

**EFFECT OF TEACHING METHODS ON ACADEMIC
PERFORMANCE IN MATHEMATICS AMONG LEARNERS WITH
HEARING IMPAIRMENT IN MERU COUNTY, KENYA**

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**A RESEARCH THESIS SUBMITTED IN PARTIAL FULFILMENT
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DECLARATION

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

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DEDICATION

This thesis is dedicated to my loving parents for their nurturing and educational foundation ingrained in me. They were my source of inspiration and psychological support through constant prayers and encouragement. I dedicate it also to my wife, sons and daughters for their moral and physical support during the study.

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ABBREVIATIONS AND ACRONYMS

E.A.R.C(S)	-	Education Assessment and Resource centre / services .
H.I	-	Hearing Impaired.
I.E.P	-	Individualized Education Programme.
K.C.P.E	-	Kenya Certificate of Primary Education.
K.I.C.D	-	Kenya Institute of Curriculum Development.
K.S.L	-	Kenya Sign Language.
K.S.S	-	Kenya Signs for Schools.
L.D	-	Learning Difficulties.
L.D.A	-	Learning Disability Association of America.
M.O.E.S.T	-	Ministry Of Education Science and Technology.
QUASO	-	Quality Assurance and Standards Officer.
S.E.E	-	Signed Exact English.
SNE	-	Special Needs in Education.
TC	-	Total Communication.
US	-	United States.

ABSTRACT

The purpose of the study was to establish the impact of teaching methods on academic performance of learners with hearing impairment in Mathematics in Igembe District, Meru County, Kenya. The study was based on Burhus Fredric Skinner's theory of motivation in learning. The argument here was that learner's motivation to undertake a task depends on expected rewards that is, achievements in accomplishment of task. This study will adopt a descriptive survey design which will allow the researcher to gather, summarize, present and interpret the information /data for the purpose of clarification. The location of the study was Igembe District of Meru County, Kenya. The target population of this study was Head teachers, Teachers teaching mathematics to hearing impaired learners and Quality assurance and standard officers in Igembe District. A sample of 53% of accessible population was purposively sampled for this study. The researcher used three (3) types of research instruments to collect data, these are, questionnaires, interview guides, and observation checklists. The research instruments were constructed based on the objectives of the study. The researcher applied test-retest method during the piloting stage to establish reliability. This was carried out in one special unit of Tigania District which will be purposively sampled to ensure validity of the research instruments. They were developed with consultation of fellow post graduate students and my supervisors. The data gathered from the field was sorted out, coded and analyzed in form of table, charts, frequencies, percentages and texts. The researcher obtained research permission from national commission for science, technology and innovation through, The Dean, graduate school, Kenyatta University before administering the research instruments in the field. The researcher made preliminary visit to the respondents and discussed the relevance of the intended study. Issues of informed consent and respect of the respondents were also discussed. The study established that the use of varied teaching methods enhances academic performance of learners with hearing impairment in mathematics. The study also found out that total communication and sign language are the main modes of communication used by the teachers while teaching mathematics to learners with hearing impairments. The study also established that effective communication, availability of learning/teaching resources, effective teacher training and student attitude impact on academic performance of mathematics by learners with hearing impairments in special schools and units in Igembe District. The study also found out that interactive teacher – learner teaching/learning such as personalized teaching and interactive learner – learner teaching/learning such as peer tutoring are used by the teachers to alleviate specific mathematic difficulties in learners.

CHAPTER ONE

INTRODUCTION AND BACKGROUND CONTEXT

1.0 Background of the Study

In this chapter, the research attempted to establish that a problem exists and there is need for a study to be carried out. This chapter was analyzed under the following divisions: background of the study, statement of the problem, the purpose of the study, objectives of the study, research questions, significance of the study, limitation and delimitation, theoretical framework, conceptual framework and operational definition of terms.

Many countries regard education as a very important tool for social, economic and political development. Education gives knowledge and skills which are necessary in the production of goods and services. Hence development of the country (UNESCO, 2002). According to (UNESCO, 2005); education facilitates acquisition of attitudes, and competencies needed in the labour market and personal development.

Present society is technologically oriented and information rich. Knowledge of mathematics is important and so children need to develop mathematical skills to be effective, contributing and confident member of the technologically oriented society (Govindan & Ramaa, 2014). Mathematics finds its application in the field of science, technology, economics and other arrays of life. But for a common man, knowledge of mathematics helps him understand the functioning of the world around him. The hearing impaired children, just as hearing children, are supposed to learn mathematics in order to live as successful, effective and independent individuals in the society. Knowing mathematics well actually means having mathematical knowledge.

Mathematical knowledge is a combination of information used in counting, calculating, solving routine mathematical problems, or conducting mathematical related findings (Tanridiler et. al, 2015). As such, learning mathematics is not an easy task and difficulties in mathematics prevent the children from enjoying the world of numbers. This difficulty is experienced not only by typically developing children but more by learners with hearing impairment (Govindan & Ramaa, 2014). The difficulties faced by children include symbol imagery or numeral imagery, concept imagery, difficulty in learning multiplication tables and math facts, grasping mathematical relationships, general computations, solving word problems and difficulty with higher mathematics.

Studies show that children with hearing-impairment can learn mathematics just as their hearing peers but at a delayed pace (Traxler, 2000; Tanridiler, 2015). On the other hand studies show that, principle and elements of balanced mathematics instruction (BMI) are important for students with hearing impairment (Stewart & Kluwin, 2001; Nunes & Moreno, 2002; Pagliaro, 2006). Possible ways and means in learning mathematics must be sought at all levels of education. This is because it is core in scientific, technological development and research. Children with hearing impairment need to be encouraged to learn mathematics by offering them the opportunities to do so. Such opportunities include problem based learning (MacMath, Wallace & Chi-2009), encouraging cognition and self-interest in solving problems (Blanco, Barona & Carrasco, 2013), teachers role in learning the subject-mathematics by the students (Shore & McNeil; 2014), improving basic mathematics instructions through technology resources (Murray, Pacuilla and Helsel; 2007), the use of semantics in improving performance in mathematics (Australian

Curriculum, Assessment and Reporting Authority (ACARA), 2014), which directly reflects on linguistic variables.

