 9.Area approximation 10.Integration

Source: KIE Syllabus.

2.3 Competence of mathematics teacher trainers

Mathematics teacher educators both at the university or teacher training colleges are the implementers of teacher education. They need to be competent in order to perform their duties effectively and efficiently (Okioma, 2010). Fullan (1982) points out that the quality of education and learning depends heavily on the competence of those who teach. Katz (1989) noted that the competence of the teacher is a central determinant of the quality and effectiveness of a programme. The teacher efficiency and effectiveness to implement a curriculum is determined by their academic and professional qualities as well as their experience as teachers. This then implies that the teacher trainers must themselves be trained teachers.

Biddle (1970) argues that teacher's competence, flexibility, and ability to innovate largely depend on their level of education and training. Teacher educators have to be familiar with the school realities, social environment and community expectation to realistically perform the challenging tasks before them. Teacher educators also need to be actively associated with the policy formulation, implementation strategies and monitoring programmes. This is because the professional quality of teacher educators will also determine the quality of the teachers. This would in turn determine the quality of school education.

From the literature above, it can be noted that mathematics teacher trainers should themselves be accomplished mathematics teachers through teacher training. They should also have practiced as teachers for a minimum of 5 to 6 years. Dreyfus and Dreyfus (1986) observe that in a period of six years most teachers have developed from beginners to experts. They no longer act analytically but their behaviour is based

on holistic paring of new situations with associated responses produced by successful experiences in similar situations. The teacher trainers should be conversant with both learner perspectives and methodology perspectives beside their academic background. Their approach to teaching and training should be informed from all the three perspective.

2.4 Subject knowledge (content)

Research on mathematics teaching suggests that many teachers do not possess the requisite subject-matter knowledge to implement high-quality instruction (Ball, 1990; Ball & Bass, 2000; Ball & Cohen, 1999; Hill, Ball & Schilling, 2004; Ma, 1999; National Commission on Teaching and America's Future, 1996).

The National Mathematics Advisory Panel (2008) underscores the need for teachers to know mathematics for teaching in order to teach effectively:

> Teachers must know in detail and from a more advanced perspective the mathematical content they are responsible for teaching and the connections of that content to other important mathematics, both prior to and beyond the level they are assigned to teach (p38).
>
> .

The logic herein is that teachers who possess strong mathematical knowledge at a greater depth and span are more likely to foster students' ability to reason, conjecture, and problem-solve, while also being able to more accurately diagnose and address students' mathematical (mis)conceptions and computational (dys)fluencies (Kilpatrick, Swafford, & Findell, 2001). Two challenges have been associated with ensuring that teachers have the adequate content knowledge to teach mathematics effectively. First, because mathematics education research has been fraught with philosophical differences, defining the content or subject matter that teachers should master has been a matter of some debate, (National Council of Teachers of Mathematics, 2006; National Mathematics Advisory Panel, 2008).

Second, the use of indirect indicators or proxies for teacher knowledge, such as certification, coursework, and teacher licensing exams, rather than more robust and direct measures of teachers' mathematical knowledge, has made the study of content knowledge and its link to student learning difficult, (Hill, Rowan, & Ball, 2005).

Despite these challenges, research on the relationship between teachers' mathematical knowledge and student achievement has offered some evidence of the impact of mathematical knowledge on teaching effectiveness and student learning. Most studies suggest general positive influences of teachers' studying mathematics on student achievement (Goldhaber & Brewer, 1997, 2000; Hawkins, Stancavage, & Dossey, 1998; Monk, 1994; Monk & King, 1994). These positive effects, however, are varied by skill level of the student (e.g., whether the students were enrolled in advanced or remedial classes) and number of undergraduate mathematics courses taken by the teacher (Monk, 1994). Although results in studies of teachers' mathematical knowledge and student achievement are mixed, it is evident that teachers' knowledge of mathematics content is a contributor to instructional quality and student achievement, (National Mathematics Advisory Panel, 2008; Wilson, Flodden, & Ferrini-Mundy, 2002).

These findings suggest that preparation and professional development programs for mathematics teachers should emphasize the mathematical topics for student mastery. The curriculum should emphasize integration of theoretical understanding with their practical application

Okioma (2010) noted that as a secondary school teacher one must acquire a good knowledge of his own specialty subjects. The teacher must have a thorough knowledge of the subjects, not only the core concepts of the subject but should also acquaint oneself with some newer areas of the subject. This strengthens the teacher's educational background. Fieter ,Vonk, and Akker(2001) observes that educational background is a very important factor when analyzing teacher characteristics. There is evidence that there is a relationship between formal education of teachers and the student performance. Brophy and Good (1986) states that:

> Research in mathematics and science instruction has shown that most concepts are counter intuitive or otherwise difficult to grasp and retain not only for students but also for teachers. Consequently teachers with limited backgrounds in certain subject matter areas may teach incorrect content or fail to recognize and correct their students' distorted understanding. Clearly, the effectiveness of lessons will vary with teachers' interests in and knowledge about the content being taught (P30).

Fuller (1987) and Fuller and Clarke (1994) confirm that in developing countries there is quite a strong relationship between the educational background of teachers and the students' achievement. The question that arises now is what kind and extent of content coverage will possibly enrich the student teachers of mathematics with adequate knowledge for classroom instruction? Key components of effective mathematics instruction addressed by the Innovation Configuration on effective practices for the teaching and learning of mathematics are the following:

1. Subject-matter knowledge in mathematics (or the teacher's knowledge of the content being taught)
2. Mathematics topics for student mastery
3. Knowledge about how to most effectively teach mathematics (or the teacher's knowledge and use of effective instructional strategies in teaching mathematics).

On mathematics topics for student mastery, National Mathematics Advisory Panel expressed the importance of student mastery in the critical foundations of algebra and the major topics of school algebra noting that algebra has long been identified as the gatekeeper to academic achievement and educational attainment. It continues to say that student proficiency in whole numbers, fractions, and aspects of geometry and measurement facilitate student understanding and advancement in algebra (National Council of Teachers of Mathematics, 2006). To foster students' mastery in these core mathematical domains and to promote more complex mathematical understandings of concepts, the panel recommended that all teachers of mathematics should master the major topics of school algebra identified in the National Mathematics Advisory Panel Report (2008: 16) shown below.

Major Topics of School Algebra

Symbols and Expressions

- Polynomial expressions
- Rational expressions
- Arithmetic and finite geometric series

Linear Equations

- Real numbers as points on the number line
- Linear equations and their graphs
- Solving problems with linear equations
- Linear inequalities and their graphs
- Graphing and solving systems of simultaneous linear equations

Quadratic Equations

- Factors and factoring of quadratic polynomials with integer coefficients
- Completing the square in quadratic expressions

- Quadratic formula and factoring of general quadratic polynomials
- Using the quadratic formula to solve equations

Functions

- Linear functions
- Quadratic functions—word problems involving quadratic functions
- Graphs of quadratic functions and completing the square
- Polynomial functions (including graphs of basic functions)
- Simple nonlinear functions (e.g., square and cube root functions; absolute value; rational functions; step functions)
- Rational exponents, radical expressions, and exponential functions
- Logarithmic functions
- Trigonometric functions
- Fitting simple mathematical models to data

Algebra of Polynomials

- Roots and factorization of polynomials
- Complex numbers and operations
- Fundamental theorem of algebra
- Binomial coefficients (and Pascal's triangle) Mathematical induction and the binomial theorem

Combinations and Finite Probability

- Combinations and permutations as applications of the binomial theorem and Pascal's triangle

The panel further noted that mathematics teachers must deepen their knowledge of this content, including the proper sequencing and closure of these topics and the topics that precede and follow them.

However, as noted by Okioma (2010), there are disagreements between colleges, schools and faculties of education and the academic departments in which student teacher learns the subject content. The content departments have developed fairly fine and detailed courses of study and sometimes so specialized to the extent that the content fails to address the curriculum content that the prospective teachers are expected to teach as revealed in Tables 2.2 and 2.3.

Ravitch (2000) also notes that departments have been accused of teaching courses which reflect a clear mismatch between the teachers' academic preparation and the increasingly vigorous demands of the classroom. Supporting this argument Feiter et al (2001) asserts that most teachers suffer from insufficient confidence and lack adequate subject mastery. They further noted that such teachers perform poorly in basic teaching skills, a cause they attribute to inadequate programmes for teachers preparation.

Yager (1980) recommends that to solve this problem both the content teachers and those who teach methodology should work together in designing the content suitable for prospective teachers. Shulman (1986) observed that professional knowledge among teachers comes from among other areas the discipline perspective which is based on the breadth and depth of the content knowledge. This comprises of understanding of the organization of concepts and principles in the discipline and the strategies the discipline uses to discover new knowledge, the development of strategies and materials to enable the learner to understand those concepts and processes as well as the use of that knowledge and its application in daily life.

Shulman's view presupposes in-depth understanding of the subject content and the development of strategies and materials to enable learners to understand those concepts. (Sundberg 1994 & 2002) cited in Okioma (2010:28) recommended that mathematics content and process should be integrated and that the number of topics covered in a single course should be reduced to improve students understanding of basic concepts coverage in the teacher. Sundberg also hold that teachers' content knowledge relates directly to student achievement, therefore concurring with Shulman (1986), Fuller (1987) and (Fuller &Clarke, 1994).

The review of 57 empirical research reports on united state teacher education done by Wilson, Floden and Ferrini-Mundy (2003) puts into evidence a positive connection between teachers' preparation in terms of subjects matter and the performance of their students. Other researchers like Wenglisnsky (2002), Gustafson, 2003), Wayne and Young (2003) have also arrived to the same conclusion.

2.5 Pedagogical knowledge

The teaching and learning of mathematics have been found to have some major setbacks due to lack of pedagogical content. Pedagogical content is a kind of knowledge known to anticipate specific student understanding and misunderstanding in specific instructional contexts and showing strategies (methods) ready to employ when students demonstrate misunderstanding or understanding. This is a kind of knowledge that a teacher is required to posses to be considered competent in his/ her teaching. Researcher Ball (1996) has a strong believe that what is needed for competent teaching in any domain is a combination of sound subject matter knowledge and general pedagogical training that a teacher must have for effective teaching and learning to take place.

