STRATEGIES FOR ENHANCING PERFORMANCE IN MATHEMATICS FOR LEARNERS WITH HEARING IMPAIRMENT IN PRIMARY SCHOOLS. A CASE OF MAKONGO SCHOOL FOR THE DEAF MAKUENI COUNTY, KENYA

BY

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DECLARATION

I declare that this thesis is my original work and has not been presented in any other university/institution for consideration of any certification. This research thesis has been complemented by referenced source duly acknowledged. Where text, data (including spoken words) graphics, pictures or tables have been borrowed from other sources, including the internet, these are specifically accredited and references cited using current APA system and in accordance with anti-plagiarism regulations.

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DEDICATION

To the Almighty God for His grace and favour upon me.I dedicate this work and give special thanks to my sons Kelvin, Sos Peter and Eric for being there for me throughout the masters study.

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ABBREVIATIONS AND ACRONYMS

ASEI	-	Activity, Student-Centered Experiment and Improvisation
ASHA	-	American Speech-Language Hearing Association
CAI	-	Computer Assisted Instruction
CIMS	-	Content Independent Multimedia System
EASL	-	English and American Sign Language
HI	-	Hearing Impairment
IEP	-	Individualized Educational Program
INSET	-	In-service Training
ISLHI	-	Interview Schedule for Learners with Hearing Impairment
JICA	-	Japan International Cooperation Agency
KCPE	-	Kenya Certificate of Primary Education
KNEC	-	Kenya National Examination Council
KSDC	-	Kenya Society for the Deaf Children
MoEST	-	Ministry of Education Science and Technology
QASD	-	Quality Assurance Standard Directorate
QMT	-	Questionnaire for Mathematics Teachers
SMASE	-	Strengthening Mathematics and Science Education
SNE	-	Special Needs Education
TESC	-	Teacher Education Steering Committee
TKCPE	-	Trial Kenya Certificate of Primary Education

ABSTRACT

The primary purpose of the study was to establish strategies of enhancing of Mathematics performance among class 5- 8 learners with hearing impairment in Makongo School for the Deaf in Makueni County. A case study design was employed. The target population comprised of the 9 teachers and all the 28 learners with hearing impairment from class 1-8 making a total of 37 respondents. The researcher purposively sampled Mathematics teachers and classes 5-8 learners who were mature enough to be interviewed to give the needed information. Two research instruments namely: Questionnaire and interview schedule were constructed to collect data from Mathematics teachers and learners with hearing impairment respectively. Data collected was analyzed using both Quantitative and Qualitative techniques using the Statistical Package for Social Sciences (SPSS) to get descriptive statistics such as percentage, frequencies and tabulations. The study found out that gestures were used by teachers in teaching Mathematics to class 5-8 learners with hearing impairment instead of using multiple methods which are core to improving learners' holistic understanding of Mathematical concepts and eventually enhancing their performance in the subject. It was also found that most of the Mathematics teachers had difficulties in translating Mathematics into sign language despite their qualification in Special Needs Education. Similarly, learners with hearing impairment found it difficult to understand Mathematical sign language due to limited Mathematical vocabulary. The study recommends that teaching methods should be interesting to stimulate learners' interest in Mathematics and there should also be organized regular in-service trainings for Mathematics teachers for class 5-8 learners with Hearing Impairment. It also recommends measures to increase teacher's motivation as well as undertaking proper follow-ups on teaching methods and resources.

CHAPTER ONE

BACKGROUND TO THE STUDY

1.0 Introduction

This chapter provides the following: Background to the study, Statement of the problem, Purpose of the study and Objectives, Research questions, Significance of the study, Limitations and Delimitations, Research assumptions, Theoretical framework and lastly Conceptual framework.

1.1 Background to the Study

Mathematics is a way of life as it allows learners to organize experiences and use them in life thus being useful to oneself and to the society. Mathematics gets widely regarded as one of the important subjects for entry into most of the careers or when intending to get further training.

Umameh (2011), in Tshabalala and Ncube (2016) stated that Mathematics is bedrock and an indispensable tool for scientific technological and economic for any nation to advance. Umameh (2011) cited Mathematics to be intimately connected to daily life and everyone's life-long activities. So, Mathematics is a subject that human life and Education cannot function efficiently without it. In Kenya, efforts to enhance the effectiveness of Mathematics Education have made the subject compulsory (Miheso, 2002). The importance of Mathematics as a subject in Kenya's Education System is recognized thus the National Committee of Education Objectives and Policy (1976), recommended that in recruiting students for teaching profession, emphasis should be

placed on Mathematics. Maintenance of good performance in Mathematics is desirable to all learners including those learners with hearing impairment.

Wasiche (2006) observes that in Kenya, Mathematics enjoys a special status in the school curriculum because it is one of the core subjects with more lessons taught in schools than Science. Despite the fact that Mathematics is essential for daily life and plays a crucial role in school curriculum, performance by learners with hearing impairment remains very low. This has caused an outcry from Mathematics teachers, educators, parents and students. In Kenyan 8-4-4 system, Mathematics takes 14% out of the 50 lessons per week in the primary timetable and 15% out of the 40 lessons per week in the secondary schools timetable (David, 2009). This recognition of the Mathematics subject indicates that it is crucial in achieving the objectives of the 8-4-4 system of Education.

According to (Oyaya, 2000), Activity, Student Centered Experiment and Improvisation (ASEI) Approach considers quality of classroom activities as critical to achieving efficient teaching and hence good performance in Mathematics. Mathematics involves meaningful manipulation (hands-on), intellectual thinking and reasoning (minds-on), discussion (mouths-on) and those that stir up the learner's interest about the subject (heart-on) activities. In an attempt to help teachers teaching mathematics, the Ministry of Education Science and Technology (MoEST) in Kenya entered into joint venture with Japan International Co-operation Agency (JICA) to improve performance in Mathematics and Science through Strengthening Mathematics and Science Education (SMASE) Program mounted in-service training (INSET) course for Mathematics and Science in Primary schools.

Nairobi City Council Education Department (2008) carried out studies on performance of Mathematics in Trial Kenya Certificate of Primary Education (TKCPE) in Nairobi 2008 Analysis Order of Merit. The findings indicate that all the 8 divisions each had a mean score of below 50 out of 100. Overall, Nairobi's 192 public schools mean score was 44.01, while the highest mean score was 74.49 and the least being 20.67 (Owegi, 2011). Owino (2011) states that learners with hearing impairment lack required resources and most of the skills necessary for solving most Mathematics problems when learning. Mwololo, et. al., (2011) carried out a study on pre-school teachers' knowledge and attitude towards the use of visual media in instruction, but did not include strategies for enhancing performance in mathematics among classes5-8 learners with hearing impairment. The current study is concerned with establishing strategies for enhancing performance in Mathematics among class 5-8 learners with hearing impairment in Makongo School for the Deaf in Makueni County.

1.2 Statement of the Problem

Hearing Impairment is a common disability among children. It is the government's responsibility to implement strategies that ensure children with disabilities who face the risk of exclusion from the society, receive adequate assistance in their education (Hallahan, Kauffman & Pullen, 2013). In Kenya, Mathematics is a core subject in the curriculum right from Primary through secondary schools. At Primary level, children sit for Kenya Certificate of Primary Education (KCPE) examinations that evaluate the eight years Primary Education Program. Mathematics is a subject taught to both hearing and non-hearing learners in Primary schools. The performance in

Mathematics in most established primary schools for the deaf since the start of KCPE in 1985 makes it difficult for students to join secondary schools. The Government is training teachers through SMASE year after year but all in vain, the performance in Mathematics of learners with hearing impairment is still very low and getting poorer and poorer (Kenya National Examination Council (KNEC) (2004).

Tipps, Johnson & Kennedy (2011) note that the challenge experienced by teachers working with students with a variety of cognitive abilities, social problems, and physical challenges is identifying strategies that maximize learning for all learners. For a greater number of children with special needs, especially learning and cognitive disabilities, their difficult arises since their processing time is slower than that of regular children. Unfortunately, no systematic research addressing the problem has been carried out in Makueni County Makongo School for the Deaf in particular. Yang, et.al. (2007), comprehensively examined the use of a computer-aided music learning system for Hearing Impaired learners but did not address performance in mathematics. However, the research and investigations of the scholars did not address strategies of enhancing performance in Mathematics in children with special needs. This gap prompted the researcher to conduct this study which sought to establish whether learners with hearing impairment have similar problems in mathematics and focused on the strategies of enhancing performance in Mathematics among class 5-8 learners with hearing impairment in Makongo School for the Deaf Makueni County, Kenya. It is in view of this fact that the researcher felt that there could be specific teaching techniques that enhance performance in mathematics.

1.3 Purpose of the Study

The purpose of the study was to establish strategies of enhancing performance in Mathematics in Primary Schools for the Deaf : A case of Makongo School for the Deaf.

1.4 Objectives

The following objectives guided the study:

1. To identify learners' characteristics that affect teaching of Mathematics in Makongo School for the Deaf.
2. To find out professional qualifications of teachers in sign language in Makongo School for the Deaf.
3. To establish the teaching methods used by teachers in Makongo School for the Deaf.
4. To explore teaching resources used by teachers in teaching Mathematics to learners with hearing impairment in Makongo School for the Deaf.

1.5 Research Questions

The following questions were derived from the objectives:

i. What are the learners' characteristics that affect the teaching of Mathematics to learners with hearing impairment in Makongo School for the Deaf?
ii. What professional qualifications in sign Language do teachers teaching Mathematics to learners with hearing impairment in Makongo School for the Deaf have?
iii. What teaching methods do teachers use in teaching Mathematics to learners with Hearing Impairment in Makongo School for the Deaf?

iv. What are the teaching resources used by teachers in teaching Mathematics to learners with Hearing Impairment in Makongo School for the Deaf?

1.6 Significance of the Study

In Kenya, students with different abilities learn together in the same classes and do same examinations. The findings of the study will therefore be of great use to parents, teachers, school administrators and other stakeholders in that they may help in the following ways: The teachers in special schools for the deaf may use the recommendations in improving the quality of their teaching and other services to the children with Hearing Impairment in order to improve their performance in this subject, the learners with Hearing Impairment may also benefit as the teacher adjusts and modifies their teaching methods. This would help those learners to understand mathematical facts, skills, principles and concepts necessary for problem solving in Examinations and the research field as the study will stimulate more research into this area of curriculum delivery to the learner with hearing impairment, hence generating more knowledge.