In the USA leveraging the use of mobile devices for education, such as instructional games, is an area of increasing interest for targeted sub-populations of students including those who are deaf/hard-of-hearing (DHH) (Shelton & Parlin, 2016). In their study on Teaching math to deaf/hard-of-hearing (DHH) Children using mobile games, Shelton and Parlin (2016) indicated that students self-reported learning orienteering skills, and practiced reading to solve mathematical problems using mobile games. One of the unintended outcomes of the study was peer tutoring and students reading the text of the game out loud as they played. Shelton and Parlin (2016) pointed out that teacher participation in the creation of an iterative design for the production of a mobile game to learn mathematics is challenging due to scheduling, curriculum integration, training, and other resource constraints. When targeting a specialized population of DHH children, those constraints can become magnified. There is an increased interest in expanding technology to appropriately address the mathematical needs of DHH students due to the success of other forms of technology that have enhanced DHH individuals' lives. Thus, utilization of games in learning mathematics may enhance performance of learners with hearing impairment.

In Pakistan, Parvez, Khan, Iqbal, Tahir, Alghamdi, Alqarni, Alzaidi and Javaid (2019) argued that the learning methods of learners with hearing impairment are different as compared to hearing people. They use Sign Language (SL) rather than natural language to communicate and learn and hence they are required to put a lot of effort into learning

different concepts using conventional pedagogies. Therefore, there is a dire need for some assistive technology to improve their learn-ability and understandability. Parvez et al (2019) sought to determine the effectiveness of a mobile interface through a developed mobile application for learning basic mathematical concepts using Pakistan Sign Language (PSL). The findings revealed that the Experimental Group (EG) participants, who were instructed by mobile application showed higher proficiency in the quizzes as compared to the Control Group (CG). Moreover, a significant difference was also observed in the time taken by participants in both groups to complete the quizzes. CG participants took 20 min longer than EG participants to complete the quizzes. The results of the ANOVA showed that the quiz scores were directly affected by the mode of teaching used for participants in both groups. This implies that adoption of technology as a teaching method can enhance performance in mathematics.

In South Africa have also been emphasizing on the use of participatory teaching methods (Prinsloo, 2000). For this case, UNESCO (1998) suggests that teachers need to develop pedagogies for the diversity, effective use of learning support, teachers and other human and material resources for full participation of learners. However many ordinary teachers face problems in instituting integrated programs within inclusive classrooms, because they lack knowledge and strategies needed to implement such programs effectively.

In Ghana, Agyire-Tettey, Cobbina, and Hemanoo (2017) pointed out that several researches have showed that the average academic performances of students with hearing impairment (SHIs) are below that of hearing students. Their study showed that challenges which hinder SHIs academic performance emanate from different systems and actors

including SHIs themselves, their parents and other institutional barriers that exist in deaf education. Results also established that institutional barriers such as effective instructional procedures adopted in deaf education, availability of facilities, teaching, reading learning materials, and curricular contents posed challenges to the academic performance of students with hearing impairment. This implies that teaching methods adopted may impact on learners performance.

In Tanzania, Mtuli (2015) revealed that teachers and students with hearing impairment in secondary school said that training and learning facilities were inadequate to the hearing impaired students and teachers were inadequately prepared to meet the new system of inclusive education system. Mtuli (2015) also indicated that teachers' incompetence in sign language led to the hearing impaired student's failure to understand the instruction in the class. This implies that many learners with hearing impairment may be disadvantaged in integrated schools and hence may perform poorly due to teacher incompetency in sign language.

In Kenya, Kenya Sign Language (KSL) was adopted, in 2004, as a medium of instruction for learners with hearing impairment (HI) after various modes were tested out but failed to fulfil the communication needs of the learners (Ministry of Education (MoE), 2004). Like in many other countries, deaf learners in Kenya have consistently trailed behind their hearing counterparts in academic performance (Omutsani, 2012). Muguna (2011) reported that most of the methods used in Kaaga school for the Deaf, Meru were either, sign language, total communication, dramatizing, use of exact English, visual aids, pantomime, role play, eye contact, lip reading, use of signed English and finally the use

of gestures. This is a clear indication that the teachers in the school were knowledgeable in the application of the various teaching methods for performance. It should however be noted that Muguna (2011) study only concentrated on a single school and did not ascertain the effect of teaching methods on mathematics performance among learners with HI. The current study sought to fill this gap by ascertaining the effect of teaching methods on academic performance in mathematics among learners with HI. This was premised on the fact that Kenya Certificate of primary Education (KCPE) results analysis for special schools for the deaf (Hearing Impaired) in Kenya indicate that mathematics is one of the subject which is poorly performed. According to Ministry of Education national result analysis indicates that the result for mathematics for the last three years was as follows;

Table 1.1: National mean -score for mathematics

Year	Mean score
2010	29.53
2012	30.35
2013	31.25
2014	32.1

Source: MOEST Result analysis.

The same trend is evidenced in Igembe District where children with hearing impairments in special school and units attained very low marks/ mean score in mathematics. The mean score for the last three (3) years was as follows:

Table 1.2: Meru County Mathematics Mean/score

YEAR	MEANS CORE
2010	30.75
2012	27.25
2013	29.30
2014	29.1

Source – MOEST Results analysis for Hearing Impaired.

1.2 Statement of the Problem

The curriculum mandated by the Ministry of Education is used in all schools in Kenya including schools for the learners with hearing impairment. These children are expected to adhere to the same curriculum used in the regular schools. It is interesting to note that when education officials group the schools for learners with hearing impairment in Kenya Certificate of Primary Education (KCPE) results with those of regular schools for learners with hearing impairments are almost the last in the district.

Teachers working with students who are deaf or hard of hearing, need to carefully consider each student's unique needs and learning styles as well as the demands of the task at hand. Mathematical concepts can be learned by children who are deaf in the same sequence and manner as by their hearing peers (Meadow, 1980). Various strategies can be offered to provide a starting point for thinking about possible combinations of teaching methods and adaptations.

In Meru County, children with hearing impairments perform significantly poor in mathematics. This is evidenced by Kenya certificate of Primary Education results for children in special school and units since 2010. They attained the following mean scores in mathematics, in the year 2010, the mean score was 30.75, and mean score of 27.25 in 2012, a mean score of 29.30 in 2013 and a mean score of 29.1 in 2014. Therefore, there is an urgent need for the study to be conducted to address the impact of various teaching methods that are used/not used by the teachers that have impact on academic performance in mathematics in Igembe District.