Traditionally the teaching of mathematics is about telling or providing clear step by step explanation of procedures while students learn by listening and practicing these procedures. Hiebert (2003) had noticed the deficiencies of this traditional approach which is a contrast to the pedagogical knowledge reform advocated in the constructivist's view of teaching and learning which emphasize students' conceptual understanding and discourse in the mathematics classrooms within the contexts of reform in mathematics.

This call for the development of pedagogy which address issues that are content specific as proposed by Geddis (1993) .This suggest that to be an effective teacher of mathematics, it is necessary to know not only the content of various topics, the subject knowledge of the topics but also the topic specific pedagogy. Bucat (2004) supports this view by noting that an effective teacher should not only know the content of various topics, the subject knowledge of the topics but should also know the particular teaching and learning demands of that particular topic.

This view is also supported by Kind (2009) who noted that even in teaching their subject of specialization pre-service teachers need pedagogical content knowledge to transform good subject matter knowledge into effective lessons. An interview with shulman reported in Berry, Loughram and Van Driel,(2008) further supported this view by noting that, Just knowing the content well was really important, just knowing the general pedagogy was really important and yet when you added the two together you do not get the teacher.

To account for this, Shulman (1986) introduced the PCK and proposed that analogies, illustrations, examples, explanations, and demonstrations should be included.

Research has established that teacher beliefs about how to teach mathematics are linked to their pedagogical knowledge and consequently student learning in the classroom, (Philip, 2007, Thompson 1992, Wilson & Cooney 2002).

This suggest that a graduate of particular subject is likely to start the transformation into a teacher of that subject when they begin to consider how best to teach the subject content in order to make it learnable by others. Hence an understanding of the true pedagogical competency knowledge is essential as an antidote to such quick fixes for bolstering teacher knowledge more adequately (Popoola & Odili, 2011). A report from the Science and Learning Expert Group (Department of Business Innovation and Skills, 2010) stresses the importance of providing subject specific training in initial teacher training specifically recommending that;

> …the consistency between initial teachers training (ITT) provides in the balance between Subject specific and general pedagogy training to ensure that subject specific pedagogical training receives high priority. Recommendation 4, (p10).

The implication here is that more units on specific subject pedagogy should be given to the teacher trainees compared to the general pedagogy. The challenge of teacher preparation in terms of pedagogical knowledge preparation programmes, however, is the limited amount of time used to impact the experiences and nudge teachers' mathematics pedagogical knowledge and increase their efficiency for teaching mathematics. Teacher understanding of fundamental mathematics pedagogical knowledge and competencies required to face the challenge of teaching is the focus of this study.

2.6 Micro Teaching.

Micro- teaching is a teacher training technique which helps the teacher trainee to master the teaching skills such as class management enforcement, stimulus variation, explaining, probing questions, use of chalk board, illustrating with examples etc. The idea of micro teaching originated at the stanford university in USA in 1963 when an experimental proposal on the identification of teaching skills was in progress. Since then, this technique has been widely used in almost all colleges and universities with great emphasis in all the teacher training programmes of developing teaching skills and competences among teacher trainees.

According to Singh (1977) micro teaching is a scaled down teaching encounter in which a teacher teaches a small unit to a group of 5 pupils for small period of 5- 20 minutes .Such a situation offers a helpful setting for an experienced or inexperienced teacher to acquire new teaching skills and to refine old ones.

Micro teaching, according to Aggrawal (2002), is the process of subjecting samples of human behaviour to the 5Rs of video tape recording, reviewing, responding, refining, and redoing. It is a method of teaching in which a video tape of small segment of a student's classroom teaching is made and later evaluated.

According to Jongira and Singh (1981), micro teaching is a training setting for the student teacher where complexities of a normal classroom teaching are reduced by;

(i) Practicing one component of skill at a time.

(ii) Limiting the content to a single concept.

(iii) Reducing the size to 5 to 10 pupils.

(iv) Reducing the duration of the lesson to 5 to 10 minutes.

The components of micro- teaching are-

(i) Teacher

(ii) The pupils

(iii) A brief lesson

(iv) The objectives of the specific micro- teaching occasion

(v) Feedback by the supervisor by using audio tape recording , video tape recordings and closed circuit television

According to Cliff, Simocini and Davidson (1976) micro- teaching procedure has three phases;-

(i) Knowledge acquisition phase

This is where the student teacher tries to get the knowledge of the skill to be practiced by reading relevant literature concerning the skill and even observing a demonstration lesson, by expert of the skill and the subject, in which the skill figures prominently. This helps the teacher trainee to get theoretical as well as practical knowledge of the skill.

(ii) Skill acquisition phase

This is where the student teacher acquires the skill through a lot of practice. He prepares the micro lesson, teaches it to have practice and through feedback evaluate his performance. He then re plans the lesson with modifications and improvement and then re-teaches the lesson. This is followed by re-feedback in order to enable him have mastery of the teaching skill.

(iii) Transfer phase

After attaining mastery levels and command over each of the skills, the teacher trainee integrates all these skills and transfer to actual classroom teaching.

Micro- teaching cycle

The six steps generally involved in micro teaching are:-

Plan- teach- feedback- re plan- re teach- feedback

These steps are diagrammatically represented in the figure below.

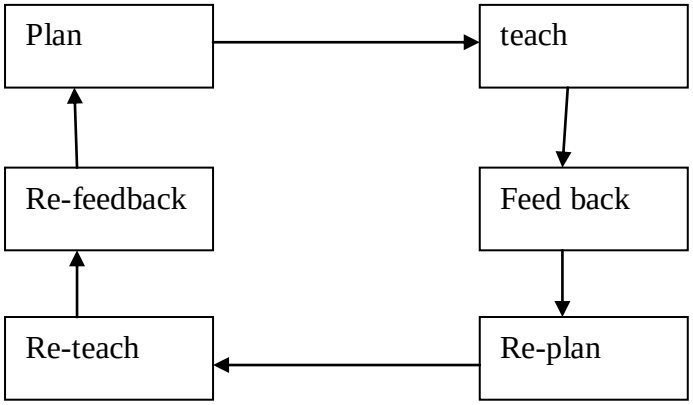


Figure 1.2: Source (Edufocus,24th January 2012)

Plan: - This involves selection of the topic and related content in which the use of the component of the skill under practice may be made easily and conveniently. The topic is analyzed into different activities of the teacher and the pupils. The activities are planned in such a way that maximum applications of the components of the skill are possible.

Teach:-This is where the teacher trainee attempts to use the component of the skill in suitable situations coming up in the process of teaching- learning as per his planning of activities

Feedback: - This is where the teacher trainee receives information on the points of strength as well as weakness relating to his performance. This helps the teacher trainee to improve his performance in the desired direction

Re-plan:- The teacher trainee re plans his lesson incorporating the points of strength and removing the points that were not skillfully handled during teaching. He can use the same topic or another topic suitable for his improvement.

Re-teach:- This is where the teacher trainee teaches the class with renewed courage and confidence to perform better than the previous attempts. He can teach the same group of pupils if the topic is changed or teach another group of pupils if the topic is the same. This is done to remove boredom or monotony.

Re-feedback: - information is further given to the teacher trainee for behavior modification in the desired direction in each and every skill practice.

Micro teaching has the potential efficacy of ensuring that the teacher trainee gets the required teaching skills to a certain level of proficiency before being exposed to real classroom situation. Akalin (2005) and Benton-Kupper (2001) notes that micro teaching, a valuable instructional tool for pre service teacher education program, is more effective than traditional teaching if the required equipment and atmosphere are provided.

According to Subramaniam (2006), micro teaching experiences provide student teachers with the following benefits;

1. It exposes student teachers to the realities of teaching.
2. It introduces student teachers to their roles as teachers
3. It helps them to see the importance of planning, decision making and implementation of instruction.
4. Enables them to develop and improve teaching skills.
5. Helps them to build their confidence for teaching

Micro teaching may be mini in nature but mighty in effect. It improves the teaching skill by uncovering and correcting the problematic aspect of the instruction. However, Agugbeum (2002) observed that the adequacy and efficiency of micro teaching as a teacher training techniques require a review saying that it does not adequately prepare teachers for effective teaching.

2.7 Teaching practice

In Kenya teaching practice is one of the most influential components in the preparation of pre-service teachers. It is a practical component of pre service teacher education programme that is supposedly content delivery bound. This practical component lasts between 6 to 12 weeks which gives the student teacher an in-depth exposure to real classrooms teaching. Primarily, teaching practice invites the student teachers to exercise all the skills learned in a real classroom situation.

Arends (2004) urges that the main purpose of the teaching practice component in pre-service education is to create a diversified scholastic expertise amongst the practicing school teachers to meet the challenges that they have to face in future in the classroom. The professional competency and development of student teachers pertains to building the instructional design, maintaining pedagogical quality, ensuring efficient content delivery and disseminating core set of knowledge gained through the pre-service training.

Teaching practice component of the teacher education aim at improving student behaviour, testing knowledge of subject matter, receiving constructive criticisms, discovering teaching strengths and weaknesses and developing a core set of pedagogical values to which a professionally component teacher adheres to.

The Sindh University Journal of Education (2008) observed that teaching practice component comprises very short duration. Teachers hardly develop their knowledge and skills of different teaching methodological in this short span of time. Bachelor of Education (BED) trained teachers experience practical constraints while commencing their career as teachers in different schools. Teaching practice consequently does not help the trained teachers achieve their professional objectives. It has been observed that during teaching practice, student teachers focus more on completing their lessons and its relevant activity and ignore their skills in developing effective lesson plans. The real classrooms quality is affected in this quest of activity completion for the sake of certificate, diploma or degree attainment.

Education researches by Koehler (1988), Sabar (2004) and Korthagen, Longhran and Russel (2006) describe teaching practice as being likely to have either negative or positive attributes developed amongst student teachers. This notion is further advocated by Tang (2003) and Tickle (2000) who posit that teaching practice often fails to achieve the desired pedagogical outcomes despite exorbitant time spent on teaching practice. It seems as a non performing scholastic activity that brings little change.