1.7.1 Limitations of the study

The study was limited to Makongo School for the Deaf in Makueni County. The study was also limited to analyzing enhancement of performance in Mathematics among class 5-8 learners with hearing impairment. The study was also limited to Mathematics teachers and learners with Hearing Impairment. Makueni County is vast with few special schools for the Deaf far apart**.** The fact that class 5-8 learners and not a cross section of all the learners in the classes were used in the study was a limitation. Some of the respondents had the view that the study was financially

supported by some donors, therefore required payment before giving the appropriate information, The study involved only one school for the deaf in Makueni County; the sample was therefore a representative of all schools for the Deaf in Kenya.

1.7.2 Delimitations

The study was carried out at Makongo School for the Deaf which was far but the researcher managed to reach there to collect data The greatest delimiting factor was finance since the work was too demanding and seemingly beyond the scope of the available resources and finance which the researcher had.

1.8 Research Assumption

The study assumed that: In schools for hearing impairment, there are certain challenges that are unique from those that exist in regular schools as in the case of this study on communication problems. The school curriculum and the textbooks used were the recommended standard ones approved by the Kenya Institute of Curriculum Development (KICD) for these classes as in ordinary schools.

1.9 Theoretical Framework

The study was guided by Piaget's theory (1972) of learning which elaborated on cognitive development. The aspect of development dealt with thinking and problem solving like in Mathematics, intelligence and language. Piaget's theory of learning guided this study in relating the mental operations involved in learning Mathematics and performance for example, in learning volume reference could be made to the already existing knowledge of the usual measurements of spatial figures (rectangles, squares and circle), algebraic expressions and basic arithmetic numbers.

The theory applies word problem that needs the knowledge of the fundamental parts of the questions, identifying the related operations to be applied and finally solving the answers for each. For the learner to be ready for learning before he/she could assimilate what is taught and understand the concepts being taught brings to the forefront the presence of existing knowledge in Mathematics of learners with hearing impairment and their level of readiness to learn. The readiness is seen in terms of the learner's age and the entry behavior at the time of being taught. New concepts are therefore linked to what the child knows and already experienced (Kitiambo, 2002). Piaget (1972), also noted that hearing impaired children may develop and understand more mathematical concepts and process, their predictions and explanations should become more sophisticated frequently reflecting a rich mathematical knowledge base evidence of logic, higher levels of analysis and greater tolerance of criticism and uncertainty. Piaget's theory was used to develop tools for teachers teaching learners with hearing impairment and for the learners with hearing impairment.

1.10 Conceptual Framework

The conceptual framework below depicts the relationship between the independent and dependent variables

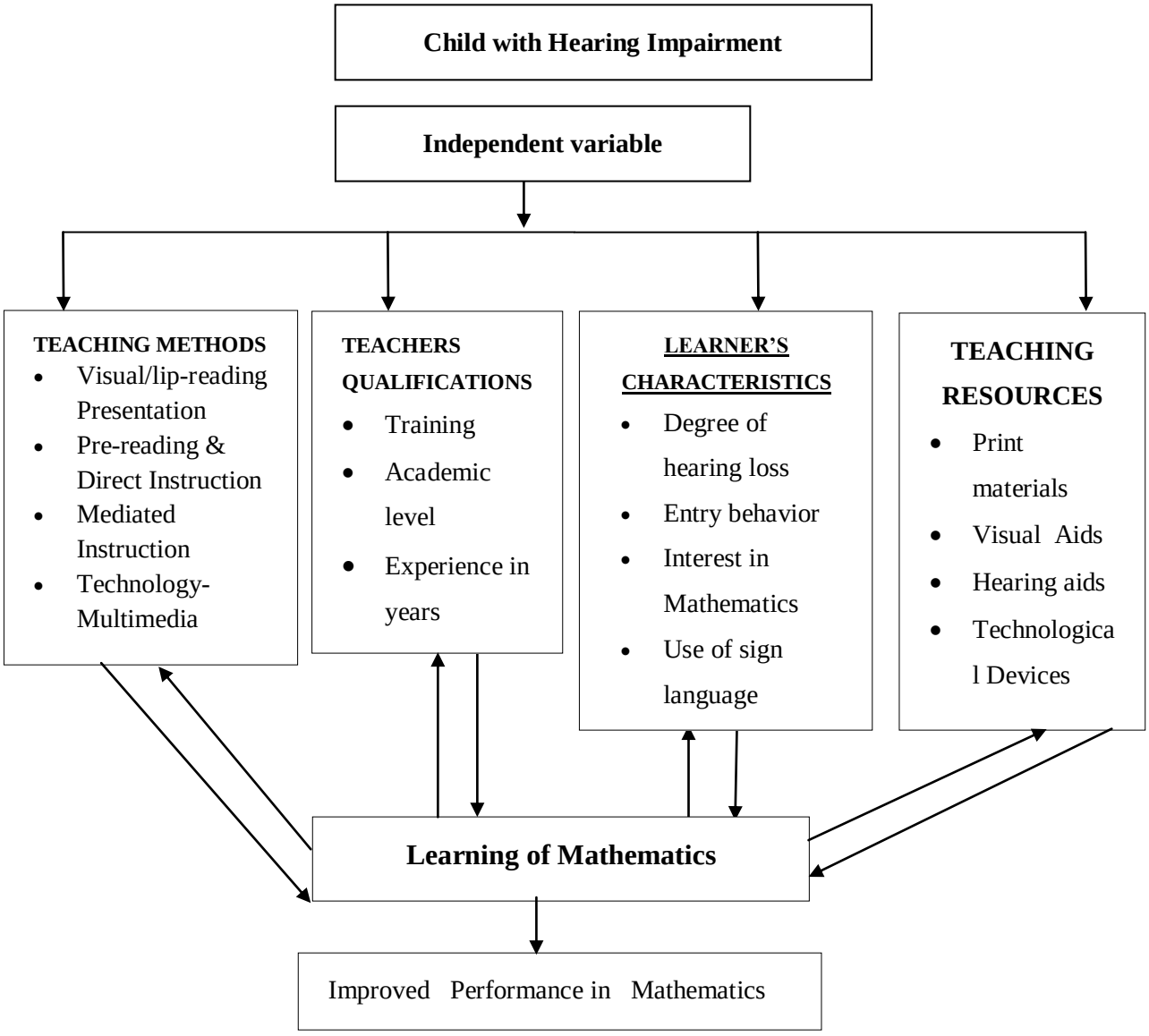


Figure 1.1: The conceptual framework *(*Adopted and modified from; Piaget 1952)

Learning of Mathematics can be affected by teaching methods, teaching qualifications, learners' characteristics and teaching resources and vice versa

1.11 Operational Definition of Terms

Academic Performance: Academic performance is the extent to which a student, teacher or institution has attained their short or long-term educational goals measured through giving grades in subjects or courses (Akareem & Hossain, 2016). In the study, academic performance is used to grade the education performance of class 5 to 8 learners with hearing impairment.

Deafness: Hearing impairment that is so severe that the child cannot process linguistic information through hearing with or without amplifications that has adverse effects on the educational performance of the learner (Lieberman & Houston-Wilson, 2009). The study focuses on learners with hearing impairment.

Hard of hearing: refers to a person with hearing loss that continuously permits the effective reception and interpretation of speech through amplified means (Braden, 2013). Some of the respondents in the study displayed hard of hearing condition; hence necessitating for the use of hearing and visual aids.

Hearing Impairment: Hearing impairment is the reduced function or loss of the normal function of the hearing mechanism (Kirk, et. al., 2011). In this state learners have difficulties in using their hearing due to a certain problem or deformity of the ear. The class 5 – 8 leaners in this study had hearing impairment.

School for the Deaf: It is a residential school for learners with hearing impairment and is equipped with hearing and visual aids and teaching is done by teachers trained in sign language (LaSasso, Crain & Leybaert, 2010). Used in his study to mean special school where children with hearing impairment board and learn.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

In this chapter the researcher demonstrates evidence of understanding of current research on the subject under investigation and show clear gaps in knowledge that was addressed in the following four objectives: to identify learner's characteristics that may affect the teaching of Mathematics, to find out teachers' professional qualifications in sign language, to establish the teaching methods used by teachers in teaching Mathematics; to explore teaching resources used by teachers in teaching learners with hearing impairment.

2.2 Child Characteristics

A lot of what is learnt in daily life including school takes place through the auditory channel. It is important to identify accurately and effectively the hearing loss of those learners with hearing impairment which may have the potential of interfering with the learning process especially in Mathematics. The greatest barrier to Education is failure to learn language which is also used in learning Mathematics. Hearing loss occurs along a broad continuum ranging in degree from slight to profound. Individuals having profound hearing loss generally get characterized as deaf, whereas individuals with lesser degrees of hearing loss get characterized as hard of hearing. Any kind of childhood degree of loss if left unmanaged, might probably lead to a negative impact on the development of spoken and receptive language, the ability to read and write and academic achievement (Frank, 2000).

According to World Health Organization (WHO) the following are the recommended grading of hearing impairments. Profound (more than 90dB) severe (70-90dB) and moderate (40-70dB) each of the categories have their own characteristics. The mild(40-70dB) can follow conversation if the room is quiet (reverberation) and will need to sit or stand near and face the speaker to lip-read. A hard of hearing learner generally with or without use of hearing aids has a hearing sufficient enough for successful processing of language and other audio logical information. An approximate hearing aid can be fitted to a child at the age of six months after the true level of hearing loss has been determined (Frank, 2000). The problem that learners with hearing impairment experience when learning Mathematics is the degree of impairment thus those who have some residual hearing are taught together with the deaf by use of sign language. In spite of the fact that they can use the residual hearing to hear what the teacher is saying if they sit in the front of the class they may be disadvantaged by the use of sign language. Hearing impairment is a factor that may rise up language problems and children with speech difficulties may develop learning problems especially in Mathematics (Aila, 2011).

Children with hearing impairment have difficulties talking, understanding, reading and/or writing American speech-language and hearing Association, ASHA (2007). Hearing impairment is estimated to affect about 10% of the population in the US (Centers for Disease Control, 2004). Children with hearing impairment have difficulties in communication and can be fitted with appropriate hearing aids to assist them to capture what the teacher is teaching. They can also be encouraged to lip-read as the teacher speaks. Most of these learners with hearing impairment have very low

concentration span so there should be no distractors in the classrooms. Learners with hearing impairment should be taught language as early as three years to enable them grow with it for proper communication in class. The possible excitement about learning mathematics is illustrated by the behavior of students. Thus, Huetinck and Munshin (2007) cite that, students must learn mathematics with understanding actively building new knowledge from experience as well as prior knowledge.