1.3 The Purpose of the Study

The main purpose of the research study is to find out the impact of teaching methods and strategies employed by the teachers that affects academic performance of mathematics by learners with hearing impairments in special school and units in Igembe District of Meru County.

1.4 Objectives of the Study

The researcher used the following specific objectives based on the statement of the problem:-

- i. To find out teaching methods employed by teachers that has positive impact on academic performance of learners with hearing impairments in mathematics.
- ii. To find out modes of communication used by the teachers while teaching mathematics to learners with hearing impairments.

- iii. To identify environmental factors that has impact on academic performance of mathematics by learners with hearing impairments in special schools and units in Igembe District.
- iv. To find out the remediation strategies used by the teachers to alleviate specific mathematic difficulties in learners.

1.5 Research Questions

- i. What teaching methods do teachers employ that have positive impact on academic performance?
- ii. Which modes of communication do teachers use when teaching mathematics to learners with hearing impairments?
- iii. Which environmental factors have impact on academic performance of mathematics by learners with hearing impairments?
- iv. What methods of remedial teaching do teachers employ to alleviate specific mathematic difficulties?

1.6 Significance of the Study

The outcome /findings of the proposed study had both theoretical and practical implication for the future of learners with hearing impairment (HI) in education in Igembe District.

Theoretically, the study is expected to contribute to the creation of knowledge, skills and attitudes about appropriate teaching methods of mathematics for learners with hearing impairment. It also pinpointed other factors that hinder successful learning in special schools and units for learners with hearing impairments. Practically the study may lead to

teachers making use of appropriate mathematical teaching methods which would lead to improved academic performance in the Kenya Certificate Primary Education (KCPE) examinations in mathematics in the special schools and units for the learners with hearing impairments. In addition, the study formed a base on which other researchers can carry out their own research studies.

1.7 Limitation and Delimitation

1.7.1 Limitation

The study was limited to only public special school/units in Igembe District. Only teachers teaching mathematics to only learners with hearing impairments were involved in the study.

1.7.2 Delimitation of the Study

The researcher was a teacher in District where the study was undertaken and also teaches mathematics. The researcher knew the area very well and therefore found it easy moving from one school to another.

1.8 Assumptions of the Study

The study was based on the following assumptions;

- a) Teacher were willing to give information on the variety of teaching methods they use.
- b) Most teachers were fluent in sign language thus comfortable to discuss the modes of communication they employ when teaching.
- c) All records on performance of learners with hearing impairments were available.

1.9 Theoretical Framework and conceptual Framework

1.9.1 Theoretical Framework

According to (Kombo & Tromp (2006) Theoretical framework is a general set of assumptions about the nature of phenomena. It attempts to clarify why things are the way they are based on theories. It helps to formulate research problems and defines the relevant data. This study was based on Burrhus Frederic Skinner's theory of motivation of learning. Skinner's main argument is that learners' motivation to undertake a task depends on expected rewards. The negative perceived rewards lead to negative attitudes and under achievements. It is true to agree that student's high performance is influenced by appropriate teaching methods, qualification of teachers, instructional resources and teaching and learning environments.

Skinner believed that people learn two different ways .They learns to avoid negative things and strive for positive things. If teachers apply a teaching method to student who had a problem in addition of numbers and the students begins to answer them correctly, then there is change in behavior and that particular teaching should be retained and improved further.

Children with hearing impairments are known to benefit effectively in a properly set up trends where services such as sign language, hearing aids, learners' friendly set up classrooms with variety of learning resources and audio logical services are put in place. It is worthy, noting here that, learners with hearing impairment will successfully benefit if a combination of variety of teaching methods and appropriate resources are put in

place. The teacher should also be committed and conversant with the current modes of communication when teaching, that is, use of total communication.

1.9.2 Conceptual Framework

The conceptual Framework was based on theoretical framework that is, learner's motivation to carry out a task depends on expected rewards /outcomes. According to the researcher, learners' behavior, that is acquiring of knowledge, skills and attitudes will greatly be influenced by the instructional methods by teachers, interaction between learners themselves and the surrounding environment. All these would automatically translate to high academic performance.

In the conceptual framework, learners are positively affected if there was effective communication, conducive environment, well trained teachers who strive to establish good teacher-pupil interaction. These would results to positive attitudes in learning, enjoyments in learning and completion of tasks. In addition, other efforts such as use of appropriate /variety of teaching methods, constant remedial work, constant appraisals and feedbacks will automatically motivate extra work, willingness to learn, self-motivation, self-reinforcements, good academic performance and acquisition of variety of skills and knowledge in mathematics.

On the other hand, where there was no effective communication, un-conducive environment, non-specially trained teachers, poor teacher-pupil interaction, lack of remedial activities, absence of appraisal, feed backs and single/poor teaching methods will automatically translate to negative attitudes, demoralized learners, tasks not

completed, no self-motivation and lastly narrow thinking and poor academic performance in mathematics. Therefore teachers should employ methods which will be geared toward learner's enjoyment in learning, reinforcing themselves, acquisition of variety of skills, knowledge and appropriate attitudes and lastly good academic performance in mathematics outcomes.