Beck and Kosnik (2002) dwells on the philosophy that teacher training component must be based on sound knowledge about its practical application in real classes to produce satisfied and effective professional teachers. Good (1983), elaborates that teaching practice components help to create an effective and reliable teacher who can assume his role competently in a natural classroom setting. Stone and Morris (1972) advocates that teaching practice is integral to the profession of teaching as it develops

the teachers' knowledge structure, instructional framework and students teaching mechanism. This can help improve the behaviour of teachers while delivering a lesson in an educational reform Endeavour. This leads to the conclusion that the major task of teaching practice is to build the core competency of teachers not only in the real classes, but also after the lesson has been delivered.

Supervision of student teachers during the teaching practice is a very important aspect. According to Dewey (cited in Anderson 2001), the conceptualization of supervision can either be in form of apprenticeship or more a kin to laboratory experience. Lyle and Stone (1987) stressed that supervision during teaching practice facilitates student teachers professional learning by bridging the gap between theory and practice. White (1989) stresses that teaching practice supervisor needs extensive training for this time consuming functions of the supervisor as the interpreter and an assessor.

The supervisor's function is to go into the school to observe the student teachers and make suggestions about their teaching. The supervisor's role according to Stone (1987), comprises, those of a manager, counselors, instructor, observer, feedback provider and evaluator. However, teaching practice supervisors have been observed to experience incompetence in real classes.

Researchers also suggests that during the teaching practice cycle student teachers must observe some of the regular teachers in their classes, watch their lessons and get the feeling of the school and of the atmosphere in different classes.

2.8 Related Studies

Various researchers have studied various issues relating to the teaching and learning of mathematics and the teacher training.

Olochoky(2011) studied the factors that contribute to poor performance in mathematics in KCSE examinations. His findings revealed that students attitudes, wrong teaching methods and availability of teaching and learning resources leads to poor performance in KCSE.

Masibo(2007),in his study on the effects of use of calculators in students attitude and achievement found out that the use of calculators in learning mathematics yields improved attitude by learners and gain in achievement scores in comparison to when conventional tools are used.

Nanjankululu (2010), in his study of the perception of teachers towards their pre-service training, found out that the content learned across all the subjects was irrelevant and inadequate to the actual classroom needs. He further established that those who went through the post graduate diploma in education programme felt that the training was relevant, adequate and that the teaching methods are easily applicable. Nanjankululu concluded that preparing teachers by first teaching the subject content followed by the teaching methods can be the best way of training teachers.

Okioma (2010), in his comparative study of the training of biology teachers by Kenya Science Teachers Training College and Moi University revealed that Kenya Science Teachers College graduates are better prepared in subject content and performance of biology practical than the Moi University graduates. Other researchers have also studied others issues pertaining to mathematics for example Pupil's capacity to use

mathematical terminologies, (Rotich, 2007) and Impact of SMASSE project on the teaching and learning of mathematics, (Langat, 2009).

However, despite the recommendations made by these researchers, performance in mathematics has not improved significantly. This calls for the need to study others factor that could be affecting the teaching and learning of the subject. This study therefore sought to establish the perception of mathematics teachers towards their pre-service training in preparing them to teach in secondary schools.

2.9 Summary of the Chapter

From the literature it is clear that for the effective training of secondary school mathematics teachers, certain specified conditions must be satisfied. These include using trainers who are accomplished mathematic teachers through training. Teachers must acquire a good knowledge of their specialty subject, particularly the content that they are going to teach, and that teachers must be well grounded in pedagogical knowledge. Similarly, teaching practice component of the teacher education aim at improving student behaviour, testing knowledge of subject matter, receiving constructive criticisms, discovering teaching strengths and weaknesses and developing a core set of pedagogical values to which a professionally component teacher adheres to.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter presents the research methodology procedures that were used to carry out the study. It entails the research design, study area, population of the study, sample size and sampling techniques, research instrument, data collection procedures, data analysis, ethical consideration and summary of the chapter

3.2 Study Area

The study was conducted in Konoin Sub County. The Sub County is located in Bomet County. It boarders Bureti Sub County to the West, Kuresoi Sub County to the East, and Bomet Central Sub county to the South. The economic activities in the area are mainly tea farming. Maize and dairy farming is also practiced but in small scale. Part of the famous Mau Forest is in the sub county. The district has 33 secondary schools. The researcher chose this area because no such study has been conducted in the same area. Similarly, the teachers teaching in the area are a representative of all the other teachers in Kenya since they trained from the same institutions. Finally, the researcher knows the physical location of all the schools in the district which makes it easy for the researcher to access all the schools.

3.3 Research Design

Research design is the plan, structure and strategy of investigation conceived so as to obtain answers to research questions and to control the variances. It is the arrangement of conditions for collection and analysis of data in a manner that aims to

combine relevance to the research purpose with economy in procedures, (Kothari, 2011).

The study was conducted using the descriptive survey design which utilizes both qualitative and quantitative research strategies. Descriptive research deals with the collection of data in order to test hypothesis or answer questions concerning the current status of the subjects in the study. It determines and reports the way things are (Mugenda & Mugenda, 2003). This design was appropriate to the study, since the researcher was able to establish and describe the state of affairs as they exist at present concerning the problem at hand Kothari,(2011). Survey according to Oso and Onen (2008) provides numeric descriptions of some part of the population. It is also suitable for extensive research and rapid data collection. This makes the design appropriate for the research.

3.4 The Study Population

The target population refers to the total number of participants in the total environment of interest to the researcher. Mugenda and Mugenda (1999) refer to it as an entire group of individuals, events, or objects having common observable characteristics. The targeted population in the study comprised of the Mathematics teachers and heads of mathematics departments in Konoin Sub County, Bomet County. There are a total of 30 public schools and 3 private schools in the Sub County. Out of the30 public schools, 6 are County schools while 24 are Sub County schools. There are a total of 78 mathematics teachers in the sub county.

3.5 Sampling Techniques and Sample Size.

Sampling is the procedure a researcher uses to select people, places or things to study. It is the process of selecting a number of individuals or objects from a population such that the selected group contains elements representative of the characteristics found in the entire group (Orodho and Kombo, 2002).

The population of schools from where the teachers were drawn to participate in the study was small (33 schools).Similarly the total number of mathematics teachers in the district was manageable (78). The researcher therefore felt that it is fitting to carry out the census in the study hence sampling procedure was unnecessary.

The HODs were however sampled. This is because the information from the HODs was only needed to supplement the information given by the teachers. Stratified sampling was used to select schools from where the HODs participated in the study. This was done by categorizing the schools into County, Sub county and private to ensure equitable representation of the population in the sample. The number of schools selected were11 (30% of the total population) as Kothari (2008), states that (10-30%) is adequate representative sample of the entire population. Simple RANDOM sampling was then used to select 7 Sub county schools, 3 County schools and 1 private school. This was done by assigning random numbers to secondary schools written on small “same-size-and-quality” pieces of papers, shuffling them thoroughly in an opaque closed container and then picking one by one until the desired sample was obtained. This ensured that the samples were selected without bias. All the mathematics teachers in the district participated in the study. The sample size comprised of 11 HODs (30%of 33 schools) and 78 mathematics teachers.

3.6 Research Instruments

Instruments are tools by which data are collected, (Mutai, 2002). According to Warwick and Lininger (1975), in carrying out research, researchers want methods which provide high accuracy, generalizability and explanatory power with low cost, rapid speed and a minimum of management demands, with administration convenience. He further asserts that the most frequent source of relevant data for training needs survey includes recorded data, interviews, questionnaires and observation. It is against this background that the study employed interviews, questionnaires and document analysis in collecting information concerning pre-service training of secondary school mathematics teachers.

3.6.1 Questionnaires

According to Brown (2001) questionnaires are written instrument that present respondents with a series of questions or statement to which they are to respond to either by writing down their answers or selecting from among the existing answers. Questionnaires were used because they gave the respondent adequate time to provide well thought out responses in the questionnaire items. Questionnaires are also cheaper and can be administered to many respondents within a short time. Nevertheless, this method has inbuilt inflexibility because of the difficulty of amending the approach once questionnaires have been dispatched; there is also the possibility of ambiguous replies or omission of replies altogether to certain questions (Interpretation of omissions is difficult) and it is difficult to know whether willing respondents are truly representative, (Kerlinger, 1973).

This data- gathering tool was preferred because it enabled the researcher to collect data from a large number of respondents within the limited time during which the research was conducted. One type of questionnaire designed for teachers was used. The questionnaire consisted of mostly closed ended and few open- ended items were used. This was meant to avoid ambiguous and irrelevant information to the researcher (Mugenda & Mugenda, 1999). For closed- ended questionnaires, five- point and three point Likert scales were used to measure opinions of the respondents. The researcher was able to overcome the constraints by carrying out a pilot study and administering the questionnaires personally and hence giving guidance to the respondents. The questionnaires were administered to all the 78 teachers of mathematics in the district. The teacher's questionnaire used in the study is shown in appendix A.

3.6.2 Document Analysis

This is a critical examination of public or private recorded information related to the issue under investigation (Oso &Onen, 2008). The researcher went through documents in the DEO's office to get data on the number of schools in the district, their categorization and number of mathematics teachers. The secondary school mathematics syllabus book, the university academic calendars and the Kenya Science Teachers Colleges course structures were also used to get information on various mathematics and professional course units offered by different institutions. This enabled the researcher to effectively organize for the study.

3.6.3 Interview Schedule

According to Oso and Onen (2008) this involves person to person verbal communication in which one person (or a group of persons) asks the other questions intended to elicit information or opinions. The interviewer may catch the informant off- guard and thus may secure the most spontaneous reactions that would not be the

case if questionnaire is used (Kothari, 2011). However, this method is expensive, time consuming, subject- to interviewer bias, and presupposes good rapport with respondents to get free and frank responses.

In addition, certain types of respondents such as important officials may not be approachable and to that extent, the data may prove inadequate. The researcher used the interview schedule to collect information from the HODs of the respective schools. This enabled the researcher to collect supplementary information about the respondents' personal characteristics and environment which was of great value in interpreting results (Kothari, 2011). The researcher also used the information from these interviews to verify the information given by the teachers. The interview schedule used in the study is shown in appendix B.

3.7 Validity and Reliability of Research Instruments

Reliability and validity are concerned with objectives accuracy, precision, consistency and stability of research instruments.