2.3 Teachers' Professional Qualifications in Sign Language

Teachers' formal qualification, experience, motivation creativity, interaction with learners and methodology may greatly influence academic performance of a school (Johnson, 2000; Passey, 2013). Many teachers believe that children with disabilities those with hearing impairment included cannot be productive as they still embed in many cultures so they find it difficult to support them. Due to lack of trained teachers "total communication" may not be practiced since many teachers are not well equipped with the relevant knowledge and skills meaning that their confidence will be low and contribute to lack of enthusiasm and hence competency. The performance of the learners is influenced by the kind of teachers that teach them, so the teacher matters most in a learner's academic life. Odden & Picus (2011) argues that there is a casual link between the quality of teaching and level of students' outcome, meaning any approach that increases the quality of teachers should consequently improve students' outcome. Solomon and Podgursky (2001) argue that evaluation focuses on the teacher's skills and knowledge that offer an incentive to improve and also an intrinsic reward through professional development.

According to Owino (2011), mathematics teachers associations should be established in schools or regions to encourage interaction among mathematics teachers especially those teaching learners with hearing impairment in mathematics. Through such interactions, the teachers could gather and gain new ideas in teaching the subject to their learners in respective schools. James (2007) observes that curriculum implementation is hampered by the degree of which teachers' commitment is constantly interfered with. Teachers are stressed due to lack of teaching facilities or lack of appropriate time to plan and their qualifications and experience in sign language play a very important role in the performance of learners especially those with hearing impairment. In many incidences, creating a positive induction experience for new teachers is a meaningful component of his reform. At the core of such support efforts is the recognition that all teachers, particularly new teachers are learners. It is also crucial that teachers require some refresher courses to keep them abreast with current trend of Special Needs Education in order to provide quality Education to learners with hearing impairment.

North Carolina Governor, James (2007), chairman of the National commission on Teaching and America's Future, notes, "Teachers with least training are assigned to teach the most disadvantaged students. A crucial ingredient missing from several teacher education efforts is a theory of social power to assist teachers to understand the dynamics of student's interaction, curriculum theory and develop pedagogy, evaluation, professionalism in sign language as these arise in classrooms. The strategies to reconsider teachers' education started in earnest in January 1995, when schools wide retreat focused on determining redundancies, overlaps and gaps in

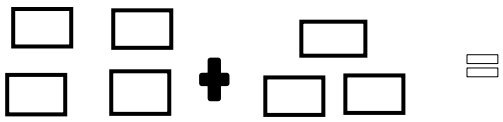
existing programs and began to consider a new conceptual framework for teacher education. Coincident with that retreat, a Teacher Education Steering Committee (TESC) got assembled and began conversations relevant to articulate a new orientation to teacher education (Scherer, 1999).

The Report of Koech Education Report (1999) Kenya Commission of Inquiry into the Education System of Kenya on Special competences of Teaching and Non- teaching staff, training of special teachers pointed out that no teacher or officer shall be appointed to teach or supervise the teaching of children with special needs unless such a teacher has passed proficiency and competency tests in the provision of such. The teacher should have Education in Sign language and similar proficiencies and competences and a holder of a certificate or other award issued by any institution recognized as competent to issue such certificates under the Education Act (1999). This was in particular to those learners with Hearing Impairment. According to the National Council of Teachers of Mathematics NCTM (2000), effective teaching requires knowing and understanding mathematics, student as learners and pedagogical strategies since teachers provide experiences from which students learn mathematics. The students understanding of mathematics, their ability to use it to solve problems, and their confidence in and disposition towards mathematics therefore, all get shaped by the teaching they get in school. This prompted the need for a study on strategies for enhancing Mathematics performance among class 5-8 learners with Hearing Impairment to be done at Makongo, Makueni Kenya.

2.4 Teaching Methods

Before beginning mathematics instruction, the teacher needs to know basic operations used in mathematics. The teacher should also know basic information about the organization of mathematics content. There are several operations that are essential to learning namely; addition, subtraction, multiplication, division, and understanding basic facts such as place value, structure and regrouping. According to Mercer, Mercer & Pullen (2013) the following explanation shows Mathematics Terms in Basic Computation thus: in addition two addends gives sum like in 8+4=12, in subtraction minuend and subtrahend gives difference as in 9-4=5, in multiplication, multiplicand and multiplier gives product as in 8×5=40 and in division, dividend and divisor gives quotient like in 48÷6=8.

Basic facts must be understood and memorized; these are the tools and simple closed number sentences used in computation. Addition and subtraction facts involve two-one digit addend and multiplication and division facts involve two-one digit factors, (Ashock, 2010). The following are instructional components for teaching computation to class 5-8 learners with hearing impairment: Provide figure experiences to promote understanding. Example



Provide semi concrete experiences to promote understanding. Example: //// + ///:4 + 3

Provide abstract activities and practice to promote mastery. Example: 4 + 3 = ___,

Teach rules that indicate patterns and relationships. Example: *zero rule:* Any number plus zero equals the number.4 + 0 = 4 and *order rule:* Addends yield the same sum

regardless of their order. Example: 4 + 3 = 7 3 + 4 = 7, Use mnemonics to help students remember algorithms or problem – solving procedures. Example: DRAW

D –Discover the sign (+, -, ×, ÷)

R –Read the problem (“four plus three equals blank”)

A-Answer a conceptual representation of the problem using line //// /// and tallies and check (4 + 3 = ____) //// ///

W-Write the answer (4 + 3 = 7)

Use a variety of practice activities to promote mastery and generalization. Example: Provide vertical and horizontal problems, use self-correcting materials, instructional games, peer tutoring, and computer-assisted instruction for seat-work, provide activities to improve the rate of responses (e.g. 1-minute probes). Teach problem solving. Example: Have students solve a variety of word problems, have students create their own word problems, provide students with ways for solving problems (Ashok2010).

Some of the teaching methods used by teachers in teaching Mathematics to learners with hearing impairment are: oralism approach, manual approach, bi cultural-bilingual approach, mediated instruction and direct instruction through multimedia approach. Owino (2011), cites that Individualized Educational Program (IEP) should be emphasized when teaching mathematics to learners with hearing impairment to help reduce, minimize or eliminate poor performance in mathematics. Teachers may help students with hearing impairment learn better by customizing their teaching strategies to support the areas of needs that their students have. Before the lesson

starts, the teacher can engage in pre- teaching either individually or a small group, (Ripley, Barret, and Fleming, 2013). In this way, the learning of these students may be supported by the explicit introduction of vocabulary for each new topic. When teaching, how the teacher speaks may impact on how well the student understands (Speake, 2003). A plan for teaching the acquisition of computation or problem-solving skills includes the use of effective teaching steps to teach the mathematics skill (i.e. introduce the lesson (Mercer & Miller, 1992).

Durkin (1991) suggest that specific strategy instruction in mathematics holds significant promise for the students with hearing impairment. An evaluated and elaborated feedback routine with students with hearing impairment was developed and their results indicated that it helps students achieve learning goals quickly and effectively for good performance in mathematics and stress that, errors represent learning opportunities for the students and teaching opportunities for the teacher. The essential features of elaborated feedback are illustrated in the following mnemonic:

FEEDBACK:

F- Find the score. Explain the grade.

E- Enter the score. Use a graph, goal setting& making it meaningful.

E- Evaluate the score in terms of the goal.

D- Identify errors by examining the pattern.

B- Begin error correction. The teacher models a similar problem.

A- Ask the student to apply the correction procedure.

B- Close out the session by giving positive feedback on correction.

K- Kick back and relax (Deshler, et. al., 2001) (a).

Ripley, Barret, and Fleming (2013) have suggested that students with difficulties in word problems may benefit from memorizing skills and “wh” question forms. Learners with hearing impairment will benefit from front row seating. An unobstructed line of vision is necessary for students who use interpreters and for those who rely on lip- reading and visual cues. Do not speak facing the blackboard. Whenever possible utilize circular seating arrangements as they offer learners with hearing impairment the best opportunity to see all class participants.

According to Speake (2003), many teachers got trained at the American School that focused on American Sign Language. The controversy surrounding the oralism-manualism debate that is how to teach children with hearing impairment, began centuries ago and continues into the twenty-first century. Opponents of oralism contend that denying children sign language is tantamount to denying them a language to communicate. However, children who can learn language orally are better prepared for a hearing world. Most educational programs involved a total communication approach - a blend of oral and manual techniques which includes sign language, signed English, lip-reading and written English to learn mathematics.

Speake (2003) suggests that proponents of American Sign Language contend that it is natural, fluent, and efficient, while signing English systems that match with spoken English are cumbersome and awkward. However, up to this day very few public schools use American Sign Language. Regardless of teaching method that is used, students with hearing impairment experience difficulties acquiring the language of the hearing society and understanding mathematics skills e.g. computation. Mediated instruction has been advocated by effective teachers ever since the earliest forms of

transparency and slide projections, and motion picture films, have been introduced. As new forms of technology enhanced the general living conditions of people who are deaf as well, educators have applied them to the classroom during mathematics lesson. Such was the case, for example, when the acoustic telephone coupler was designed by three deaf inventors in 1964. Shortly after the modem came out, the large, noisy 250-pound teletypewriters were being lugged into classrooms across the country to provide primary and incidental language learning experiences for deaf students.

Not until recently, however, has technology shown great promise to become an integral component of classroom instruction for deaf students. There is an avenue of research on technology for mathematics education for deaf students at the National Technical Institute for the Deaf at Rochester Institute of Technology. This arena of technological research is direct instruction in the classroom through multimedia approaches. Deshler et. al., (2001) (a) focus on how teachers can help students with hearing impairment to explore important questions about content information being taught and how teachers can prepare assessment tools or other ways to measure students' understanding of specific content in Mathematics. From the foregoing literature, teaching methods were viewed as one of the factors that were worth investigating in this study towards poor performance in Mathematics among class 5-8 learners with hearing impairment in Makongo School for the Deaf.

2.5 Teaching Resources

According to the report of the commission of inquiry into the Education system of Kenya chaired by Koech (1999), use of visual aids to reinforce spoken presentations

whenever possible is amenable to wearing a microphone transmitter for use with an assisted listening device. Be flexible, allow deaf student to work with visual materials independently and for a longer period of time during a mathematics lesson. The report further recommends that the minister shall establish and maintain a unit for development, production, procurement and distribution of special equipment, materials, supplies and devices for use in the education of learners with special education needs instructional materials aid in teaching because they increase learners interest. Availability of instruction resources determine the level of teacher to learner and learner to learner interaction and thus enhance learning (Nyambura, 2004). Twoli, Maundu, Kiio, Muindi, and Kithinji (2007), state that the Mathematics teacher will need to select and use a wide variety of resources in teaching to take care of every individual differences in class. Learner interaction is enhanced in a conducive environment which keeps the learner actively motivated and the teacher's competence highly upheld for critical and productive thinking (Rukangu, 2012).