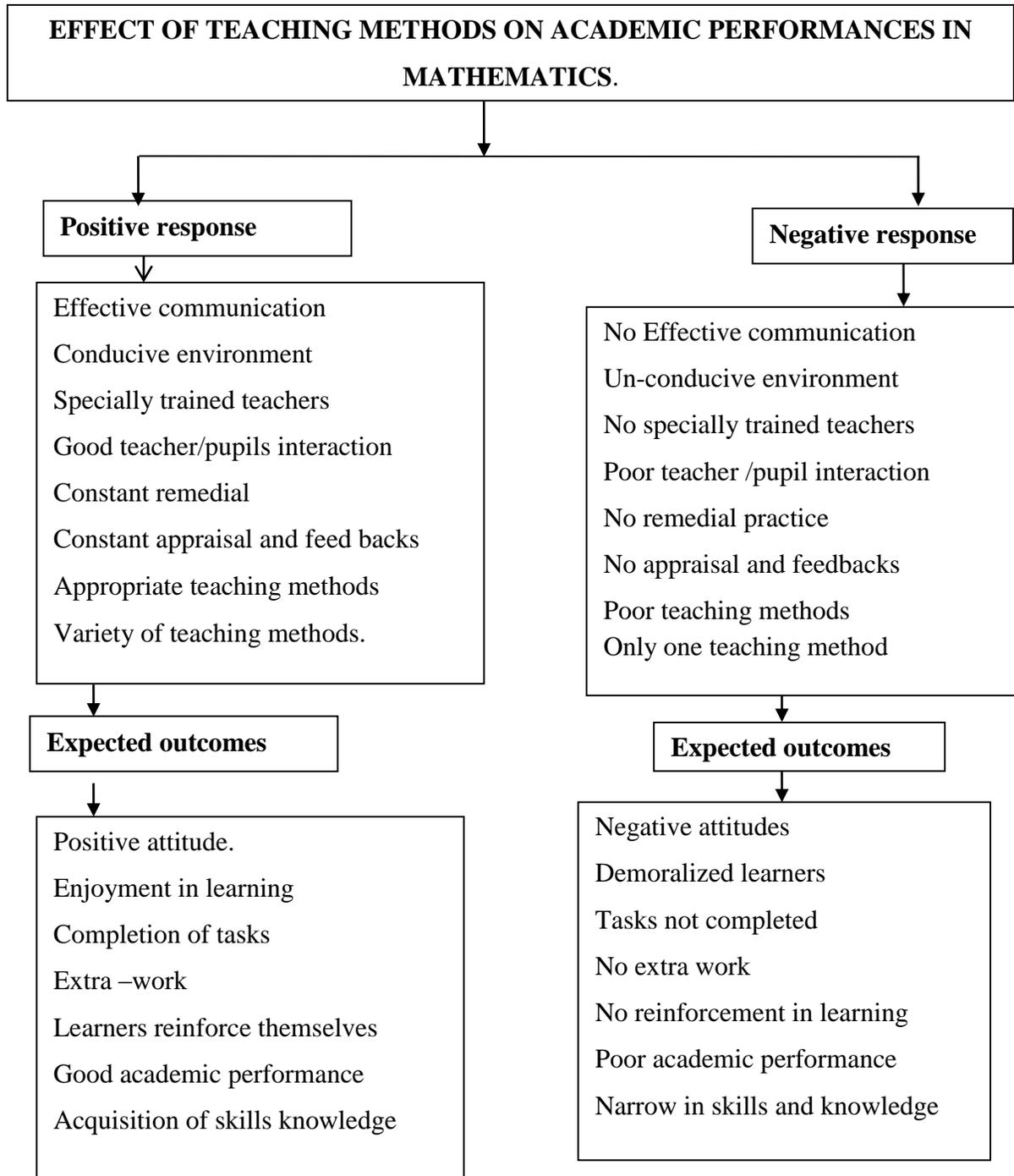


Figure 1. Conceptual framework

NB. On the left hand side is the positive response will lead to the expected outcomes in the bottom box. On the right hand side are the negative responses which will produce the expected outcomes on the right hand side lower box.

1.10 Operational Definition of Terms

Concrete materials -These are real objects presented to the learners to manipulate. (Ogonda, 2001).

Deaf –Persons with a hearing loss of 81d B+ and /or close to be a member of a deaf community (WHO, 2001).

Hard of hearing (HOH) –This refers to someone who doesn't hear well .This may be because they were born with a hearing loss or they may have lost some or all of their hearing later in life (<http://www.nchearingloss.org>).

Hearing impairment refers to hearing loss of varying degrees, ranging from hard-of-hearing to total deafness (Shemesh, 2010).

Incidental learning it is unintentional or unplanned learning that from other activities. It can result in improved competence, changed attitudes and growth in interpersonal skills, self –confidence and self-awareness (Kerka, 2000).

Inclusive setting is a place such as a school or college where children of all abilities learn together. In an inclusive classroom, children with learning disabilities such as dyslexia, and physical disabilities, and deafness, learn alongside children of both average and exceptional ability. (Koenig, 1999)

Individual differences – This refers to the extent and kind of variations or similarities among people on some of the important psychological aspects such as intelligence, personality interest and aptitude. (www.nios.ac.in/.../enapter-3.pdf)

Individualized education programme – A Written statement that describes what the teacher and other professionals will do to meet the special needs of the child – (Otiato,2002).

Informal knowledge – This is the larger part of a person knowledge base. It is knowledge gained as a result of years of experience, insight and intuition. (Zaggle, 2011)

Intervention – Strategy to teach learners who have learning problems by use of special methods (Tseng, 2003).

Observation –Careful watching of learners behaviours usually carried out in the classroom or outside the classroom. (Ogonda, 2002)

Sign language –It is a language which uses manual communication and body language to convey meaning as opposed to acoustically conveyed sound patterns. It involves simultaneously combining hand shapes, orientation and movement of hands arms or body and facial expression to fluidly express speaker’s thoughts. (Wikipedia)

Total communication –This is an approach to create a successful and equal communication between human beings with different language perception and or production. To use total communication amounts to a willingness to use all available means in order to understand and be understood, (Itansen, 1990)

Visual cues are cards with drawings and short phrases that give children suggestions for interactions in inclusive play groups -(Ganz & Flores, 2010).

CHAPTER TWO

REVIEW OF RELATED LITERATURE

2.0 Introduction

This chapter was devoted to reviewing literature relevant to the problem, based on the research objectives. The researcher reviewed studies done by other people related to the area of this study. The literature was discussed under the following sub-headings:- methods of teaching mathematics to learners with hearing impairments, Modes of communication used by teachers, other factors hindering effective learning of mathematics and lastly, remediation methods to alleviate mathematics difficulties.

2.1 Methods of Teaching Mathematics

Erbas (2017) sought to ascertain strategies that teachers use to support the inclusion of students who are deaf and hard of hearing. This qualitative study was designed to gather information about the teaching practices of general education teachers in a small sample of K-6 inclusive elementary classrooms in a small town in the Midwest. The purpose of the study was to examine whether general education teachers used strategies that promote the inclusion of students who are deaf or hard of hearing (DHH) and to identify the ways in which these strategies were applied. The data was gathered through observations and interviews with the participation of three general education teachers. Per the research that was been carried out, it was concluded that the general education teachers attempted to support the inclusion of students who are DHH by employing various strategies. This included use of workstations, multiple representations of information by including visual and technological aids in their instruction, the seating arrangement the seating arrangement, hard of hearing received support from assistive listening devices and use of

personal microphone to support the students' assistive listening devices in the three classrooms. This implies that teaching learners with hearing impairment requires integration of various strategies.