3.7.1 Validity of the Research Instrument

Mugenda and Mugenda (2003) define validity as the degree to which results obtained from the analysis of the data actually represent the phenomenon under the study. For validity of instruments, the researcher consulted colleagues, supervisors and experts in the Department of Curriculum Instruction and Education Media of Moi University who helped in determining whether the instruments solicited relevant information. Their suggestions and clarifications were used to improve on the instruments. The experts examined the validity of the measuring instruments as well as the adequacy. Their suggestions were also used to improve on the instruments.

3.7.2 Reliability of the Research instruments

Reliability is a measure of the degree to which a research instrument yields consistent results or data after repeated trials (Mugenda & Mugenda 2003). Bell, (2005) points out that piloting is one way of checking ambiguity of poorly prepared items.

A pilot study was carried out to test the reliability of the instruments in two schools in the neighboring Bureti Sub County before the actual research was carried out. The test re-test method was employed to test the reliability of the questionnaires and interview schedules. The first test was administered to the respondents and after two weeks a second test was given to the same respondents. The two tests were analyzed separately. Corrections and adjustments on areas of weakness were made to the instruments. The Pearson's product moment correlation (r) was used to calculate the reliability coefficient between the first and second scores. The formula is as shown below;

$$r = \frac{N\sum xy - (\sum x)(\sum y)}{[N\sum x^2 - (\sum x)^2][NY2 - (\sum y)^2]}$$

Where

r = coefficient of reliability

N = Total number of subjects

X = Rated values of 1st administered test

Y = Rated values of 2nd administered test

$\sum$ = Summation

A correlation coefficient of (r) 0.85was obtained for the mathematics teachers and 0.80 for the Mathematics Heads of Department's interview schedules. Since 0.8 was more than 0.7 it was considered appropriate to ascertain the reliability of the

instruments. Mugenda and Mugenda, (2003) note that, reliability co-efficient of 0.7 or more is appropriate to ascertain the reliability.

3.8 Data Collection Procedure

The researcher obtained an introduction letter from Moi University and a research permit from the National Council for Science and Technology before embarking on the data collection process. A prior visit to schools was also made for purposes of booking appointments with teachers. The researcher personally delivered the research instruments, administered and collected them for analysis.

3.9 Data Analysis

Data analysis entails the separation of data, to distinguish its component parts, or elements separately or in relation to the whole (Oso & Onen, 2008).This process started after all the research instruments had been collected from the respondents. Data was then analyzed using both quantitative and qualitative techniques. Data collected was tabulated and frequency tables established. The frequencies were converted to percentages to illustrate relative levels of opinions. Information gathered was analyzed using descriptive statistical technique. This technique was chosen because data obtained was mainly nominal and ordinal. The Statistical Package for Social Sciences (SPSS) assisted to analyze the data collected.

3.10 Ethical Considerations

Considering the sensitivity of information about the study at hand, the researcher explained to the respondents the purpose of the study and how confidentiality will be guaranteed and the importance of the findings. The research tools were also designed in such a way that the data could not be linked to a specific respondent or secondary school. The researcher also assured the respondents of confidentiality of the source of

the collected data. Research principles of privacy and confidentiality of respondents were adhered to. Similarly, the researcher also ensured that he gets approval from the Ministry of Education and the respective schools' administration where the research was conducted.

3.11 Summary of Chapter Three

The research design, study area, population of the study, instrumentation, sample size and sampling procedure discussed in this chapter were found out to be appropriate for the study. Reliability and validity of the research instruments, data collection procedure, data analysis and ethical consideration are also appropriate. These helped the researcher to collect data, organize, analyze, interpret, discuss findings, draw conclusions and make the necessary recommendations on the study.

CHAPTER FOUR

DATA PRESENTATION, ANALYSIS, INTERPRETATION AND DISCUSSION OF FINDINGS

4.1 Introduction

This chapter deals with data analysis and the interpretation of findings based on responses in the questionnaire, interview schedule and document analysis. Data analysis refers to examining what has been collected in a survey or experiment and making deductions and inferences out of the same. It involves uncovering underlying structures, extracting important variables, detecting any anomalies and testing any underlying assumptions. It involves scrutinizing the acquired information and making inferences, (Kombo &Tromp, 2006**).**

Discussion of results is based on the following objectives

The perception of mathematics teachers on the;

i. Relevance of mathematics content learned during their pre- service training to the mathematics teachers' needs in the secondary school.
ii. Suitability of the teaching methods learned during the pre-service training to their teaching needs in secondary schools. practice
iii. The effectiveness of micro-teaching in preparing them for teaching in the secondary schools.
iv. The role of teaching practice in preparing them to teach in the secondary schools

4.2 Response rate

This section gives the background information on the response rate of mathematics teachers and heads of department. Their response rate is as illustrated in Table 4.1

Table 4.1: Response rate

Respondents	**Expected No. of participants**	**Actual Participants**	**Response rate (in%)**
Heads of departments	11	10	90.90
Mathematics teachers	78	70	89.74
Total	**90**	**80**	**90.32**

Results in the Table 4.1 showed that out of the 78 expected mathematics teachers, 70 of them representing 89.74% responded to the questionnaires. This return rate was contributed by the fact that most teachers were out on invigilation and supervision of National Examinations during the research period. Questionnaires for the absent teachers were left behind for them to fill and were to be collected later. Some of them (8) however did not fill leading to the drop in the response rate.

Ten (10) heads of departments representing 90.90% percent out of the expected 11 were interviewed. This high rate was due to the fact that the schools were almost closing and being teachers they were in school busy marking examinations in preparation for the closing of the school. The one, who was not interviewed, was out on national examination supervision.

4.3 Initial Qualification of the Teachers

This section gives the initial qualification of respondents categorized as diploma, degree and BA/BSC with PGDE. This is the qualification with which the teachers entered the teaching profession. The analysis of the same is given in the Table 4.2.

Table 4.2: Initial Qualification of the Teachers

Mathematics teachers	**Number**	**Percentage**
Diploma	24	34.30
B/Ed	42	60.00
BA/ BSC with PGDE	4	5.70
Total	**70**	**100**

Out of the 70 mathematics teachers who responded to the questionnaires, 24 of them representing 34.30% initially trained under Diploma in Education programme, 42 of them representing 60% initially trained under Bachelor of Education degree programme while 4 of them represent 5.70% initially trained under either Bachelor of Arts or Bachelor of Science degree programme with PGDE. It is evident that majority of mathematics teachers in the secondary school initially trained under B/ED programme followed by those who initially trained under diploma in education programme.

4.4 Present Qualification of Teachers

This section gives the present qualification of the mathematics teachers who participated in the study. The qualification is categorized under Degree, Diploma, BA or BSC with PGDE and Post graduate degree level. Analysis of the same is given in the Table 4.3.

Table 4.3 Analysis of the Present Qualification of Teachers

Mathematics teachers	Number	Percentage
Diploma	6	8.60
B/Ed	51	72.86
BA/ BSC with PGDE	2	2.86
Post graduate degree	11	15.71
Total	**70**	**100**

Table 4.3 shows the current qualification of all the mathematics teachers who responded the questionnaires. Out of the 70 mathematics teachers, 6 (8.l6%) currently hold a diploma certificate. Comparing this with their initial training where there were 24 diploma teachers, it means that 18 diploma teachers have been able to further their studies to higher levels, 51 (72.86%) teachers are currently B/ED degree holders which is an increase from the initial 42 (60%). This also gives an indication that nine (9) B/ED teachers have been able to further their studies to post graduate level. Those who initially trained with BA/BSC with PGDE have changed from 4 to 2 and those with postgraduate degrees have increased to 11. This implies that mathematics teachers at all levels are motivated to further their studies.

4.5 Teaching Experience

This section gives the teaching experience of the mathematics teachers categorized as 0-5 years, 6-10 years, 11-15 years and above 15years. Analysis of the same is given in the Table 4.4.

Table 4.4: Analysis of the teaching experience of the teacher

Years	Frequency	Percentage
0-5 years	12	17.14
6-10 years	15	21.43
11-15 years	27	38.57
Above 15 years	16	22.86

From Table 4.4, 12(17.14%) of teachers have taught for between 0-5 years, 15(21.43%) have taught for between 6-10 years, 27(38.57%) have taught for between 11-15 years and16 (22.86%) have taught for above 15 years. This implies that majority of teachers (82.86%) are experienced enough to evaluate the pre-service training programme as Dreyfus and Dreyfus (1986) observed that in a period of 6 years most teachers have developed from beginners to experts.

4.6 The Mathematics subject matter content

This section addresses the first objective of the study which sought the perception of mathematics teachers on the mathematics subject content that they learned during their pre- service training in preparing them to teach in the secondary school**.** To achieve this objective four questions were asked to the respondents under the sub-headings below.

4.6.1 Relevance of Pre-service Mathematics subject content to the secondary school mathematics teachers' needs

Mathematic teachers were asked to respond to the question that the mathematics subject content they learned in college is relevant to what they teach in the secondary school. They were to respond using a scale of 1-5, that is, SA-strongly

Agree, A-Agree, U-Undecided, D- Disagree and SD-strongly Disagree. Their responses are recorded in the Table 4.5

Table 4.5: Teachers' responses on the relevance of mathematics subject content

Mathematics content learned in college is relevant to what is taught in the secondary school	**Frequency**	**Percentage**
Strongly Agree	3	4.30
Agree	16	22.90
Disagree	37	47.10
Strongly Disagree	18	25.70
Total	**70**	**100.0**

From Table4.5, 18(25.70%) respondents strongly disagreed that the mathematics content that they learned during their pre-service training was relevant, 37(47.10%) did disagree that the mathematics content that they learned during their pre service training was relevant. 16(22.90%) percent agreed that the content they learned was relevant while 3(4.30%) strongly agreed that the content that they learned was relevant. It is then coming out clearly that a larger number of respondents 55 (72.80%) that is disagree and strongly disagree ,felt that the content that they learned in college is not relevant to what they teach in the secondary schools. Similarly, 19(27.20%), that is, Agree and Strongly Agree, felt that what they learned is relevant.

This is in agreement with other researchers like Ball (1990), Ball & Cohen (1999), schilling &Ball (2004), Ma (1999) and National Commission on Teaching and Americans Future (1996) who underscored that many teachers do not possess the requisite subject matter knowledge to implement high quality instruction.