Scholars have undertaken various studies to identify ways in which learners with Hearing Impairment would receive learning support in an effort to develop digital technologies that assist music learning for learners with hearing impairment, Yang, (2007) examined the application of computer-aided music-learning system. The system can assist the learners the kind of pitch and tempo being played, hence then learn to play songs thus increasing individual interest in music classes and improving performance. The system functioned by providing an instant feedback mechanism for hearing impaired learners in the form of automatic assessment of their learning performance. Al -Bayati and Hussein's (2009), study on the impact of e-tutorials on

the motivation of hearing impaired learners and the results indicated e-tutorials might benefit the learners.

Diana (2005) note some support resources essential for learners with hearing impairment like, Financial Assistive, Helpful Website Links, Leader Support and Order Materials. People with hearing impairment demonstrate computer technology for schools and work in this video collection presentation. It can be used to train educators, technology support staff, students with hearing impairment and advocates so that they can harness the power of computer technology to promote learning for people with hearing impairment. Quick Time and Window Videos are provided for downloading and playing from the computer. There are two avenues of research on technology for mathematics education for deaf students at the National Technical Institute for the Deaf at Rochester Institute of Technology. These arenas of technological research are assistive device technologies for enhancing access to classroom teachers and use of technology for networking in teacher preparation and teaching of mathematics. The researcher therefore wished to find out what teaching resources are used by teachers of Mathematics to teach learners with hearing impairment in Makongo, Makueni Kenya.

2.6 Summary

Frank (2000) observed that childhood hearing loss of any type and degree if unmanaged is likely to have negative impact on the development of spoken and receptive language, the ability to read and write and academic achievement. Nevertheless, the study did not highlight on strategies of enhancing performance in Mathematics among class 5-8 learners with hearing impairment. Huetinck and

Munshin (2007) cite that, students must learn Mathematics with understanding actively building new knowledge from experience and prior knowledge. However the study never addressed strategies of enhancing performance in Mathematics among class 5-8 learners with hearing impairment. Solomon and Podgursky (2001) observed that evaluation focuses on the knowledge and skills of teacher, which provides an incentive for all teachers to improve and also an intrinsic reward through professional development. This study never addressed strategies of enhancing performance in Mathematics among class 5-8 learners with hearing impairment. Owino, (2011) observed that Mathematics teachers associations should be set and encouraged in schools or regions to encourage interaction among mathematics teachers especially those teaching learners with hearing impairment in Mathematics. However, the study never addressed strategies of enhancing performance in Mathematics among class 5-8 learners with hearing impairment.

Speake (2003) observes that proponents of American Sign Language contend that it is natural, fluent, and efficient, whereas signing English systems, which correspond with spoken English, are cumbersome and awkward. However, the gap on strategies of enhancing performance in Mathematics among learners with hearing impairment was never closed. Diana, (2005) note some support resources essential for learners with hearing impairment like, Financial Assistive, Helpful Website Links, Leader Support and Order Materials. People with hearing impairment demonstrate computer technology for schools and work in this video collection presentation. Nevertheless, the study never addressed strategies of enhancing performance in Mathematics among class 5-8 learners with hearing impairment.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1Introduction

This chapter discuss the research design, variables, location of the study, target population, Sampling Techniques and sample size, data collection instruments, piloting, data validity and reliability and data collection techniques.

3.2 Research Design

The study adopted a case study research design whereby the researcher used only one school to collect data from members of a population in order to determine the status of that population with respect to one or more variables (Mugenda and Mugenda, 1999; Johnson & Christensen, 2008). That was why it was suitable for the study as the researcher collected data from teachers and learners. Qualitative narrative researches enrich lives of both the researcher and the participants (Creswell, 2005).

3.2.1 Variables

The dependent variable was performance in mathematics for learners with hearing impairments in class 5- 8 examinations**.** Independent variables comprised learner's characterisitics, teacher's professional qualification in sing language, teaching methods and teaching resources.

3.3 Location of the Study

The study took place at Makongo School for the deaf where the researcher got respondents who gave the needed information. The school is located in Makueni County which is located in the Southern part of Eastern region along the Machakos-Wote road just before Mukuyuni town from Nairobi. Makueni County borders four

counties with Kitui to the East, Taita Taveta to the South, Kajiado to the West and Machakos to the North. The researcher felt that the school being one of the largest and oldest for learners with hearing impairment could give a true picture of challenges faced by teachers as they use strategies to enhance performance in Mathematics among class 5-8 learners. Singleton Jr, Straits& Straits (1993), observed that an ideal setting for the study is the one directly related to the researcher's interest.

3.4 Target Population

In the study only one special school for learners with hearing impairment was used which has been presenting candidates for the KCPE examination within the last five years (2010-2014).The study targeted all the learners with hearing impairments from class one to eight (28) and their teachers (9) giving a total of 37 in the whole population.

3.5 Sampling Technique and Sample Size

A sample size is a small part of a large population which is to be representative of a large population (Orodho, 2009).A sample size was taken from class 5-8 (20) understanding and mature learners who were able to give the needed information. According to Krejcie and Morgan (1970), 19 respondents were required to achieve a 95% confidence interval in generalizing to the 20 learners as shown in Table 1 (Appendix 1), the mathematics teachers and the head teacher made the sample hence a sample size of 24 respondents out of the 37 in the whole population. They were sampled purposively to give the reliable information needed. This is attributable to the fact that class five to eight learners are mature enough and able to answer interview

questions with ease. Classes 1-4 were not in a position to give a clear figure of their performance.

3.6 Data Collection Instruments

The researcher developed and used Questionnaires for the teachers and Interview schedule for the learners with hearing impairment respectively in the study. The researcher interviewed the learners with Hearing Impairment with help of one of the teachers in the school using sign language. All the research instruments were administered to the Mathematics teachers by the researcher personally. In the questionnaire both close- ended and open- ended questions were set. Such questions helped the researcher to collect the appropriate data which when analyzed helped the researcher to answer the research questions hence achieved the research objectives. Questionnaires were necessary as they made the researcher obtain some data that could not easily be obtained by the use of other tools.

3.7 Piloting

A pilot was done to test the validity and reliability of the research tools. A pilot test of the field procedures is viewed as significant as it is the only way a researcher can determine if everything "works", especially the research instruments (Kombo and Tromp, 2006). The pilot test was done in Machakos School for the deaf on respondents with similar characteristics as the respondents in the main study. This was done through a test re-test technique following the same conditions which were used in the actual study. The pilot test was done two weeks earlier than the actual study so as to allow for ample time to modify the data collection instruments.

3.7.1 Validity of Research Instruments

During the pilot test the research questions and study objectives were validated since they were to find out whether they measured what they were intended to measure. The pilot test was done at Machakos School for the Deaf and helped in judging clarity in the items of the questionnaire. The content validity of the instrument was determined by seeking the opinion of my supervisors on the research instrument. The researcher then made the necessary modifications of the tools.

3.7.2 Reliability of the Research Instruments

According to Orodho (2009) a correlation coefficient of 0.7 is high enough to declare the instrument reliable.In order to test the reliability of the instrument to be used in the study, the test- retest method was done using Pearson Product Moment Correlation Coefficient of 0.70 after two weeks to ascertain reliability of the instruments. This established the extent to which the questionnaires elicit the same responses every time they were administered.

3.8 Data Collection Procedure

The researcher made two visits to the school where the data was to be collected. In the first visit, the researcher explained the intention of the study to the head teacher in the school. A second visit was made to distribute the data collection instruments. Semi-structured questionnaires and interview guides were used to collect data from specific respondents. Questionnaires were administered to the mathematics teachers and interview was done to class 5-8 learners with hearing impairment with the help of one of the teachers from the school using sign language. Another visit was made for collection of the questionnaires. The questionnaires were then packed for data

analysis and details on each was utilized well and given accordingly. The questionnaires in both instruments addressed the objectives of the study.

3.9 Data Analysis

Data collected was processed and analyzed to facilitate answering the research questions. Qualitative data was done manually which involved extraction of information from interview which was then translated and coded based on established themes. Data from the completed structured questionnaires was edited, coded and entered into SPSS version 17 for windows and cleaned for analysis. The analyzed data was presented in form of frequency, percentage and then discussed. After the qualitative and quantitative analysis, the results were interpreted and discussed.

3.10 Logistical and Ethical Considerations

After the researcher got the letter from the Graduate School, the supervisors lead the researcher on how to go on with the data collection. The researcher sought permission to undertake the research in Makongo School for the Deaf, Makueni County from the Ministry of Higher Education Science and Technology. The researcher then reported to the County Education Officer, Makueni County and then visited the sampled school. The researcher then sought permission from the school head to carry out the research. A meeting was then held for the mathematics teachers where the researcher explained the basic issues about the research and its benefits. Before the actual assignment of questionnaire the consent of the mathematics teachers and learners was sought .The researcher assured the respondents that the results got from the respondents were to get treated with confidentiality of the highest degree and no other

person was to have access to it apart from the researcher. The information was only to be used for the research purpose.

CHAPTER FOUR

DATA PRESENTATION, ANALYSIS AND DISCUSSION

4.0 Introduction

The purpose of the study was to establish strategies of enhancing performance in mathematics among class 5-8 learners with Hearing Impairment in Makongo School for the Deaf. Quantitative and qualitative methods were used to analyze the data on demographic characteristics of respondents, teaching methods and resources used in teaching students with hearing impairment an determinants of enhancing performance in Mathematics of the learners. Percentages and frequencies of the data were generated using quantitative methods. Cross tabulation was used to analyze relationships between variables. Qualitative analysis was conducted by generating themes based on the objectives of the study. Frequency tables, charts and graphs have been used to present the data.

4.1 Demographic Characteristics of Respondents

4.1.1 Teachers

The study through a Questionnaire investigated the demographic characteristics of sampled teachers in Makongo School including gender, age, level of education and work experience. From Table 1, majority 3 (75%) of the teachers were male and 1 (25%) was female. Most 2 (50%) of the teachers were mature and aged between 41-50 years, while 1 (25%) was aged between 31 to 40 years and 1 (25%) was aged above 50 years. On Education, the study looked at the highest level of education attained by teachers. Half 2 (50%) of the teachers had attained university education while the other half 2 (50%) had college education. All the teachers at Makongo

School had a work experience of less than 10 years. The table shows the demographic characteristics of teachers that are gender, age bracket, highest level of education and work experience.

Table 4.1: Demographic characteristics of teachers by gender, age bracket, highest level of education and work experience, frequency and percentage

Gender	**Frequency**	**Percent (%)**
Male	3	75
Female	1	25
Total	4	100
Age bracket	**Frequency**	**Percent (%)**
31-40	1	25
41-50	2	50
>50	1	25
Total	4	100
Highest Level of Education	**Frequency**	**Percent (%)**
University	2	50
College	2	50
Total	4	100
Work Experience (no. of yrs.)	**Frequency**	**Percent (%)**
>10	4	100

4.1.2 Learners

Similarly to the teachers, the study looked at the demographics of learners in Makongo School with hearing impairment including gender, age and level of education. Table 2 shows that slightly over half of the learners were males 10 (53%), while females were 9 (47%). The age of learners with hearing impairment studied was between 13-18 years. Slightly above a quarter 6 (32%) were 17 years of age. The class level of the participants in the study was between classes 5-8, with majority of the learners coming from class 8. In Kenya, most learners between the ages 13-18

years are in secondary/high school level of education. Learners interviewed in this study were at primary school class 5-8 level.