Tanridiler, Uzun, and Girgin, (2015) carried out a study on teaching and learning mathematics with hearing impaired students. The purpose of this action research was to analyze the teaching efforts of mathematics to seventh grade hearing-impaired students at the Education and Research Center for Hearing Impaired Children (ERCHIC). The data were collected via video recordings of the group and individual mathematical instructions; the audio recordings of the reflective meetings, lesson plans, exams, reflective diaries, data evaluation charts, and interviews; and the files related to the students' mathematics work in 2009–2010. Different quantitative and qualitative data analysis techniques have been applied before, during, and after the research process. It was observed that the students participating in the study have benefited from the application of balanced mathematics instruction (BMI).

Swanwick, Oddy, and Roper (2005) study sought to explore the reasons for this persistent underachievement by focusing on results from the National Mathematics tests taken in the UK by all 14 year olds. The study analysed a sample of test papers with the aim of identifying ways in which deaf and hearing responses to the test items differed and possible explanations for these differences in terms of access to the mathematics teaching, assessment and curriculum provision. Findings from the project led to preliminary conclusions regarding the range of national test entry levels for deaf pupils, the types of linguistic issues they encounter, the learning strengths they demonstrate and

their experience of mathematics curriculum provision. The concluding analysis raises significant questions about deaf pupils' access to mathematics educational provision and more specifically about the deaf experience of mathematics learning and how they perceive themselves as mathematicians.

Abiatl and Howard (2019) study sought to ascertain whether a digital assistive technology improve the mathematics achievement of deaf children. The study gathered scientific evidence by conducting a quantitative experiment with constructivist digital assistive technology and qualitative interviews with the teachers involved. The findings from the experiment suggest that the constructivist digital assistive technology may have had a positive effect on the mathematics achievement of the learners, which was supported by the findings from the interviews. This makes an original contribution to the domain and offers an intervention that was feasible, practical and potentially effective for improving the teaching and learning of mathematics for deaf learners.

MOEST (2001) which argues that teachers should employ an important strategy which is to create an environment in which students are engaged in practical activities from which mathematics can be learnt in an interesting and meaningful way. This is actually moving from the former practice which was text-book-driven teacher centred and consisted mainly of transmission of knowledge from the teacher to the students. (MOEST 2001)

Herold (2008) argued that the learning, language, knowledge and skills of young children who are deaf are enhanced when parents frequently interact with their children, in engaging varied and meaningful interaction that incorporate basic mathematics concepts,

For example number counting, quantity, time/sequence and categorization into day-to-day family routine.

Researchers of Oxford University have developed a new teachers pack to help deaf children who are weak in mathematics improve their numeracy skills (Nunes, 2007). This was a programme for teachers who are working with children aged five to eight years. The programme was based on a year trial period involving 28 schools. A lot of lessons for deaf children are centred on language rather than numeracy in their first years of school (Nunes, 2007). The research revealed that deaf children also miss the incidental learning that goes on in the home, such as when mum or dad count out the sweets as they are doled out. Hearing the logical reasoning behind numeracy at the same time as watching the visual cues is the key to understanding. The research findings also shows that children need to improve understanding in their key concepts, i.e. in numeracy, additive composition, the inverse relation between addition and subtractions and multiplicative reasoning. The researcher also concludes by arguing that these concepts should be taught by providing activities with strong visual cues to improve understanding of deaf children. The activities should not be taught as a sequence but taught as interwoven strands that build on each other (Nunes, 2007).

Ansell and Paglioro (2008), argues that problems in mathematics requires more than, simply using the correct operation (e.g. addition, subtraction, multiplication). Success also requires individuals to use their informal knowledge as gained from day-to-day experience to understand story within the problem. The researchers went further and said that “unfortunately, many students who are deaf and hard of hearing ignore the story and

focus upon the rigid use of mathematical operations, this limits their success within mathematics. The research concludes by agreeing that success within mathematics can be enhanced by parents and teachers using the language of mathematics in their everyday conversations and engaging learners in exploring their thinking on how they solve real life problem (Ansell & Pagliaro, 2012).

Stewart and Kluwin (2001) established that early intervention for learners with hearing impairments in mathematics is very important. Mathematics concepts should be introduced alongside language and communication programmes. Many deaf and hearing impaired students lag behind in learning mathematics (Stewart & Kluwin, 2001; Traxler, 2000). As a result, these students may not be able to take advantage of many regular, unmodified activities in mathematics, they are often not given the opportunity to develop skills within their ability, and they do not learn to play math games or activities in the general education classroom. Too often, unless an effort is made to accommodate this skills lessons on math concepts may go unnoticed with some creative thought and imagination, however, curriculum adaptations can be made to meet the needs of these learners.

Other techniques used include activities such as math origami, Origami is an art of paper folding. In Japanese, it literally translates as “ori” (folding) “gami” (paper). In traditional origami, constructions are done using a piece of square paper. Another form of origami is called “modular origami,” it is a compound structure composed of a number of individual units that are folded from a single sheet of paper. Math origami activities incorporate

both mental and physical involvement in the learning process; students have to use their hands and brains at the same time (Stewart & Kluwin, 2001).

Levenson (n.d.) found that origami has shown that paper folding, particularly in the elementary school years, is a unique and valuable addition to the math curriculum. In recent years, math origami theory has been applied to produce a wide range of practical applications (Origami, n.d.), and new materials, new methods, and new ideas have transformed the traditional world of math origami. Many origamists have intentionally ventured into the abstract world of mathematics, assembling spectacular interlocking polyhedra or tile mosaics. Deaf and hard-of-hearing students often have a delay in their math performance. Therefore, teachers should choose the appropriate adaptations of activity to meet the needs of the child (Stewart & Kluwin, 2001). By using origami, teacher can make lessons relevant, functional, and interesting. In addition, math origami is appropriate for all ages, inexpensive to do, and will challenge students of all ability levels. In summary, origami math as a hands-on learning art is an innovative method for teaching math to deaf and hard-of-hearing students at various levels. Deaf students are often socially isolated in regular schools settings (Andrews, Leigh, & Weiner, 2004) and therefore would need the support and encouragement of teachers to develop positive relationships with peers, which as a result will help with their academic learning.