This may imply that the mathematics teachers may not be effective in the teaching of the subject. The National Mathematics Advisory Panel (2008) underscores the need for mathematics teachers to know mathematics for teaching in order to teach effectively .It noted that teachers must know in detail and from a more advanced perspective the mathematical content that they are responsible for teaching and the connections of that content to other important mathematics, both prior to and beyond the level they are assigned to teach.

This perceived lack of relevant mathematics content for teachers may be the reason why students are performing dismally in mathematics as the National Mathematics Advisory Panel's Task Group on Teacher Education (2008) posit that research on the relationship between teachers' mathematical knowledge and students' achievement supports the importance of teachers' content knowledge in students learning.

4.6.2 Relevance of Mathematics subject content analyzed along initial level of pre service training.

The findings in the Table 4.5 were further analyzed along the level of initial pre-service training of the respondent teachers and the findings are recorded in Table 4.6

Table 4.6: Relevance of pre-service mathematics subject content analyzed along the level of initial pre service training.

	Mathematics content learned is relevant to what is taught in the secondary school.				
First qualification	**SA**	**A**	**D**	**SD**	**Total**
Diploma	3(12.50%)	12(50%)	4(16.67)	5(20.83%)	24
Degree	0(0%)	2(4.76%)	27(64.29%)	13(30.95%)	42
BA/BSC with PGDE	0(0.00%)	2(50%)	2(50%)	0(0.00%)	4
Totals	**3**	**16**	**33**	**18**	**70**

From the Table 4.6, Out of the 51(72.80%) teachers who felt that the content that they learned in the pre- service training is not relevant to what they teach in the secondary school, 9(17.60%) initially trained under diploma in education, 40(78.40%) initially trained under Bachelor of Education Degree Program while 2(3.90%) initially trained under BA or BSC Degree Programmes.

The implication here is that more bachelor of education degree holders (78.49%) felt that what they learned is largely irrelevant to what they teach compared to their diploma (17.60%) or BA or BSC with PGDE (3.90%) counterparts. This is further confirmed by a content analysis of the secondary school mathematics syllabus, diploma college mathematics courses and B/ED mathematics courses which revealed that secondary school has 67 topics, diploma college offer between 10 and 17 mathematics courses while B/ED University programme offers between 12 to 19 mathematics units. Further analysis revealed that diploma units relates to between

55.22% to 88.23 %of the secondary school topics at its level while B/ED courses relates to 5(7.46%) secondary topics and at an advanced level. This is in agreement with the findings of Okioma (2010) who noted that the university teaching is largely theoretical and fails to address the teaching needs of schools. His respondents felt that much of the content they covered in the university was largely irrelevant for secondary school teaching.

Poor performance that has for many years been recorded in secondary school mathematics may be attributed to this poor preparation of teachers in terms of subject content. This believe tends to agree with the position held by Darling-Hammond and Hudson (1989), who observed that how well prepared teachers are, depends on what they have taken during their training and how well these courses compare to the actual content and skills required for teaching the intended curriculum.

4.6.3 Ability of the mathematics teachers to confidently teach secondary mathematics using the subject content learned during the pre –service training.

Mathematic teachers were asked whether they could confidently teach secondary school mathematics using the mathematics content that they learned in college. They were to respond using the scale of 1-5, that is, A-strongly Agree, A-Agree, U-Undecided, D- Disagree and SD-strongly Disagree. Their responses are recorded in the Table 4.7.

Table 4.7: Ability to confidently teach using the subject content learned during the pre service training.

	Frequency	Percentage
Strongly agree	4	5.70
agree	16	22.90
undecided	3	4.30
disagree	30	42.90
Strongly disagree	17	24.30
Total	**70**	**100.0**

From the Table 4.7, 47 (67.20%) mathematics teachers did not agree that they can confidently teach secondary school mathematics using the subject content learned in college while 20(28.60%) agreed that they can confidently teach secondary mathematics using the subject content learned in college. However, 3(4.30%) were undecided. This confirms the finding given by the HODs during the interview that mathematics teachers when newly posted to secondary schools are unable to handle all the topics from form one to form four. All the HODs, 10(100 %), said that there are many reported cases of teachers skipping some topics and in other cases teachers give students wrong information. Majority of the HODs also said that they themselves felt challenged by many secondary school topics even after going through the pre-service training. They felt that they were not well prepared on the content and reported that they learned more of the content in the field through interaction with colleagues than during the training. The HODs attributed this to poor teacher preparation during the pre- service training.

An analysis of the secondary school mathematics syllabus, diploma college mathematics courses and B/ED mathematics courses revealed that secondary school mathematics syllabus has 67 topics, diploma college offer between 10 and 17 mathematics courses while B/ED university programme offers between 12 and 18 mathematics courses. This clearly shows that the (14.92%-25.37%) and (17.91%-26.87%) diploma and B/ED courses respectively may not be adequate in preparing a teacher to teach 67 topics in the secondary school. Brophy and Good (1986) on the same issue posit that:

> Research in mathematics and science instruction has shown that most concepts are counter intuitive or otherwise difficult to grasp and retain not only for students but also for teachers. Consequently teachers with limited backgrounds in certain subject matter areas may teach incorrect content or fail to recognize and correct their students' distorted understanding.(p30).

The effectiveness of lessons therefore varies with teachers' mastery of the content being taught.

4.6.4 Ability of the mathematics teachers to confidently teach secondary mathematics using the subject content learned during the pre –service training analyzed along the level of initial pre -service training

The same outcomes in the Table 4.7 on the ability of mathematics teachers to confidently teach secondary school mathematics using the subject content learned during the pre-service training were further analyzed along the teacher's level of initial pre- service training and the findings are given in the Table 4.8.

Table 4.8: Analysis of the ability to confidently teach using the subject content learned during the pre –service training analyzed along initial level of pre service training.

Initial level of pre-service training	SA	A	U	D	SD	Total
Diploma	4(16.67%)	11(45.83%)	1(4.17%)	4(16.67%)	4(16.67%)	**24**
Degree (BED)	0(0.00%)	2(4.76%)	2(4.76%)	26(61.9%)	12(28.57%)	**42**
BA/BSC	0(0.00%)	3(75%)	0(0.00%)	0(0.00%)	1(25%)	**4**
Totals	**4**	**16**	**3**	**30**	**17**	**70**

Out of the 47 respondents who do not agree that they can confidently teach secondary mathematics using the subject content learned during their pre-service training, 8(17.02%) initially trained under diploma, 38(80.85%) under B/ED and only 1(2.13%) under BA/BSC programme. It is coming out clearly that more B/ED trained teachers felt ill equipped to implement the secondary school curriculum than their diploma or BA/ BSC counter parts.

However analysis of the secondary school mathematics syllabus, diploma in education mathematics courses and B/ED mathematics units revealed that diploma teachers learned almost the same number of mathematics courses as the B/ED teachers, that is, between 10-17 and 12-18 respectively. The implication here could be that the diploma courses are to the level of the secondary school curriculum while the B/ED courses at levels above the secondary school curriculum.

4.6.5 Percentage of secondary school mathematics content learned in college

The question on the percentage of secondary school mathematics content learned during their pre- service training was asked to the teachers to further confirm on the adequacy of the content. The Table 4.9 gives the responses from the 70 teachers.

Table 4.9: Analysis of the percentage of secondary school mathematics content learned in college

Percentage of secondary school content learned in college	**Frequency**	**Percentage**
0-25%	40	59.10
26-50%	23	32.90
51-75%	3	4.30
76-100%	4	5.70
Total	**70**	**100.0**

Table 4.9 shows that 40(57.10%) of the teachers said that they learned between 0-25% of the secondary school context, 23(32.90%) said that they learned between 26-50%, 3(4.30%) learned between 51-75% and 4(5.70%) learned between 76-100%.With 90% of the teachers saying that they learned between 0 and 50% of the secondary school content confirms that Mathematics teachers are ill prepared in terms of subject matter content to effectively perform their teaching functions in the secondary school. Much of mathematics content that student teachers learn during their pre-service training is irrelevant to them as far as their teaching needs are concerned.

This supports the findings of Ravitch (2000) who noted that departments have been accused of teaching courses which reflect a clear mismatch between the teachers' academic preparation and the increasingly vigorous demands of the classroom. Okioma (2010) further noted that a secondary school teacher must acquire a good knowledge of his specialty. He continues to note that a teacher must have a thorough knowledge of the subject not only the core concepts of the subject but also should acquaint oneself with some newer areas of the subject. This, he says, strengthen the teacher's educational background.

4.6.6 Percentage of secondary school mathematics content learned in college analyzed along initial pre-service training.

The findings in Table 4.9 were further analyzed along the initial pre-service training of the mathematics teachers. This was meant to determine whether there is a difference in perception amongst teachers who initially trained at different levels .The findings are recorded in the Table 4.10.

Table 4.10: Percentage of secondary school mathematics content learned in college analyzed along initial pre-service training

	Percentage of secondary school mathematics content learned during initial pre service training.			
Initial qualification	**(0-25)%**	**(26-50)%**	**(51-75)%**	**(76-100)%**
Diploma	4(16.67)	13(54.17)	6(14.29)	1(2.38)
Degree	31(73.81)	11(26.19)	0(0)	0(0)
BA/ BSC degree	1(25)	1(25)	1(25)	1(25)

From the Table 4.10, 4(16.67%) of all the diploma teachers said that they learned between 0-25percent while 31(73.81%) B/Ed degree trained teachers said that they

learned between 0-25percent. 13(54.17%) diploma teachers agreed that they learned between 26-50% while 11(26.19%) degree teachers said that they learned between 26-50%. None of the B/ED students claimed to have learned more than 50% of the secondary school content while 16.77% of the diploma said that they learned more than 50%.

An analysis of the secondary school mathematics syllabus, diploma college mathematics courses and B/ED mathematics courses revealed that secondary school mathematics syllabus has 67 topics, diploma college offer between 10 and 17 mathematics courses while B/ED university programme offers between 12 and 18 mathematics courses. This shows that the number of courses learned under both degree and diploma programmes are almost the same in number. The difference is that more diploma courses relates to the secondary school syllabus at its level while few of the degree courses relates to secondary school topics and at an advanced level. This is in agreement with a study done by Okioma (2010) on the preparation of biology teachers which revealed that diploma level syllabus shows that the content covered is designed to reflect the topics as they are covered in the secondary school. He further noted that trainees and graduates from Kenya Science Teachers College reported of their close use of the secondary school syllabus. Kilpatrick, Swafford and Findell, (2001) asserts that teachers with limited mathematics knowledge may not be able to foster students ability to reason and problem solve at the same time they might not be able to diagnose and address students' mathematical misconception and dysfluencies.