Table 4.2: Demographic characteristics of learners by gender, age, class level, frequency and percentage

Gender	**Frequency**	**Percent (%)**
Male	10	53
Female	9	47
Total	19	100
Age	**Frequency**	**Percent (%)**
13	2	11
14	2	11
15	4	21
16	4	21
17	6	32
18	1	5
Total	19	100
Class level	**Frequency**	**Percent (%)**
5	4	21
6	5	26
7	4	21
8	6	32
Total	19	100

This implies that hearing impairment could have delayed their admission to primary school. It could also be that their disability hindered them from learning and moving to the next level/class within the required time.\

4.2 Learner's Characteristics and their Effect on the Ability to Learn Mathematics

4.2.1 Degree of Hearing

The objective one of the study was to examine the learners characteristics and the possible effect they may have on their ability to learn Mathematics. Table 3 shows

that majority 12 (63%) of the learners interviewed said they could not hear at all while 7 (37%) said that they could hear very little sound. The study results support Chinn (2014) who said the problem that learners with hearing impairment experience when learning mathematics is such factors like degree of impairment thus those who can hear a little are taught together with those who are profound by use of sign language.

Table 4.3: Degree of hearing by frequency and percentage

Can hear or cannot	**Frequency**	**Percent (%)**
No	12	63
Yes	7	37
Total	19	100

4.2.2 The Effect of Degree of Impairment of Learners to Performance in Mathematics

The teachers were asked how the degree of impairment of learner's can affect the performance in mathematics. Teachers as respondents reported that hearing impairment makes it difficult for learners to grasp mathematical concepts easily due to the challenge in communication. Teachers expressed that explaining concepts to the learners is difficult due to the limited vocabulary in sign language. The study results support early childhood curriculum document Te Whaariki (1996) which say that the reality for many children who have hearing impairment or are deaf is that they find it difficult to learn mathematical content/processes and to interpret and understand the language of mathematics. The teachers reported that hearing impairment makes it difficult for learners to grasp mathematical concepts easily which could affect their performance. This support Cole & Flexer (2015) who note that a child with hearing problem may have limited range of distance of hearing that child may need to be

taught directly many skills that other children learn incidentally. Hence, this finding could lead to assertion that learner's characteristics have to be taken into account to enhance mathematics performance in class 5-8 in Makongo School for Deaf.

4.2.3 Reasons why Degree of Impairment of Learners Affect their Performance According to Mathematics Teachers

All class 5-8 Mathematics teachers were asked reasons why degree of impairment of learners can affect performance.

Mathematics teacher gave the following as a reasons why degree of impairment of learners can affect performance

With profound hearing loss, communication is a problem since learners cannot be helped by hearing aids. They are not able to relate to things since they have never heard words spoken. It is hard for learners with hearing impairment, learners gain more from a teacher who uses both signing and speaking. Some mathematical concepts cannot clearly be explained through sign language due to limited vocabulary.

4.2.4 Reasons why Degree of Hearing Impairment of Learners Affect their Performance According to Learners

The students were asked how hearing impairment affected their performance in mathematics. The students expressed that hearing impairment made it difficult to understand mathematical equations written in words. This is because of the language barrier caused by hearing impairment. The study results support Lee (2006) who said the greatest barrier to Education is failure to learn language which is also used in learning mathematics. This implies that students understand better when sign language is used than when words are used.

4.2.5 Effect of Hearing Impairment on Performance in Mathematics

Leaners were asked the effect of hearing impairment on their performance in mathematics. Four (21%) of the learners said "*difficult to understand word problem"*. Four (21%) of the learners also said, "*Language problem*". Four (21%) of the learners said, "*Words are hard to understand"*. Three (15%) of the learners said "*long mathematical sentences*," one (7%) learner said, *"understanding mixed operations*", and three (15%) of the learners said "*none"*.

4.2.6 Challenges Faced in Learning Mathematics

Learners were asked challenges they face in learning mathematics. Three (15%) of the learners said, "*Mathematics is hard to understand*", three (15%) of the others said "*difficulty in explaining",* and another three (15%) of the learners said "*getting wrong many times* "yet another three (15%) of the said "a lot of work" Two (10%) learners said *"mathematical problems are hard*," One (6%) of the learners said, *"understanding difficult mathematics,*" one more (6%) of the learners said "*solving area problems*," another one (6%) of the learners said "*mix mathematics*," another one (6%) of the learners said '*measurement,"* and another one (6%) of the learners said "*understanding equation on currency.*

4.3 Professional Qualification of Teachers in Sign Language

4.3.1 Teachers Professional Qualifications in Sign Language and Length of Training

The professional qualifications of teachers were examined in the study as objective two. Half of the teachers had university education while the other half had P1 college education. Additionally, the study further found that in all the teachers teaching

mathematics to class5-8 learners with hearing impairment that were interviewed had training in special education in sign language. The study results in table 4 showed that teachers' length of training in special education in sign language varied. Two of the teachers had in-service training of 2 years in sign language; one had trained in sign language for 4 years, while the last one had other training in sign language.

Table 4.4: Teacher's professional qualification by highest level of education and length of training for teachers

Highest Level of Education	**Frequency**	**Percent (%)**
University	2	50
College	2	50
Total	4	100
Length of training for teachers	**Frequency**	**Percent (%)**
In-service	2	50
4 years	1	25
Others	1	25

From Table 5.5, despite the training in special education, the study gathered that most 3(75%) of the teachers had difficulties in translating mathematics into sign language. Only one teacher 25% was reported to have no difficulties in translating mathematics to sign language. The study results were supported by Lee (2006) who say that the greatest barrier to Education is failure to learn language which is also used in learning Mathematics. This is a clear indication that teacher's professional qualification could have a negative effect on class 5-8 learners with hearing impairment performance in mathematics. According to Nur (2010) achievement in mathematics teacher needs more than just a qualification. All the teachers 4 (100%) were trained in special education in sign language.

Table 4.5: Teacher's professional qualification by training in special education and teachers have difficulty in translating mathematics into sign language

Teachers have difficulty in translating Mathematics into sign language		**Frequency**		**Percent (%)**	
Yes		3		75.0	
No		1		25.0	
Total		4		100.0	
Training in special education in sign language		**Frequency**		**Percent (%)**	
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	4	100.0	100.0	100.0

4.4 Teaching Methods

4.4.1 Teaching Methods Used by Teachers in Teaching Mathematics to Learners with Hearing Impairment

In objective three, the researcher established the teaching methods used by teachers in teaching Mathematics to learners with hearing impairment. The researcher interviewed the learners in Makongo School for the Deaf to find out the teaching methods used to impart knowledge to them. Most of the learners interviewed, 9 (47%) indicated that the teachers used gestures in teaching mathematics, 7 (42 %) indicated that the teachers used multiple methods including gestures, technology/multi-media, direct instruction, use of group assignments and lip reading while 3 (11%) said the teachers used lip-reading.

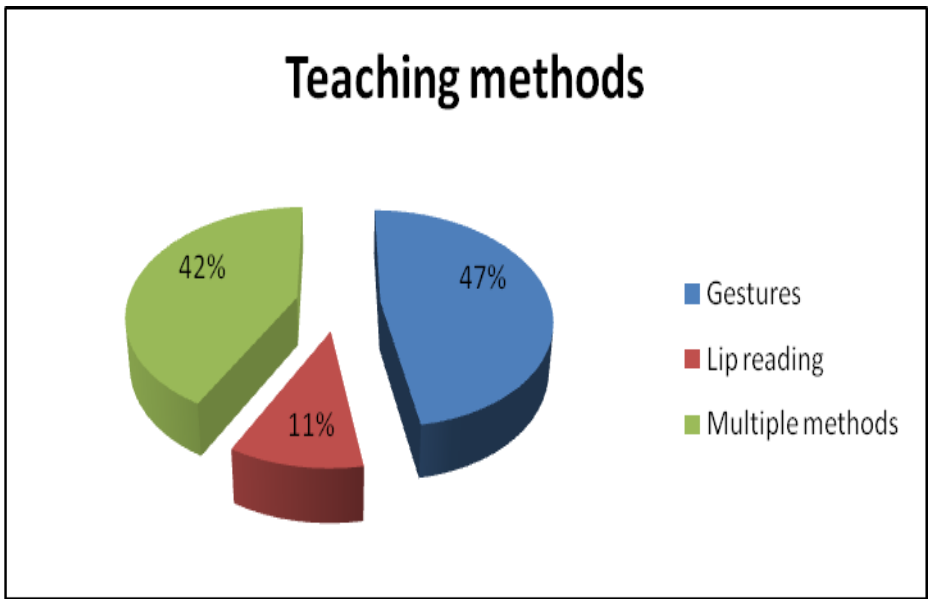


Figure 4.1: Teaching methods used in teaching Mathematics

4.4.2 Methods used to Promote Communication/Interaction

Teachers were asked what methods they used to promote communication and interaction during mathematics lessons. The teachers indicated that they used question and answer method to promote interaction between them and the learners. Demonstrations and use of examples were also cited as an effective method of promoting interaction. To promote interaction between the learners, the teachers indicated that they encouraged peer tutoring among the learners. Use of visual aids and individualized teaching were also some of the other methods that the teachers cited.

Four respondents were questioned on the methods used by teachers to promote Communication/Interaction during Mathematics lessons.

Mathematics teachers gave these Methods to be used to promote Communication Interaction during Mathematics lessons:

Total communication and visual aids

Peer tutoring and individualized teaching

Demonstration, question and answer

Question and answer and explanation through examples.

4.4.3 Effectiveness of Teaching Methods on Performance of Mathematics

The researcher also sought to know which method the teachers found most effective in teaching mathematics to learners with hearing impairment. Majority of the teachers reported that total communication was one of the most effective methods. According to the teachers, this involves combining various methods of communication including signs and sign language, facial expression, speaking, drawing, pointing and dramatizing. One of the teachers indicated that having a question and answer session and marking students' assignments was useful in assessing whether there was communication.

Methods used by Teachers in Teaching Mathematics by their Effectiveness

Four respondents were asked the most effective methods used by teachers in teaching Mathematics.