Deaf and hard-hearing individuals (who sign) have an advantage over hearing individuals in making math visual in the head and doing mental manipulations (Marschark, 2003). This strength makes origami particularly appropriate for students who are deaf and hard of hearing and might be especially motivating and socially useful and reinforcing. The

ability to visualize in the head is a talent that can be strengthened with simple practice. implementing origami in the classroom can mean rich, hands-on math experiences for students who are deaf and hard of hearing. Math origami can be used as an entry point to mathematical discourse and applications ,origami makes mathematics more visual and hands-on, which we want our deaf and hard-of-hearing students to experience. Hopefully, in this way, math teachers can help the public education fulfill its responsibilities of maximizing each student's opportunity to learn and succeed in the least restrictive environment.

The researcher is interested in trying to find out if the teachers in Igembe combine variety of teaching to teach mathematics to learners with hearing impairments. It is worth noting that hearing impairments range from mild ,moderate ,moderate to severe, severe and profound, integrating play with mathematics makes this students develop interest in learning the subject this can be done by ensuring that students read loud this mathematical terminologies embedded in their play, The use of active learning, application of learning in real-life situations, and integration of learning with other topics will make them successfully achieve mathematics milestones, in turn making them achieve competency in mathematics.

2.2 Modes of Communication Used by Teachers when Teaching Learners with Hearing Impairment.

Benzahra (2002) argues that communication is made up of language components of phonology, syntax, morphology, semantics and pragmatics. According to Shea & Bauer (1994), communication is the verbal and non-verbal means of transmitting and decoding

messages from one individual with the intention of stimulating meaning in the mind of another. Ruesch (1982) also says communication includes all the procedures by which one mind may affect the other. This involves oral and written, music, pictorial art and in fact, all human behavior. Ellis & Beattie (1986) also assert that communication occurs when there is an organism encodes information into a signal which passes to another organism which decodes the signal and is capable of responding appropriately. Without communication, teaching and learning would not occur. Hence, teachers are intimately involved in the communication process as they interact with students on a daily basis. Thus teachers constantly send messages to students and receive messages from students. Therefore, communication is central to the learning process. Without communication, learning can never take place. Moore (1996) observes that though most teachers understand the importance of verbal communication, many underestimate how much students learn from teachers' facial expression, body language, use of space and motion, use of time and use.

Offei (2005), stated that there was a pronouncement to change from the use of Sign Language to the use of total communication in all Schools for the Deaf. In 1999, there was a drastic move to change the mode of communication from Total Communication to Sign Language. Ofori et. al., (2013) define communication as the process of transmitting or receiving information. Okyere and Adams (2003), also describe communication as the passing on and understanding of information using verbal or non-verbal language. Sekyi-Baidoo (2005) says communication is receiving and giving of information for the purpose of enhancing one's life and the life around him. In most cases, two people are involved, the sender and the receiver. By being able to communicate, we get a way of controlling

what happens to us. Indeed, to be able to communicate effectively as an important step towards building a relationship and involvement in the community. Speech and language are tools used for communication. It requires encoding and decoding messages.

According to study done by Omutsani (2012) on factors affecting KCPE performance of learners with hearing impairments in special schools in selected counties, in Kenya, concluded that communication/language was one of the factors that hinder performance of hearing impaired learners in KCPE. The study revealed that majority of teachers lacked the knowledge and skills of sign language and teaching format. They, therefore, could not effectively assist deaf learners to boost their academic performance Omutsani, (2012). Omutsani's study is in concurrence with a paper written by Shiekh and Norma (2002) on barriers to effectively educating the Deaf in Kenya, which reviewed that ineffective communication, is the main barrier in education of the deaf. Shiekh and Norma were Peace Corps volunteers from U.S working in Kenyan schools for the deaf children.

They pointed out that many teachers are unable to properly teach Deaf children in Kenya because they cannot communicate with them. Many teachers sign very poorly and don't have a clearly direction on how they should communicate with deaf children. According to Sheik & Norma (2002) there is great confusion on what is proper sign modality to use with deaf children, whether they should use Kenyan sign for schools (KSS), or Kenya sign language (KSL). KSS is similar to sign exact English (SEE) used in United States, It is a system that visually transmits on hand what is spoken in English. KSL is a language and follows the language structures found in American Sign Language (ASL). KSL often

incorporates non-manual markers to complement signs. Examples of non-manual markers include things as gestures, facial expression, signing space and speed of signs.

Sheik & Norman, (2002) considered total communication as another mode of communication used in schools besides KSS and KSL. Total communication aims to incorporate a number of communication modes such as signs, oral, written and visual aids depending on the particular needs and ability of the child. Other components of total communication includes:- Pentomime, amplification, pointing, cued speech, bliss symbols, natural signs, eye contact, speech reading, finger spelling, pictograms and mimicry.

A study done by Sharilyn, (2009) at University of Sheffield, observed that effective communication is vital with hearing impaired students to ensure success. It is important to keep a few points in mind when you are teaching. The teacher should look directly at student and face him/her when communicating in an inclusive setting, the teacher should assign the student a desk near the front of the classroom or where the teacher plan to deliver most of the lectures, speak naturally and clearly, Remember speaking louder won't help and lastly don't exaggerate your lip movement but slowing down a little may help some students Sharilyn (2009). Teachers/learners should be encouraged to use all modes of communication, that is, oral communication and manual communication, simultaneously speak and sign, use and allowing students to view the lips of people speaking to them. The researcher also agrees that total communication can be of great use, especially when teaching mathematics concepts and calculation involving word problems.

Avoke (2001) observes that what Ghana has in the absence of such policy political oratory and policy statement featuring in many official platforms. Offei (2005), states that in September, 1997 at a meeting of Heads of Special Schools for the deaf, there was a pronouncement to change from the use of Sign Language to the use of Total Communication in all Schools for the Deaf. In 1999, there was an issue. There appears to be consensus in the field as to where and how to educate individuals with hearing impairment. The council of the education of Deaf (1976) in United States of America has formally stated that no single method of instruction and communication can best meet the needs of all students with hearing impairment. In a national survey of five hundred and seventy-six (576) programmes, King (1984) found that many educators combined different parts of various languages instructions approaches rather than adhering closely to any single method. The three most common methods of instructions and communication included oral communication, total communication which involves simultaneous sign and oral communication and American Sign Language.