Further analysis of the secondary school mathematics syllabus, diploma college mathematics courses and B/ED mathematics courses revealed that different training institutions offer differentiated curriculum in terms of the number of course units and the course titles as revealed in Table 2.2 and Table2.3.This could be the reason why teachers who initially trained under the same level gave varied responses.

4.6.7 To whom do the mathematics teachers attribute the secondary school mathematics content that they teach

A question was asked to the teachers on whom they attribute the mathematics content that they teach in the secondary school and they gave their responses as recorded in the Table 4.11

Table 4.11 Analysis of whom the mathematics teachers attribute the content that they teach

Whom the mathematics teachers attribute the content they teach	Frequency	Percentage
Secondary school teacher	50	71.40
College subject content	9	12.90
Both	11	15.70
Total	**70**	**100.0**

From the Table4.11, 50(71.4%) teachers said that they attribute the mathematics content that they teach to their secondary school teacher,9(12.9%) said that they attribute the same to the college subject content learned while 11(15.7%) attributed what they teach to both their secondary school teacher and the college subject content learned. This further confirms that the mathematics content learned during the pre-

service training is largely irrelevant and does not assist teachers to teach mathematics in the secondary schools.

4.6.8 Mathematics topics that are normally skipped by teachers and need to be included in the pre-service training mathematics curriculum.

The HODs were asked to list the topics that are normally skipped by teachers which may need to be included in pre-service training curriculum. The HODs listed the following topics which they say are very abstract and difficult both to the teacher and the students and make significant contributions in the national examinations**.**

Reflection, Mixtures and Rates of Work, Matrices and Transformation, Loci, Longitudes and Latitudes, Linear Programming, 3-dimensional Geometry and commercial arithmetic They said probability ,vectors, integration and differentiation, though covered in the pre-service training are totally different in content from what is in the secondary school curriculum. The HODs said that these topics are very important in the secondary school curriculum hence their content should be reviewed in line with the secondary school curriculum.

4.7 Teaching Methodology

This section addresses the second objective of the study which sought the perception of mathematics teachers on the teaching methodology courses that they learned during their pre service training in preparing them to teach in the secondary school**.** To achieve these objective four questions were asked to the respondents under the sub headings below.

4.7.1 Applicability of the general teaching methods learned during pre-service training

A question was asked to the teachers on the applicability of the teaching methods learned during their pre-service training to their teaching needs in the secondary school and the responses were as shown in the Table 4.12.

Table 4.12 Analysis of the applicability of the general teaching methods learned during pre service training

	Frequency	**Percentage**
Strongly Agree	21	30.0
Agree	34	48.6
undecided	4	5.7
Disagree	6	8.6
Strongly disagree	5	7.1
Total	**70**	**100.0**

From the Table 4.12, 55 (78.6%) teachers agreed that the teaching methods learned are easily applicable to teaching while 11 teachers (15.7%) do not agree that the teaching methods learned are easily applicable. Going by these percentages, it can be concluded that generally the teachers do not have any problem with the teaching methods and can teach mathematics effectively using the teaching methods that they learned. This confirms a very strong view of the researchers Ball (1996) and Harrington (2003) who posit that what is needed for competent teaching in any domain is a combination of sound subject matter knowledge and general pedagogical training that a teacher must have for effective teaching and learning to take place. This is true to all the categories of teachers irrespective of their initial pre-service training.

4.7.2 Adequacy of the number of methodology courses learned

A question was asked to the mathematics teachers on the adequacy of the number of methodology units learned during pre-service training. Their responses are recorded in the Table 4.13.

Table 4.13 Analysis of the adequacy of the number of methodology units learned.

Adequacy of the number of methodology units learned.	**Frequency**	**Percentage**
Very adequate	9	12.9
Adequate	30	42.9
Undecided	7	10
Inadequate	20	28.6
Very inadequate	4	5.7
Total	**70**	**100.0**

From the Table 4.13, 39(55.8%) teachers agreed that the number of methodology units offered are sufficient to learn and practice the methods; while 24(34.3%) do not agree on the same. This gives a general feeling that the teachers are satisfied with the number of methodology units learned. This feeling is true for all the teachers irrespective of their first level of pre-service training.

4.7.3 Adequacy of one semester allocated for learning the teaching methodology in the mathematics subject

When the mathematics teachers were asked about the adequacy of the one semester period allocated for the learning of teaching methodology on mathematics subject, their responses were as tabulated in the Table 4.14

Table 4.14: Analysis of the adequacy of one semester allocated for learning the teaching methodology in the mathematic subject

Adequacy of one semester allocated for learning the teaching methodology in the mathematic subject	**Frequency**	**Percentage**
Very adequate	5	7.14
Adequate	13	18.59
Undecided	2	2.86
Inadequate	35	50.0
Very inadequate	15	21.43
Total	**70**	**100.0**

The findings in Table 4.14 reveals that, 50(71.43%) mathematics teachers did not agree that the one semester allocated for the learning/ teaching of methodology course units in the subject was enough to learn the skills of handling various topics in the subject.18(25.73%) ,however agreed that the period was enough. This then implies that more time should be allocated to the teaching methodology of the subjects as opposed to the general teaching methodology. This concurs with a report from The Science and Learning Expert Group (Department of Business Innovation and Skills, 2010) which stresses the importance of providing subject specific training in initial teacher training by recommending that,

> "the consistency between initial teacher training (ITT) provides in the balance between subject specific and general pedagogy training to ensure that subject specific pedagogical training receives high priority" recommendation 4, p10.

Geddis (1993) also supports the same view by noting that to be an effective teacher of mathematics, it is necessary to know not only the content of various topics, the subject knowledge topics but also the topic specific pedagogy. The researcher also feels that more time should be allocated to the teaching/learning of teaching methods in the subject with emphasis on particular teaching methods for various topics in the syllabus and how to apply the methods. This then calls for a combination of the subject content and its teaching methods.

4.8 Micro Teaching

This section addresses the third objective of the study which sought the perception of mathematics teachers on the effectiveness of micro teaching in preparing them for teaching**.** To achieve these objective three questions were asked to the respondents under the sub- headings below.

4.8.1 Organization of media practical before micro teaching.

Teachers were asked a question on the organization of media practical that they undertook before micro teaching. They were asked to rate as excellent, good, fair, poor and very poor. Their responses were as shown in the Table 4.15.

Table 4.15: Analysis of the teachers' perception on the Organization of media practical before micro teaching

Teachers' perception on the organization of media practical before micro teaching	**Frequency**	**Percentage**
Very good	13	18.6
Good	31	44.3
Average	23	32.9
poor	2	2.9
very poor	1	1.4
Total	**70**	**100.0**

Majority of the teachers, 44 (62.9%) were satisfied with the organization of the media practical and felt that they were either good, 31(44.3%) or very good, 13(18.6%). 23 (32.9%) respondents rated it as average while 3(4.3%) rate it as poor.

The implication here is that majority of the respondents appreciated how the media practical are organized in order to prepare them for the micro teaching session. Media practical according to Sighn (1987), offers helpful setting for an experienced or inexperienced teacher to acquire new teaching skills and to refine old ones

4.8.2 The extent to which micro teaching help practice various skills learned during the lecture

A question was asked to the respondents to rate the extent to which micro teaching helped them to practice the various skills learned during the lecture and their responses are given in the Table 4.16.

Table 4.16: Analysis of the extent to which micro teaching helped teacher trainees practice the various skills learned during the lecture

Extent to which micro teaching helped teacher trainees practice the various skills learned during the lecture	Frequency	Percentage
large extent	55	78.6
undecided	8	11.4
Small extent	7	10.0
Total	70	100.0

From the Table 4.16, 55(78.6%) of respondents agreed that micro teaching helped them to a large extent to practice all the teaching skills that they learned during the lectures while 7(10%) felt that micro teaching helped them but to a small extent. 8(11.4%) however were undecided. The implication here is that the teachers appreciate that micro teaching is a very important component of pre-service training and gives the teacher-trainees a good opportunity to practice what they had learned. This supports the view of Subramanian (2006) who posit that micro teaching helps the teacher trainees to develop and improve their teaching skills, and to build their confidence for teaching.

Akalin (2005) also supports this finding by noting that micro teaching has the potential efficacy of ensuring that the teacher trainee gets the required skills to a certain level of proficiency being exposed to real classroom situation**.**

4.8.3 General conduct and evaluation (feedback) process of peer teaching as a way of training teachers

Respondents were asked to rate the general conduct and evaluation (feedback) process of peer teaching as a way of training teachers and their responses were as given in Table 4.17

Table 4.17: Analysis of the General conduct and evaluation (feedback) process of peer teaching as a way of training teachers

General conduct and evaluation (feedback) of the peer teaching process	Frequency	Percentage
Very helpful	37	52.8
Moderately helpful	25	35.7
Not very helpful	8	11.4
Total	**70**	**100.0**

From the Table 4.17, 8 (11.4%) teachers rated the process as not very helpful while 25 (35.7%) rated it as moderately helpful, 37(52.8%) on the other hand rated it as very helpful. The indication is that majority of the respondents feel that the feedback process really helped them to improve their teaching skills. Cliff etal (1976) noted that micro teaching helps the teacher trainee to prepare the micro lesson, teach it to have practice and through feedback evaluate his performance. He then re- plans the lesson with modifications and improvement and then re-teaches the lesson. This is then followed by re-feedback which enables him to have mastery of the teaching skill.

4.9 Teaching Practice

This section addresses the fourth objective of the study which sought to establish the perception of mathematics teachers on the effectiveness of teaching practice in

preparing them to teach in the secondary schools**.** To achieve these objective four questions were asked to the respondents under the sub headings below**.**

4.9.1 Awareness of the purpose of teaching practice

A question was asked on whether the teachers were aware of the purpose of teaching practice before they went to the field. The responses are tabulated in Table 4.18

Table 4.18: Analysis of awareness of the purpose of teaching practice

The purpose of teaching practice was known to me before going to the field.	**Frequency**	**Percentage**
Strongly Agree	13	18.6
Agree	45	64.3
Undecided	1	1.14
Disagree	8	11.4
Strongly disagree	3	4.3
Total	**70**	**100.0**

In the table 4.18, Many of the teachers 58 (82.9%) agreed that they were aware of the purpose of teaching practice before they went to the field while 11 (15.7%) did not agree. This then implies that teaching practice is well designed to prepare them to teach in the secondary schools. This supports what Arend (2004) urges that the main purpose of the teaching practice component in pre-service education is to create a diversified scholastic expertise amongst the practicing school teachers to meet the challenges that they have to face in future in the classroom.