Teachers gave these Methods to be used in teaching Mathematics:

Total communication

Signing/sign language and facial expression

Lip-reading, sign, speak, draw, point, and dramatize to enhance learning

Using examples, question and answer through sign language and marking

Pupils 'assignments to assess if there was communication

4.4.4 The impact of Teaching Methods on Performance in Mathematics

All the teachers strongly agreed that teaching methods had a strong impact on performance of learners as indicated in Table 6.

Table 5.6: Teaching methods have a strong impact on performance

Teaching methods have a strong impact on performance by frequency and percentage				
	Frequency	**Percentage**	**Valid Percentage**	**Cumulative Percentage**
Strongly agree	4	100.0	100.0	100.0
Agree	0	0.0	0.0	0.0
Undecided	0	0.0	0.0	0.0
Disagree	0	0.0	0.0	0.0
Strongly Disagree	0	0.0	0.0	0.0

4.4.5 Extent to which Teaching Methods Affect Performance in Mathematics

Learners with hearing impairment need translation of mathematical concepts into sign language to facilitate understanding. The study examined the challenges faced by teachers in translating mathematics into sign language. Teachers reported that it was challenging to translate mathematics since some technical terms in mathematics have no sign language signs. Majority of the teachers also said translation was difficult since there is limited vocabulary in sign language. One of the teachers observed that sign language is not as rich as oral or written language. Another teacher reported that hearing impairment created a language barrier for learners making it difficult for them to read and understand some mathematical words.

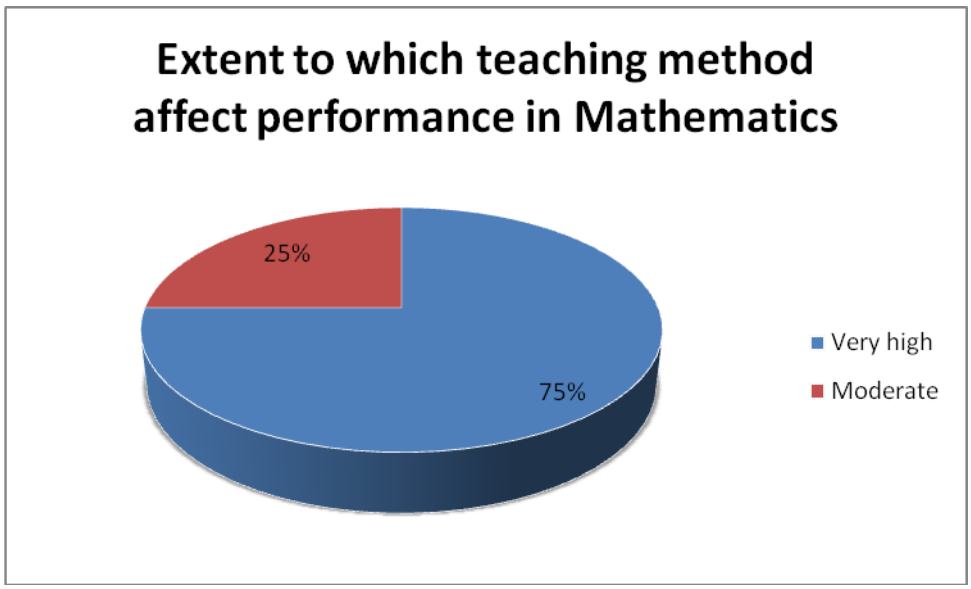


Figure 4.2: Extent to which teaching methods used affect performance in mathematics

4.4.6 Difficulties Experienced in Translating Mathematics to Sign Language

The study found that teachers faced various challenges in teaching mathematics to learners with hearing impairment. The teachers cited lack of resources and inadequate teaching facilities such as text books, geometrical sets as a major setback in teaching mathematics to learners with hearing impairment. Some of the challenges mentioned were related to the condition of learners. The teachers indicated that some learners had multiple disabilities including intellectual difficulties and specific learning difficulties making learning difficult so they needed frequent feedback on what had been taught. These study results were supported by Deshler, et. al., (2001) (b), who said that frequent and appropriate feedback would also help teachers to enhance their teaching approaches. Therefore it is always advisable for teachers to provide learners with feedback; however it was established in the literature review that provision of immediate and appropriate feedback helps learners benefit from their

mistakes and therefore enhance their performance. Communication was also reported as a challenge due to the hearing impairment of learners.

Difficulties experienced by teachers in translating Mathematics into sign language by respondents:

Four respondents were asked which difficulties are experienced by learners in translating Mathematics into sign language.

Teachers gave the following as difficulties:

Some technical terms have no sign language signs, learners with hearing impairment have problems of reading and understanding worded questions due to language barrier, sign language is not as rich as oral or written, and language limited vocabulary in sign language

4.5 Teaching Resources

4.5.1 Teaching Resources Used by Teachers in Teaching Learners with Hearing Impairment

The study's objective four was to explore the resources used by teachers in teaching Mathematics to learners with hearing impairment. Above half of the learners 13 (69%) indicated that teachers used multiple resources including a combination of print materials, visuals and hearing aids in teaching Mathematics. About 5 (26%) of the learners said that teachers used print materials, while below a quarter of the learners 1 (5%) reported that the teachers used visual and hearing aids.

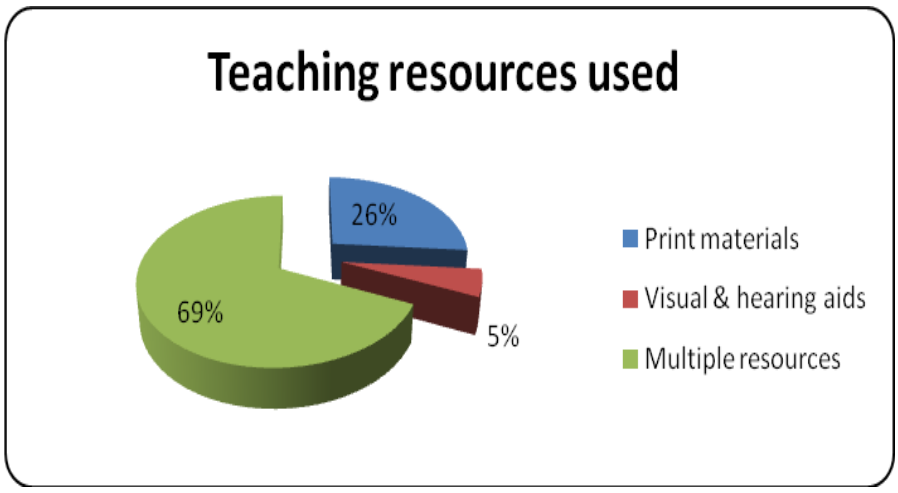


Figure 4.3: Teaching resources used

4.5.2 Teaching Resources Used By Teachers To Promote Communication

Teachers were asked to indicate the teaching resources they used to promote communication and interaction during mathematics lessons. The teachers used a combination of resources including textbooks, drawings, wall/mathematical charts, multiplication tables, counters and chalk boards. The study results support Nur (2010) who points out that resources like compasses, charts, diagrams, models, projectors and computers were not used in Banadir Region in Somalia

Resources used to promote communication/interaction during Mathematics lesson by respondents:

Four respondents were asked which resources could be used to promote communication/interaction during Mathematics lessons. The respondents gave the following resources:Text books, drawings, charts, multiplication tables, books, teaching aids/real objects, resource persons, chalk, real objects like counters, wall/mathematical charts, counters, chalk board.

4.5.3 Effect of use of Teaching Resources on Performance of Mathematics

The findings of the study suggest that teaching resources used have an effect on performance in mathematics. The teachers said teaching resources such as visual aids enhanced understanding and provoked reasoning among learners with hearing impairment. Learners also reported to understand mathematical concepts better when the teaching resources were used.

Effect of teaching resources used on performance in Mathematics by respondents:

Four respondents were asked the effect of teaching resources used.

The teachers gave the following:

They help the learners to understand better**,** they enhance understanding, provoke reasoning**,** use of visual aids enhance learning, theoretical learning makes them confused and they enable learners to understand concepts better

4.5.4 Other Teaching Resources that Can Be Employed to Further Assist in Teaching Mathematics

Teachers were also asked to state other teaching resources that can further be used to enhance learning in mathematics. Information and communication technology (ICT) was mentioned as some of the resources that could be useful for learners with hearing impairment. Specifically, the teachers mentioned technological equipment including computers and calculators, videos and television as some of the ICT resources that can be used. Diana (2016) noted some support resources essential for learners with hearing impairment like, Leader Support and Order Materials which teachers in Makongo School for the Deaf said were missing. Charts for instance those prepared by K.I.C.D and a variety of textbooks were also identified as some of the resources

that could be used, Table 16. Similar to the teaching resources, all the teachers interviewed agreed that teaching resources have an effect on performance in Mathematics.

Other teaching resources that can be employed to further assist in teaching Mathematics by respondents

Four respondents were asked which other teaching resources can be employed to further assist in teaching Mathematics. They gave the following:

Technological equipment, videos, lighting, T.V, real objects/ charts ICT equipment (computers, calculators), wall charts prepared by KICD, play items (play Station, number puzzles), variety of textbooks

4.5.5 Appropriateness of Teaching Resources Used by Teachers during Mathematics Lessons by Learners

Further, the study sought to find out if teaching resources currently being used by the teachers were appropriate in teaching mathematics to learners with hearing impairment. Fifteen learners (78.95%) said," *No"* three learners (15.79%) said "*yes*" and one learner (5.26%) said, *"No answer"*.

Table 4.7: Teaching resources used by teachers during Mathematics lessons appropriate by learner's answers, frequency and percentage

Learner's answers	FREQUENCY	PERCENT (%)
No	15	78.95%
Yes	3	15.79%
No answer	1	5.26%
Total	19	100%

4.5.6 Extent to which School is Adequately Equipped with Mathematics Learning Resources

Teachers were asked to indicate the extent the school is equipped with mathematics learning resources. Majority three, (75%) of the teachers reported that the school was not adequately equipped with Mathematics learning resources. Only one 25% of the teachers said that the school was adequately equipped. The study investigated the nature of textbooks provided for use in class 5-8 by students with hearing impairment.

This study supports World Bank Report (1995) who said: From the evidence we have so far, the availability of books appears to be single most consistently positive school factor in predicting academic achievement.