Northcott (1980b) states that the priority in the education of learners with hearing impairment is to ensure that all learners with usable hearing have the maximum opportunity to develop listening and oral skills with the maximum opportunity to speak for themselves, to be and to participate actively in decision regarding their own lives and goals. It is important to support students in the use of their residual hearing. Children typically begin wearing hearing aids as early as possible to increase an awareness of environmental sounds and to facilitate language development (Sander, 1982). Learners with hearing impairment vary widely in their communication characteristics professionals and families often have strong preference about which communication method they

believe is more appropriate. However, in Ghana, it appears there is no definite policy with regards to mode of communication used in the education of individuals with hearing impairment. Preference of education and personal unfairness establish whether Sign Language or oral education is promoted and used.

Kumedzro (2007) stress that there are differences in the way students are taught. Kumedzro (2007) goes on to say that the choice of method of communication for a particular group of Hearing Impaired individuals should be based on the needs of Hearing Impaired are not only meant for communication to take place but also bring about acquisition of language. There's a clear indication that the choice of communication modes for a particular group of individuals with hearing impairment should depend on the needs of the individual. The individual Tucker and Powell (1991) assert that the communication modes used for the oral communication or oralism. Oral communication, otherwise known as speech is the form of language in which articulated sounds or words are used to convey ideas. Oral communication to the Hearing Impaired involves the use of a combination of residual hearing, hearing aids, and speech reading, that is, watching others lips and face. Oral communication demands the utterances of speech sounds and a conversation form between one or more persons. It is supplemented by lip reading or speech reading. Riekehof, (1987) also describes Oral Communication as a method of training or educating individuals who are hearing impaired through speech or speech-reading without employing the language of signs or finger-spelling. Kumedzro, (2007) indicates that the auditory-verbal philosophy postulates that it is the right of children with all degree of hearing loss to have the option of develop their ability to listen and

communicate using the spoken language while growing up in the regular living and learning environments of their communities.

The British Association of Teachers of the Deaf (1998) confirms this by stating that the majority of individuals who are deaf would have had sufficient hearing through the use of appropriate audiological aids to develop understanding of spoken language. It is expected that they will follow a similar process of language acquisition to that of hearing children. According to Baker and Cokely, (1980), 'whenever there were people who needed to communicate there has been signed language that they and their ancestors have developed.' Sign Language or manualism is the use of several kinds of signs made with the hands to communicate ideas. As the Sign Language is a language that uses manual symbols to represent ideas and concepts, the term is generally used to describe the language used by individuals who are deaf in which both manual signs and finger spelling are employed.

2.3 Other Factors Hindering Effective Learning of Mathematics by Learners with Hearing Impairment.

Classroom based factors and mathematical activities that support students' mathematical performances have been studied by Brew (2011) at Sekondi-Takorandi' municipality in Ghana. Brew (2011) used a sample of thirty two (32) teachers and 4 schools to carry out the study. His work revealed that mathematics learning can be effective if appropriate teaching and learning materials are employed in the teaching process. This was confirmed as majority of students accepted the facts that appropriate teaching and

learning material would help them to grasp the concept well and be able to solve mathematical problems with ease.

A study by Omutsani, (2012) on Factors affecting KCPE performance of learners with hearing impairment in selected counties in Kenya. The schools sampled were Maseno, Nyangoma, Nyangweso and Kuja. The study identified some factors that affect KCPE performance of learners with hearing impairment. Teachers did not make use of instructional materials and even do not improvise materials to make use of the other active senses when one has hearing loss. No evidence of teachers giving individualized attention to pupils with hearing impairment. Majority of teachers handled the learners just like the hearing. Other factors revealed by this study included:- incomplete content coverage, poor learning environment (poor seating, inappropriate classrooms and lack of furniture), limited cognitive ability, poor memory and short attention span.

Shikuku, (2001) while contributing to “International panel on policy and practice in mathematics Education 2001 report” revealed that in Kenya about 10% of the children like and are willing to study mathematics. The rest have to be persuaded or forced to study mathematics because it is compulsory. They have a completely negative attitude towards the subject (especially the Girls). The researchers tend to think that it more challenging to those with hearing impairment. Shikuku.(2001) and other mathematics teachers- about 400 mathematics examiners at the national levels are now convinced to put a “smile” on mathematics as a subject. This is moving away from former practice where mathematics was scaring, painful, difficult, punishment, horror, monstrous and unfriendly subject and unfriendly teachers. She says that she has made mathematics very

popular by eliminating punishment to slow learners and taking more time with them. She always wears a smile on her face, try to be fair but firm and ensure that pupils complete their homework. “I use real life situations and real objects that can be seen and touched during the lessons” said Beatrice. The researcher would want to borrow a leaf from Beatrice (2001) that her suggestions might be effective to learners with hearing impairments where mathematics teachers need to be firm, friendly, fair and encourage learners to complete their task and do more practice.

In 2003, the Government of Kenya implemented free primary education. Education was and is still recognized as a basic right for all learners, including learners with special needs. Parents, who were financially unable to send their learners to primary school, were then required to do so. This policy increased the enrolment of learners into government schools across Kenya, including those with special needs (Kochung, 2003). Schools for the Deaf saw an increase in enrolment and deaf units in regular schools were created across the country. Under the free primary education program, the government did not build new classrooms nor guaranteed that the number of teachers allocated to schools would match the increased intake of students. Deaf schools and units have lacked the necessary resources to facilitate affective learning; teachers have not been trained and lack the materials, equipment and guidance to enable them in curriculum delivery. Special curriculum adaptations have not been made in order to accommodate Deaf learning. Many teachers assigned to the schools and units have poor fluency in Kenyan Sign Language (Kochung, 2003).

In their study in regular schools Lewin and Sabates (2011) attribute a pattern in Kenya whereby the age range in a class widens from Standard 4 onwards partly to repetition. While they note that standard 8 learners fall between ages 12 and 18 years for regular learners, some Deaf learners in Kenya leave primary school when they are much older due to late entry and compulsory repetition of classes (Mundi, 2009). Deaf schools all over Kenya have performed below average in national examinations and when ranked with other public hearing schools, they are among the bottom last with mean scores as low as 131 out of a possible 500. For instance in the 2012 KCPE national exam, Kuja School for the Deaf, Maseno School for the Deaf and Mumias School for the Deaf attained mean scores of 151,131 and 155 respectively and were ranked last in their respective counties (MoE, 2012). These results are replicated in deaf schools all over the country and the trend has been an ongoing for years. This has cultivated a culture of failure and acceptance of failure among the Deaf learners and the society as a whole. Several factors can be attributed to this achievement in various parts of the country. However, this study focuses on socio-cultural factors, curriculum factors, language of instruction and availability of teaching and learning resources and their influence on academic achievement in the coastal region of Kenya.