4.9.2 Ability of the teacher trainees to implement all the techniques that they had learned

A question was asked to the respondents on whether they were able to implement all the teaching techniques that they had learned during the lectures. Their responses are recorded in the Table 4.19.

Table 4.19: Analysis of the Ability of the teacher trainees to implement all the techniques that they learned

Ability of the teacher trainees to implement all the techniques that they learned	**Frequency**	**Percentage**
Strongly Agree	1	1.4
agree	24	34.3
undecided	2	2.9
Disagree	33	47.1
Strongly disagree	10	4.3
Total	**70**	**100.0**

The findings from the Table 4.19 reveals that 43 (61.4%) of the respondents said that they were not able to implement all the techniques that they had learned while 25(35.7%) noted that they were able to implement all the techniques that they had learned. The reason given by the majority is that the time was too short with minimum support from the other teachers in their teaching practice schools. Others commented that they were concerned with getting a good grade than ensuring that they practice the skills. This supports the findings of the Sindh University Journal of Education (2008) which observed that teaching practice component comprises very short

duration. Teachers hardly develop their knowledge and skills of different teaching methodologies in this short span of time. It continues further to note that during teaching practice, student teachers focus more on completing their lessons and its relevant activity and ignore their skills in developing effective lesson plans. This, he noted, affects the quality of the real classroom teaching in the quest of activity completion for the sake of certificate, diploma or degree attainment. This notion is further advocated by (Edmundson, 1990: Feiman- Nemser and Buchman, 1987; Tang, 2003,; Tickle, 2000; Wilson, 2006) who commented that teaching practice often fails to achieve the desired pedagogical outcomes despite exorbitant time spent on teaching practice. It is seen as a non-performing scholastic activity that brings little change.

Majority of the respondents further commented that some schools should be selected near the college where students should regularly visit to observe the experienced teachers put into practice different skills that they have been thought before they are allowed to go out for teaching practice.

4.9.3 The number times the trainees were supervised

The respondents were asked the number of times they were supervised and they were to give their responses as once, twice or more than twice. Their responses are given in the Table 4.20

Table 4.20: Analysis of the number of times the trainees were supervised.

Number of times the trainees were supervised	Frequency	Percentage
Once	40	57.14
twice	25	35.71
More than twice	5	7.14

From the Table 4.20, 40(57.14%) of the respondents were supervised once, 25(35.71%) of them were supervised twice and 5(7.14%) of them more than twice.

It is evident that majority of the teacher trainees were only supervised once or twice which is not enough to guide the teacher trainees. Lyle (1996) and Stone (1987) stressed that supervision during teaching practice facilitates student teachers professional learning by bridging the gap between theory and practice. This may not be achieved in this kind of scenario since the interaction between the supervisor and the teacher trainee for observation, feedback and evaluation is minimal (Stone, 1987).

4.9.4 The input and discussion of feedback with the supervisor.

The respondents were asked to rate the input and the discussion of feedback with their supervisors during the teaching practice process. Their responses were as recorded in the table 4.21.

Table 4.21: Analysis of the perception of teachers towards the input and discussion of feedback with their supervisor

Perception of teachers towards the input and discussion of feedback with their supervisor	**Frequency**	**Percentage**
Above average	7	10
Average	43	61.43
Below average	20	28.57

From the Table 4.21, 7(10%) respondents rated the input and the discussion of feedback with the supervisors as above average.43 (61.43%) rated it as average while20 (28.57%) rated it as below average. The respondents commented that there was a minimum opportunity to discuss the feedback.

This researcher feels that though the teaching practice is well designed to prepare teachers to teach in secondary schools, the minimal opportunities between the teacher trainees and the supervisor may render the whole process unproductive.

4.10 Chapter Summary.

This chapter has reported the findings of the study. The areas covered include the response rate initial qualification of teachers, present qualification of teachers, their teaching experiences, the mathematics subject content, the teaching methodology courses, micro-teaching and the teaching practice. The next chapter provides a summary of the findings, draw conclusions and make suggestions for further research.

CHAPTER FIVE

SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter contains the summary of findings, conclusions, recommendations and suggestions for further research based on the analysis of data. It is divided into four sections. The first section presents the summary of findings, the second section presents the conclusions, the third section gives the recommendations and the fourth section presents suggestions for further research based on the analysis of data.

5.2 Summary of Findings

The findings given in this study are based on the objectives of the study below.

1. To find out the perception of mathematics teachers on the relevance of Mathematics subject content learned during their pre-service training to the secondary school teaching.
2. To establish the mathematics teachers' perceptions on the suitability of the teaching methodology courses in preparing them for teaching.
3. To establish the perceptions of mathematics teachers towards the effectiveness of micro teaching in preparing them for teaching practice.
4. To establish the teachers' perceptions about the role of teaching practice in preparing them to teach in secondary schools.

5.2.1 The subject matter content

The first objective sought to establish the perception of mathematics teachers on the mathematics subject content learned during their pre-service training in preparing them to teach in secondary school. The findings which addressed this objective were derived from the mathematics teachers and the HODs who participated in the study.

5.2.1.1 Relevance of the mathematics subject content learned during the pre-service training to the teachers' needs in the secondary school.

Analysis of research findings revealed that a large percentage of mathematics teachers do not agree that the mathematics content that they learned during the pre-service training is relevant to what they teach in the secondary school. This is further supported by all the HODs who reported that when new teachers are posted to their schools, they do not display competence in handling all the topics from form one to form four. The HODs said that those teachers skip very important topics during the teaching and even during setting of exams. This, they claim denies the students exposure to some topics leading to mass failures in national examinations. The HODs further commented that those topics are so abstract and were never thought by their secondary school teachers leave a lone during the pre-service training. The HODs blame this on the irrelevant mathematics content that they were exposed to during pre-service training which they say cannot help them implement the secondary school curriculum.

It is however coming out clearly that a high percentage of those who initially trained under BED programme feels that the content that they learned is irrelevant compared to their diploma and BA/BSC counter parts. An analysis of the secondary school mathematics syllabus, diploma college mathematics courses and B/ED mathematics courses further revealed that the diploma mathematics course units though few relates to more secondary school topics at its level while B/ED courses though many relates to few secondary topics and at an advanced level.

Poor performance that has for many years been recorded in secondary school mathematics may be attributed to this poor preparation of teachers in terms of subject content

5.2.1.2 Ability to confidently teach secondary school mathematics using the content learned during pre-service training.

The research findings revealed that majority of the secondary school mathematics teachers cannot confidently teach mathematics using the mathematics content they learned in college. The HODs supports this view by saying that even after going through the pre-service training, they still felt challenged by many secondary school topics. They claimed that they were not adequately prepared in the content and that they learned more of the content in the field than during the training. It however came out that majority of those who feel inadequately prepared initially trained under B/ED programme compared to those who initially trained under diploma in education and BA/BSC programme.

This may imply that the mathematics teachers may not be effective in the teaching of the subject. Such teachers on the other hand may not be able to foster students ability to reason and problem solve at the same time they might not be able to diagnose and address students' mathematical misconception and dysfluencies. This lack of adequate mathematics content for teachers may be the reason why students are performing dismally in mathematics.

5.2.1.3 Percentage of secondary school mathematics content learned during the pre service training

Analysis of research findings revealed that majority of the mathematics teachers learned less than half of the secondary school content during pre-service training. These findings further confirm the inadequacy of the mathematics subject matter content in preparing mathematics teachers for secondary schools. Further analysis along the initial level of pre-service training revealed that diploma level curriculum though differentiated offer more secondary school mathematics than the BED mathematics curriculum.

The implication here is that diploma teachers interacted with more secondary school content than their B/ED counterparts. This is confirmed by the HODs who reported that those teachers who went through diploma education programme and had excelled in the subject perform better than those who initially went through the degree programme

5.2.1.4 To whom does the mathematics teachers attribute the secondary school mathematics content that they teach?

The research findings revealed that majority of the teachers attribute the mathematics content that they teach to their secondary school teacher. Further analysis revealed that majority of teachers who initially trained under degree programme attribute what they teach to their secondary school teacher while majority of teachers who initially trained under diploma attribute what they teach to their college mathematics content that they learned. This further confirms that BED pre-service training programme does not prepare their trainees well to be able to competently handle the secondary school mathematics content.

5.2.2 Teaching Methodology.

The second objective of the study sought to establish the perception of mathematics teachers on the teaching methodology courses learned during their pre service training. This objective was addressed under three sub headings below;

5.2.2.1 Applicability of the general teaching methods learned during pre service training.

A large percentage of teachers agree that the teaching methods learned are easily applicable to teaching. It can then be concluded that mathematics teachers do not have any problem with the teaching methods and can teach mathematics effectively using the teaching methods that they learned .This is true to all the categories of teachers irrespective of their initial pre-service training as reflected in the table below

5.2.2.2 Adequacy of the number of general teaching methodology course units learned

Analysis of the research findings revealed that majority of the teachers agrees that the number of methodology courses offered is sufficient to learn and practice the methods. This gives a general feeling that the teachers are satisfied with the number of general teaching methodology course units learned.

5.2.2.3 Adequacy of one semester allocated for learning the mathematics teaching methodology in the mathematics subjects.

Analysis revealed that majority of the respondents did not agree that the one semester allocated for the learning/ teaching of methodology in the subject is enough. They commented that more time should be allocated to the teaching methodology of the subjects as opposed to the general methodology. More time should be allocated to the teaching/learning of teaching methods in the subject with emphasis on particular

teaching methods for various topics in the syllabus and how to apply the methods. This then calls for a combination of the subject content and its teaching methods.