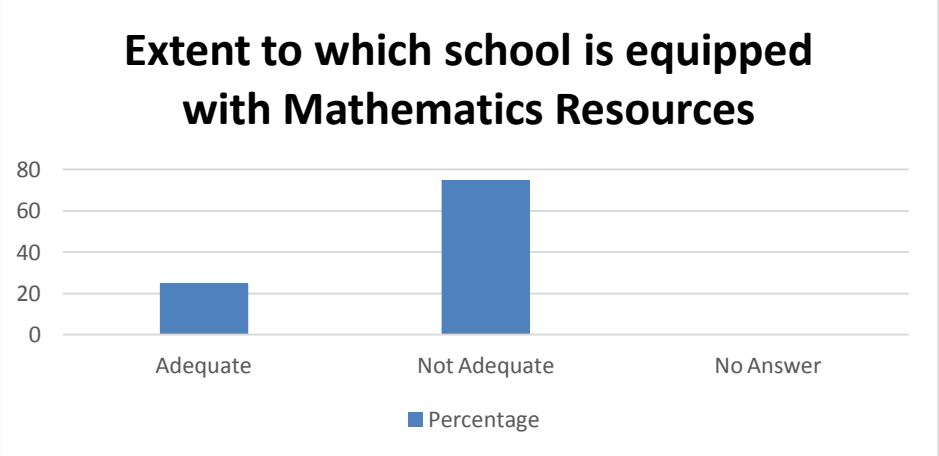


Figure 4.4: Extent to which school is equipped with mathematics resources

4.5.7 Nature of Textbooks Used for Class 5-8 Learners

All the Mathematics teachers teaching class 5-8 learners with hearing impairment were asked how the textbooks they used to teach mathematics related to the impairment of the learners in place. Three (75%) of the teachers described the

textbooks they used to be too difficult for the learners to understand and only one (25%) of the teachers said that the textbooks were appropriate for the learners.

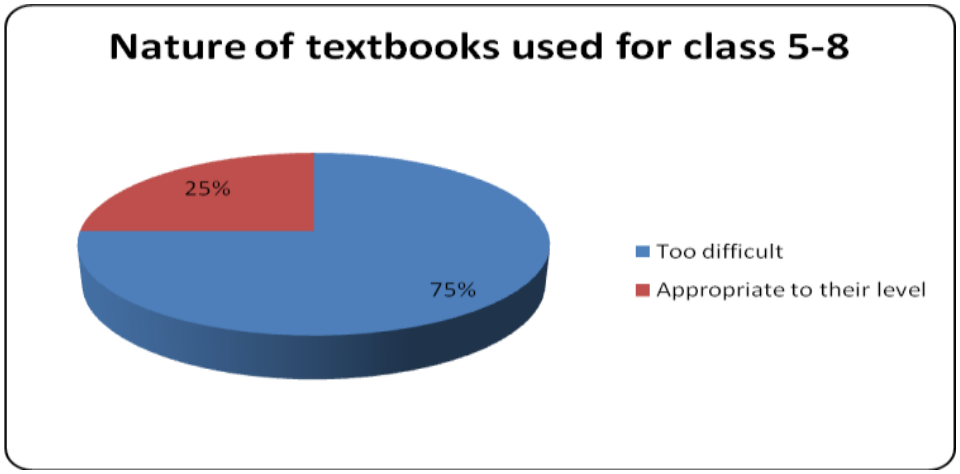


Figure 4.5: Nature of text books used for class 5-8

4.5.8 Factors for Effective Teaching Mathematics to Learners with Hearing Impairment

Teachers were interviewed to find out strategies that could be applied to motivate learners with hearing impairment to perform like their counterparts without hearing impairment. Most of the teachers 3(75%) recognized rewarding good performance of the students as one of the effective ways of motivating the learners. Some of the methods of rewarding mentioned include clapping when learners answer questions correctly, giving gifts, congratulating and applauding good performance. One (25%)of the teachers reported that learners can also be motivated to perform well by employing stimulating and relevant teaching aids during lessons.

Factors considered by teachers to be important for effective teaching in Mathematics for learners with hearing impairment:

Teachers gave the following as factors considered important for effective teaching in Mathematics for learners with hearing impairment; mode of communication, modification of syllabus, variation of testing methods, modification of language used in testing the learners, adequate teaching and learning resources including textbooks, visual aids, classroom desks, geometrical sets, adequate lighting and a conducive environment for learning with qualified and motivated teaching personnel adequate time allocation to exhaust teaching and explanation of the concepts, patience in teachers.

4.5.9 Ways to Motivate Learners

The study sought the views of learners on what the teachers can do to deliver mathematics lessons better. Almost all the students were of the view that offering elaborate explanations and putting more emphasis through repetition while teaching would enhance delivery during mathematics lessons. Ten learners (52.6%) said, "*Explaining more",* seven learners (36.8%) said "*repeating*," one learner (5.3%) said "*changing teacher"*, and another one (5.3%) said "*using methods that learners can understand*."

Strategies to motivate learners with hearing impairment to perform like other learners in Mathematics by respondents:

Four respondents were questioned on the strategies to motivate learners with hearing impairment to perform like other learners in Mathematics.

Teachers gave the following strategies:

Congratulating students whenever they answer questions correctly and encouraging them, making learning relevant to their daily experiences, using stimulating and

relevant teaching aids in lessons, applauding them when they perform well and taking them for tours within the local market.

4.5.10 Teaching Resources Teachers Use to Teach Mathematics

As earlier discussed, the study results suggest that teaching resources were essential in enhancing performance in Mathematics for learners with hearing impairment. The learners were interviewed to find out types of teaching resources that would enhance their performance. Most of the students reported that a combination of teaching resources including information technology devices, abacus, counters, charts and hearing aids would be effective in enhancing their performance. Other resources mentioned included print materials, and visual aids.

Eleven learners (57.8%) said," technological devices (ITC), abacus, counters, charts, hearing aids, "two learners (10.5%) said "technological devices," one learner (5.3%) said "visual and hearing aids, technological devices (ITC)" another one (5.3%) said, "print materials, visual and hearing aids", one another (5.3%) said "visual and hearing aids, technological devices (ITC)" another one (5.3%) said "print materials, visual and hearing aids, technological devices" and the last two (10.5%) said 'print materials."

4.5.11 What Government Can do to Enhance Performance in Mathematics

The government is responsible for financing education including provision of teaching resources. The teachers interviewed were asked to state the government interventions they deemed necessary to boost performance of learners with hearing impairment. There was an emphasis on the need for the government to review the syllabus to take into account needs of learners with hearing impairment. One of the

teachers reported that personal development for teachers through seminars, workshops and training was necessary for teachers dealing with this category of learners. The study findings also indicate that government intervention is required in provision of teaching resources including technological resources, auditory equipment and other instructional materials.

Government intervention to enhance performance of learners with hearing impairment in Mathematics by respondents

Four respondents were questioned on the Government Intervention to enhance performance of learners with hearing impairment in Mathematics. They gave the following:

Provision of adequate instructional materials, introducing frequent seminars, workshops and trainings for the teachers handling children with Hearing Impairment. Encouraging use of technology in learning because these learners learn more through their sight. Equipping all hearing impairment learner's schools with auditory equipment (hearing aids, speech training kits).Reviewing the syllabus to eliminate topics that are insensitive to hearing impairment learners and modification of the syllabus to fit the learners also having examinations that suit them.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.0 Introduction

This chapter discusses the summary of the research findings, conclusion and thereafter recommendations made in accordance with the research questions and objectives set in chapter one. The three aspects of this chapter are presented below:

5.1 Summary of the Research Findings

The purpose of this study was to establish the strategies of enhancing Mathematics performance for class 5-8 learners with hearing Impairment at Makongo School for the Deaf, Makueni County, Kenya. Four factors that guided this study were: Learners characteristics, Teachers professional Qualifications, Teaching methods, and Teaching Resources. The following is a brief summary of the findings based on the general research questions of the findings.

5.1.1 Learners Characteristics

Majority of learners with hearing impairment in the study did not have residual hearing. Degree of hearing impairment makes it difficult for learners to grasp mathematical concepts easily due to challenge in communication and language barrier.

5.1.2 Teachers Professional Qualification in Sign Language

Majority of the mathematics teachers who participated in this study were qualified in special needs Education, although they had difficulties in translating Mathematical language to sign language. Mathematics teachers in Makongo School

for the Deaf used variety of methods in teaching Mathematics to class 5-8 learners with Hearing Impairment.

5.1.3 Teaching Methods

Most of the teachers used gestures, lip-reading, and multiple methods such as gestures, multi-media, direct instruction, use of assignments and lip-reading. The teachers reported the use of total communication which was a combination of signs and sign language, facial expressions, speaking, pointing and demonstration was one of the best methods to teach mathematics to class 5-8 learners with hearing impairment. There is therefore the need for class 5-8 Mathematics teachers to be conversant with different teaching methods for different categories of learners.

5.1.4 Teaching Resources

Majority of the teachers and class 5-8 learners with hearing impairment indicated the use of multiple resources including a combination of print materials and visual and hearing aids.The mathematics teachers used combination of resources namely textbooks, drawings, wall/ mathematical charts, multiplication tables, counters and chalkboard. Nyambura (2004), indicated a positive relationship between textbook availability and learner's performance. 'The findings in this study reveal that learners performance in Mathematics can be improved through increasing number of textbooks available to the learners .Thus the learners should be provided with a variety of textbooks and also the teachers should ensure they utilize them effectively to enhance learner's performance. This was supported by (Twoli, Maundu, Kiio, Muindi and Kithinji, 2007) who said that the Mathematics teacher will need to select and use a wide variety of resources in teaching Mathematics.

5.3 Conclusions

Learners in the study did not have any hearing, which made it difficult to grasp mathematical concepts easily. The study found out that teachers used only gestures in teaching mathematics to class 5-8 learners with hearing impairment instead of using multiple methods to communicate. The multiple methods are core to improving learner's holistic understanding of mathematical concepts and eventually enhancing their performance in the subject. This means failure to engage the students using multiple methods of communication hindered proper learning of mathematics. While most of the mathematics teachers were qualified in special needs Education, they had difficulties in translating mathematics concepts into sign language. Likewise, learners with hearing impairment found it difficult to understand mathematical sign language due to limited mathematical vocabulary and therefore continued to fail in mathematics examinations, and especially the word problems.

Most of the teachers did not use variety of resources when teaching mathematics subject to learners with hearing impairment resulting in students failing to perform well. Unless mathematics teachers of class 5-8 learners with hearing impairment use multiple methods and resources and also understand how to translate mathematics into sign language, learners would continue performing poorly. For this reason, the following recommendations are made:

5.4 Recommendations

The study recommends the following based on the analyzed and interpreted data.

i. The Government to Organize in-service trainings for Mathematics teachers who teach class 5-8 learners with hearing impairment with regard to one

common Mathematics sign language vocabulary which is limited because most Mathematics teachers use different sign language like the Kenya sign language and local sign language depending on the local area language.

ii. The Government through KICD to revise the curriculum of the teacher training instruction in special Education to improve the competence of the mathematics teacher and also modify the syllabus in some mathematics concepts like measurement, currency and mixed equations to suit learners with hearing impairment. The current testing methods and language used in testing learners with hearing impairment should also be modified to suit the learner to enhance their performance in Mathematics.

iii. The Government should motivate all teachers teaching in special schools and special units and any other teacher dealing with learners with special needs like those resource rooms.

iv. The Quality Assurance Standard Director (QASD) inspectorate division of the Ministry of Education should make proper follow-up on the teaching methods and resources used by teachers in teaching Mathematics to class 5-8 learners with hearing impairment. Further suggestions on how to improve on methodology of teaching and also to provide feedback to the teacher should be given.