5.2.3 Micro –teaching

The third objective sought to find the perception of mathematics teachers on the effectiveness of micro teaching component of pre service training in preparing the to teach in the secondary schools

5.2.3.1 Organization of media practical before micro teaching

A good number of respondents were satisfied with the organization of the media practical. This then imply that the media practical are well organized and can prepare the teacher trainees well for the micro teaching session.

5.2.3.2 The extent to which micro teaching help practice various skills learned during the lecturer

The research findings revealed that micro teaching helped the teachers practice all the teaching skills that they learned during the lectures. The implication here is that micro teaching is a very important component of pre-service training and gives the teacher-trainees a good opportunity to practice what they have learned.

5.2.3.3 The general conduct and evaluation of feedback process of peer teaching as a way of training teachers

Majority of the respondents feels that the feedback process really helped them to improve their teaching skills.

5.2.4 Teaching practice

The fourth objective sought to find the perception of mathematics teachers on the effectiveness of teaching practice component of pre service training in preparing them to teach in the secondary schools.

5.2.4.1 Awareness of the purpose of teaching practice

Majority of the teachers agreed that they were aware of the purpose of teaching practice before they went to the field. This then is a strong indication that teaching practice is well designed to prepare teachers to teach in the secondary schools. However when the same teachers were asked whether they were able to implement all the techniques that they had learned, they said that they were not able to implement The reason given by the majority is that there was minimum support from the school administration and other teachers in the school and that they were more concerned with getting a good grade for the course than putting the learned skills into practice.

The same respondents were also asked the number of times they were supervised during the teaching practice period and the findings revealed that majority of them were supervised only once and a few twice. The implication here is that majority of the teacher trainees are supervised only once which is not enough to guide the teacher trainees on improving students' behaviour, testing knowledge of subject matter, receiving constructive criticisms, discovering teaching strengths and weaknesses and developing a core set of pedagogical values to which a professionally component teacher adheres to.

5.2.4.2 The input feedback with the supervisor

The input and the discussion of feedback with the supervisors as revealed by the research findings were not satisfactory .The respondents commented that there was a

minimum opportunity to discuss the feedback with the supervisor. The implication here is that though the teaching practice is well designed to prepare teachers to teach in secondary schools, the minimal opportunities between the teacher trainee and the supervisor may render the whole process unproductive.

5.2.4.3 The adequacy of three month period of teaching practice

The respondent said that the three month teaching practice period is enough though they commented that some schools should be selected near the college where students should regularly visit to observe the experienced teachers put into practice different skills that they have been taught before they are allowed to go out for teaching practice.

5.3 CONCLUSIONS

From the analysis of the research findings, the following conclusions can be made .

5.3.1 The subject matter content,

The mathematics content that is learned in teacher training institutions is largely irrelevant and inadequate in preparing teachers to teach in the secondary schools. However, the mathematics content learned in diploma teacher training colleges is more relevant than what is learned in the school of education in the university.

5.3.2 The teaching methodology courses

Both the general teaching methodology course units and the mathematics teaching methodology course units learned are easily applicable to teaching. The numbers of general methodology course units offered are also sufficient to learn and practice the methods. However the one semester allocated for the learning/ teaching of methodology in the mathematics subject is not enough.

5.3.3 Micro Teaching

The organization of the media practical is satisfactory and helps the teacher trainees practice all the teaching skills that are learned during the lectures. The discussion /feedback process with the peers is also very helpful and prepare the student teachers well for teaching practice. This is true for both categories of teacher training institutions.

5.3.4 Teaching Practice

Teaching practice both in the university and diploma teacher training college is well organized and its objectives clear to the student teachers. The length of time allocated for teaching practice is also okay in both categories of teacher training institutions. However, the applicability of the, discussion of feedback with the supervisor and the number of times the student teacher is supervised is wanting.

5.4 Recommendations

The study and its findings have necessitated the researcher to make the following recommendations:

1. Diploma Teacher training colleges and Schools of Education in the universities should constantly review their curricula to ensure that what they are teaching correlates well with what their students will teach in the secondary schools. During their curriculum review; they should involve the mathematics teachers who are teaching in the secondary school at the time of the review. This ensures that they produce graduates who can competently implement the curriculum in their place of work.
2. Diploma Teacher training colleges and schools of education in the universities should devote more time to the teaching methods in a particular subject and more so Mathematics. This is the area where teacher

trainees are practically guided on how to handle various topics or concepts in the subject which various researches have proved to be difficult for the teachers to handle.

3. Mathematics subject content and its methodology should be integrated and taught together as one course.
4. Teacher trainers should make the purpose of teaching practice very clear to their learners. They should emphasize that the main purpose of the teaching practice component in pre-service education is to create a diversified scholastic expertise amongst the practicing school teachers to meet the challenges that they have to face in future in the classrooms as opposed to merely working to get a good grade.
5. Teaching practice supervisors should work closely with the practicing teachers to observe their lessons and make the necessary suggestions about those lessons. They should be able to help them improve their knowledge of subject matter , discover their teaching strengths and weaknesses , develop a core set of pedagogical values to which a professionally component teacher adheres to and give constructive criticisms .
6. The commission of higher education should ensure that the same course content is offered in all the universities for the same course to ensure uniformity in the quality of graduates since they are all going to implement the same curriculum.

5.5 Suggestions for Further Research

There were very important issues that were not covered in this study as a result of its limited scope. In view of this, the following areas require further research:

1. A research should be conducted in university school of education to determine the factors that influence their selection of mathematics subject content that they teach to their B/ED students.
2. A study should be conducted to establish the factors which limit the TP Supervisors' frequency of supervision
3. A study should be conducted to determine secondary teachers perception on the general education courses in preparing them to teach in the secondary schools
4. A similar study should be conducted in other areas of the country.

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APPENDICES

APPENDIX A: Teachers' questionnaires

Dear Respondent,

I am a second year master's student in Moi University studying curriculum development. I am undertaking research in pre-service preparation of mathematics teachers for secondary schools

You are kindly requested to respond to this questionnaire which seeks information about the mathematics teacher training programme .The responses will be treated as confidential and will be used only for this study. Freely respond and your responses will be used to improve the mathematics teacher education programme in Kenya.

PERSONAL DETAILS

1. GENDER: Male ☐ Female ☐
2. What is your teaching experience? 0-5years ☐ 6-10 years, ☐
   11-15years, ☐ Above 15years ☐
3. What is your highest qualification?—Diploma ☐ Degree ☐ BA or BSC
   with PGDE ☐ Post graduate degree level. ☐
4. Was education your first choice in your application to the university?
   Yes ☐ No ☐

A) SUBJECT CONTENT LEARNED

I. Use the key provided to answer the questions below.

SA-Strongly Agree, A-Agree, U-Undecided, D-Disagree, SD-Strongly Disagree.1

	SA	A	U	D	SD
i)The mathematics content that I learned in college was relevant to what I teach in the secondary school					
ii) can confidently teach secondary school mathematics using the mathematics content I learned in college					

2. What percentage of the secondary school mathematics content did you learn in college? Between 0-25%, ☐ 26-50%, ☐ 51-75%, ☐ 76-100% ☐

3. To whom do you attribute the mathematics contents that you teach in the secondary school

(i) Secondary school mathematics teacher [ ]

(ii) College mathematics content [ ]

(iii) Both [ ]

(B)TEACHING METHODS TAUGHT

1. Use the key provided to answer the questions below.

SA-Strongly Agree, A-Agree, U-Undecided, D-Disagree, SD-Strongly Disagree.1

	SA	A	U	D	SD
i)The teaching methods I learned in college are easily applicable in teaching.					
ii)The number of methodology courses offered are sufficient to learn and practice the methods.					
iii)The length of time(one semester) allocated for learning the teaching methodology in the subject is adequate to learn all the needed skills					

2. How best can the teaching methods be taught to be effectively used to teach the secondary school mathematics?

C) TEACHING PRACTICE

1. Use the key provided to answer the questions below.

SA-Strongly Agree, A-Agree, U-Undecided, D-Disagree, SD-Strongly Disagree.1

	SA	A	U	D	SD
i)The purpose of teaching practice was well known to me before I went to the field.					
ii)I implemented all the teaching techniques which I had learned with ease.					
iii)The three month teaching practice is adequate in the training of teachers					
iv)The discussion of inputs and feedback with the supervisor was productive					

2. How many times were you supervised? Once [ ] twice [ ] more than twice [ ]

3. What changes are needed to make teaching practice more effective?

(D) MEDIA PRACTICAL AND MICRO-TEACHING

1. Fill in the table below by ticking in the column appropriately

	Excellent	Good	Fair	Poor	V. poor
i) What can you say about the organizations of media practical that you undertake before peer or micro-teaching					
ii) Rate the extent to which Micro-teaching helped put into practice various teaching skills that you learnt during the lectures.					
iii) How will you rate the general conduct and evaluation of peer-teaching as a way of training teachers in your institution?					

2. Identify any aspects in pre-service training that need urgent address .give reason

3. Briefly give a general comment about the pre-service training of mathematics teachers in Kenya.

THANK YOU.

APPENDIX B: HODS INTERVIEW SCHEDULE.

Dear Respondent,

I am a second year master of philosophy student in Moi University studying curriculum development. I am undertaking research in pre-service preparation of mathematics teachers for secondary schools.

You are kindly requested to respond to this interview schedule which seeks information about the pre-service mathematics teacher training programme .The responses will be treated as confidential and will be used only for this study. Freely respond and your responses will be used to improve the mathematics teacher education programme in Kenya.

1. After going through the pre-service training, did you at some point feel challenged by the secondary school subject content?

   Yes ☐

   No ☐

2. Explain your answer.

3. (i).Do you have reported cases of teachers skipping some topics?

   Yes ☐

   No ☐

   (ii) Explain your answer.

4. When new teachers are posted to the school, do they display competence in handling all the mathematics topics from form one to form four?

   Yes ☐

   No ☐

5. Have you identified teachers of particular Levels who perform far better or worse than others?

   Yes ☐

   No ☐

6. If yes, which levels and how?
7. What is your general comment about mathematics teacher training in terms of preparing teachers on;
   - Content adequacy
   - Teaching methodology
   - Preparation and use of teaching aids
8. Which area of mathematics teacher training according to you needs urgent attention?

THANK YOU.

APPENDIX C: RESEARCH PERMIT

APPENDIX D: MAP OF AREA OF STUDY