5.5 Recommendations for Further Research

i. Due to limited scope of this study, the researcher was not able to carry out extensive research so further and related studies are recommended to be carried out in other counties of Kenya so that results could be compared.

ii. Research related to Science subjects may be conducted to check if the same problems may be faced.

iii. Further study should be done to examine the type of training in college and universities that gets undertaken by class 5-8 mathematics teachers for learners with Hearing Impairment, so as to determine the relevance of the knowledge gained. The study should also focus on the skills acquired regarding ability to translate mathematics into sign language.

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APPENDICES

APPENDIX I

Table 1: DETERMINING SAMPLE SIZE FOR RESEARCH ACTIVITIES

ROBERT V. KREJCIE

University of Minnesota, Duluth

DARYLE W. MORGAN Texas A. & M. University

N	*S*	*N*	*S*	*N*	*S*
10	10	220	140	1200	291
15	14	230	144	1300	297
20	19	240	148	1400	302
25	24	250	152	1500	306
30	28	260	155	1600	310
35	32	270	159	1700	313
40	36	280	162	1800	317
45	40	290	165	1900	320
50	44	300	169	2000	322
55	48	320	175	2200	327
60	52	340	181	2400	331
65	56	360	186	2600	335
70	59	380	191	2800	338
75	63	400	196	3000	341
80	66	420	201	3500	346
85	70	440	205	4000	351
90	73	460	210	4500	354
95	76	480	214	5000	357
100	80	500	217	6000	361
110	86	550	226	7000	364
120	92	600	234	8000	367
130	97	650	242	9000	368
140	103	700	248	10000	370
150	108	750	254	15000	375
160	113	800	260	20000	377
170	118	850	265	30000	379
180	123	900	269	40000	380
190	127	950	274	50000	381
200	132	1000	278	75000	382
210	136	1100	285	1000000	384

Note : N is Population size,

S is Sample size

APPENDIX II

QUESTIONNAIRE FOR TEACHERS

Instructions: *Please tick within the boxes and fill the structured questionnaire with applicable answers.*

SECTION A: PERSONAL INFORMATION

a. Gender

Male ☐

Female ☐

b. Age Brackets

Between 18-30 years. ☐

Between 31- 40 years. ☐

Between 41-50 years. ☐

Above 50 years. ☐

d. Highest Level of Education in sign Language Attained

Primary ☐

Secondary ☐

College ☐

University ☐

e. Work Experience

Less than one year ☐

Between 1-5 years ☐

Between 6-10 years ☐

Above 10 years ☐

SECTION B: LEARNERS CHARACTERISTICS

a) As teachers do you think learners with hearing impairment can negatively affect the general performance of the class in Mathematics at KCPE?

Yes ☐

No ☐

Please give a reason to your choice

……

……

b) How are learners with hearing impairment motivated to perform like others in class?

Please explain……

……

c) Children with hearing impairment can learn and socialize in the same way as ordinary children.

i) Strongly Agree ☐

ii) Agree ☐

iii) Undecided ☐

iv) Disagree ☐

v) Strongly Disagree ☐

d) To what extent does child him/herself affect performance of Mathematics at KCPE in your school?

Very High ☐ High ☐

Moderate ☐ Low ☐

e) Generally what factors are considered by teachers to be important for effective teaching and good performance of learners with hearing impairment? Please explain

……

SECTION C: TEACHERS PROFESSIONAL QUALIFICATIONS IN SING LANGUAGE AND EXPERIENCE

ග) What are the teacher's Professional Qualifications in sign language teaching Mathematics to learners with hearing impairment in your school? Please tick appropriately:

Trained Specialists ☐ Not trained ☐

ඛ) Do you have any training in special Education in sign language?

Yes ☐

No ☐

If yes specify the length of training

a) In-service ( ) b) One to two weeks ( )

c) Three months ( ) d) Four years ( )

c) How many years of teaching experience do you have?

a) Less than 1 year ( ) b) Between 1-5 years ( ) c) Between 6-10 years ( ) d) Above 10 years ( )To what extent does professional qualification in sign language and experience of teachers teaching learners with hearing impairment affect performance of Mathematics at KCPE in your school?

Very high ☐

High ☐

Moderate ☐

Low ☐

Poor ☐

SECTION D: TEACHING METHODS

a) Teaching methods are said to have a strong impact on poor academic performance.

i) Strongly Agree ii) Agree

iii) Undecided iv) Disagree

v) Strongly Disagree

b) Indicate any methods you use to promote communication (interaction) during mathematics lesson.

Any two applicable i)……..ii)……

c) Which mode of communication do you use in teaching mathematics best?

Please explain…….

d) Do you have difficulties in translating mathematical language into sign language when teaching learners with hearing impairment?

Yes ☐ decided ☐

No ☐ Undecided ☐

Explain ……..

e) To what extent does the teaching method used by teachers in teaching learners with hearing impairment affect the performance of Mathematics at KCPE in your school?

Very high ☐

High ☐

Moderate ☐

Low ☐

f) What challenges do you face when teaching mathematics to learners with hearing impairment? Explain briefly

---

SECTION E: TEACHING RESOURCES

a) Indicate any resources you use to promote communication (interaction) during mathematics lesson? At least four:

i)……

ii)……...

iii)……..

iv)……..

b) Do the teaching resources used by teachers in teaching learners with hearing impairment have any effect on the performance of Mathematics at KCPE in your school?

Yes ☐

No ☐

Explain ……

……..……

c) Text books provided for use in class 5-8 mathematics are:

Too difficult ☐

Too simple ☐

Appropriate to their level ☐

Undecided ☐

d) To what extent is your school adequately equipped with learning resources?

a) Very adequate ( )

b) Adequate ( )

c) Not adequate ( )

e)What other teaching resources do you think can be employed further to assist in teaching of Mathematics to learners with hearing impairment? Please name them:

i)……

ii)……

iii)……

iv)……

(5) In your own opinion what do you need the Government to do or add in place in order to enhance you performance in mathematics?

Please say it

……

…….....

APPENDIX III

INTERVIEW SCHEDULE FOR LEARNERS WITH HEARING IMPAIRMENT

Personal Information

Gender……

Age……..

Class**……....**

SECTION C: LEARNERS CHARACTERISTICS

1) Do you have some residual hearing? If yes, to what extend? Please explain

Yes ☐ No ☐

……

……

……

2) Do you normally miss classes because of hospital appointments? If yes explain

Yes ☐ No ☐

……

……

……

(3)Do you think your hearing impairment has any effect to your performance in mathematics examinations?

Yes ☐ No ☐

If yes please explain

……

……

4) What challenges do you face when learning mathematics? Please explain……

……

……

SECTION A: TEACHING METHODS

(1) How do you teachers teach you mathematics? (Tick)

Using gestures	☐	In groups	☐
Technology-Multi-media	☐	Lip reading	☐
Direct instruction	☐		

(2) Do you understand well when being taught?

Yes ☐ No ☐

(3) According to you, how do you think your teacher can teach mathematics appropriately? Please explain

……..

……..

(4)What do you think the teachers can do to improve the teaching of mathematics? Please explain

……

……

SECTION B: TEACHING RESOURCES

1) Which of the following teaching resources do your teachers use in teaching mathematics? (Tick)

i) Print materials ☐

ii) Visual and hearing aids ☐

ii) Web site links ☐

iv) Technological devices (ITC) ☐

2) Are the resources used by the teachers appropriate for your learning?

Yes ☐ No ☐

Please explain…….

……

3) To what extent is you school adequately equipped with learning resources?

a) Very adequate ( ) b) Adequate ( )

c) Not adequate ( )

4) What other resources do you think teachers can use in order to enhance your mathematics performance? Please name them

i……

ii……..

iii…….

APPENDIX IV

RESEARCH APPROVAL LETTER (Kenyatta University Postgraduate Department)

KENYATTA UNIVERSITY
GRADUATE SCHOOL

E-mail: kubps@yahoo.com
dean-graduate@ku.ac.ke
Website: www.ku.ac.ke

P.O. Box 43844, 00100
NAIROBI, KENYA
Tel. 810901 Ext. 57530

Internal Memo

FROM: Dean, Graduate School

DATE: 13th December, 2014

TO: Ms. Mirriam Uhuru Mwololo
C/o Special Needs Education Dept.
KENYATTA UNIVERSITY

REF: E55/CE/22955/10

SUBJECT: APPROVAL OF RESEARCH PROPOSAL

This is to inform you that the Graduate School Board at its meeting of 10th December, 2014 approved your M.Ed. Research Proposal entitled "Strategies for Enhancing Mathematics Performance among Class 5-8 Learners with Hearing Impairments in Makongo School for the Deaf, Makueni County, Kenya".

You may now proceed with your Data collection, subject to clearance with the Principal Secretary, Higher Education, Science and Technology.

As you embark on your data collection, please note that you will be required to submit to Graduate School completed supervision Tracking Forms per semester. The form has been developed to replace the progress Report Forms. The Supervision Tracking Forms are available at the University's Website under Graduate School webpage downloads.

Thank you.

JOHN M. ODONGI
FOR: DEAN, GRADUATE SCHOOL

c.c. Chairman, Special Needs Education Dept.

Supervisors:

1. Prof. Geoffrey G. Karugu
   C/o Special Needs Education Dept.
   KENYATTA UNIVERSITY
2. Dr. Mary Runo
   C/o Special Needs Education Dept.
   KENYATTA UNIVERSITY

JMO/cao

APPENDIX V

National Commission for Science, Technology and Innovation

(RESEARCH CLEARANCE PERMIT)

THIS IS TO CERTIFY THAT:
MS. MIRRIAM UHURU MWOLOLO
of KENYATTA UNIVERSITY, 1576-90100
Machakos,has been permitted to
conduct research in *Makueni County*

on the topic: *STRATEGIES FOR ENHANCING MATHEMATICS PERFORMANCE AMONG CLASS 5-8 LEARNERS WITH HEARING IMPAIRMENT IN MAKONGO SCHOOL FOR THE DEAF, MAKUENI COUNTY, KENYA.*

for the period ending:
31st December,2016

Applicant's Signature

Permit No : NACOSTI/P/15/6739/4728
Date Of Issue : 29th January,2015
Fee Recieved :Ksh. 1000

Secretary
National Commission for Science, Technology & Innovation