2.4 Remediation Strategies to Alleviate Mathematics Difficulties in Learners with Hearing Impairment

Ntinda, S'lungile, and Tfusi, 2019), reported on the experiences of teachers of the deaf and hard-of-hearing students in a special needs high school for the deaf in Eswatini. The study adopted a qualitative approach and was exploratory in nature. Participants comprised of eighteen (n =18) purposively sampled teachers of deaf and hard-of-hearing

students. They participated in individual in-depth and focus group discussion interviews on the teaching and communication aspects with deaf and hard-of-hearing students. Data were also collected through documents review. Data were thematically analysed for important meanings. Teachers reported to experience gaps in professional competencies to teach the mainstream curriculum for which they needed further education. Variation in sign language impacting learner engagement hindered teachers' communication with the deaf and hard-of-hearing students and their parents. Teachers reported to have in-service professional training needs which included collaboration, consultation, assessment instruments and language skills. This implies that there is urgent need for the country to consider having a standardized sign language which could enhance positive teaching and learning outcomes as well as social integration for the future lives of these students.

Issaka (2018) carried out a study on appraisal of needs and access of in-service education and training for teachers in basic 'Schools for the Deaf' in Ghana. The study examined the availability of in-service training to teachers of the deaf in Ghana as well as the requirements for the provision of in-service education. To achieve this, ninety-four teachers and four administrators from the schools for the deaf from ten regions were sampled for the study. Questionnaire and interviews were used to collect data. The data were analyzed using descriptive and inferential statistics. The study revealed that in-service training programmes are highly irregular. Insufficient funds have also been identified as one of the major factors hindering the organization of in-service education. Key recommendations of the study were that staff development should be viewed as a policy issue, as a necessity and continuous process.

Mbaluka (2012) investigated how learners with hearing impairments acquire speech and language skills. This study was carried out in Machakos School for the Deaf, Machakos County, Kenya which caters for learners with hearing impairment not only from Kenya, but also from other countries of East Africa. Target population was 89 subjects. The research adopted mixed method approach design. Machakos School for the Deaf was purposely selected for the study because it was used by the MOEST for pilot study on total communication in 1988. Quantitative and qualitative data was collected using questionnaires and interview guides from pupils, teachers, headteacher and parents respectively. A pilot study was carried out to establish the validity and reliability of the research instruments. Descriptive statistics in SPSS such as frequency tables, percentages and graphs were used to analyse quantitative data while thematic texts were used to analyze qualitative data. Data was then analysed to generalize conclusions on the findings of the study. The study showed that the standard two teacher was more conversant with various speech and language strategies of teaching the learners with hearing impairments. However, they preferred using sign language that is indicating a limitation on teachers' competence to meet the diverse needs of learners with hearing impairment especially the hard of hearing category who are good at speech training skills. This implies that teachers for learners with hearing impairment need to be in-serviced and trained to equip them with knowledge and skills on speech training.

Busch (2012) revealed the following strategies that can help learners during the lesson. First, he indicated that break learning into small parts could benefit deaf and hard of hearing while in the beginning stages of literacy development. However, this is an instructional technique that will benefit students with hearing loss and learning

difficulties throughout their academic career. Busch (2012) also pointed out that the use of graphic organizers are useful tools in all subject areas of Education. Graphic organizers can serve as a way to augment concepts in pictures (learning disabilities association of America (2004). Visually organizing information that is presented help students with hearing loss see another way to look at the information.

Report by the Government of Hongkong special administrative region (2007) on “intensive remedial teaching programme in primary schools” cited that teaching approaches should not only focus on the transmission of knowledge but pupils should benefit from the entire learning process. Teacher should give concrete examples before proceeding to abstract concepts by way of simple and easy steps at a pace in line with the learning abilities of students. The Hongkong reports continue to suggest that teachers may teach new concepts from different perspective by various approaches so that pupils can grasp the ideas through meaningful repeated illustrations. Teachers should encourage pupils’ active participation by more frequent use of teaching aids, games and activities. They can also make use of information technology and all the teaching resources available to help pupils understand the main points. The researchers support the above approaches of teaching learners with learning difficulties. These approaches can also be useful when teaching learners with hearing impairments (Busch, 2012).

According to Sharilyn (2009), providing classroom adaptation and implementing communication strategies will ensure success for students who are deaf and hard of hearing. To adapt the classroom, the teacher need to utilize visual aids, create effective communication methods and monitor students’ progress throughout the year. The

researcher feels that the above hints by Sharilyn (2009) can be applied to support learners with hearing impairment when learning mathematics. Students with special needs, like normal peers, ought to learn mathematics painlessly without much anxiety, stress, and tension in their minds. To achieve this, teachers must first demystify the subjects by the way they approach them. They need to use teaching methods that are capable of creating and maintaining students' interest and intrinsic motivation in the subjects. In terms of teaching, the use of language that is suitable to the level of the learners is highly recommended (Kalisk, 1979). Teaching methods should also involve students to learn things practically through activities or manipulations done preferably collaboratively (Dodd, 1992). Pro-social teaching and learning methods are desired to increase interaction and minimize isolation (Dodd, 1992). In some cases, team teaching is necessary if a regular teacher needs help from a specialist. More training in special education is highly desirable to increase the teacher's knowledge, skills and confidence in handling disabled students. To reduce anxiety and fear of failing, teaching methods should emphasize mastery and competence in acquisition of knowledge and skills (A.Martinez, 1987).

Regardless of the educational setting where the deaf child is located, much of the responsibility for the child's education is placed on the shoulders of the specialist teacher of the deaf (Lewis, 2000). The value of this role can be better enhanced, considering that in many countries it is a mandatory requirement for teachers willing to become involved in the education of deaf children to be trained. This is the case in the U.K., where teachers are required to attend a full-time one-year or a part-time two-year course in order to qualified as teachers of deaf children (Training Establishments for Teachers of

the Deaf in England, Northern Ireland, Scotland and Wales, 1995), and also, in the U.S.A., where specific standards have been developed as a foundation for the development and maintenance of effective richer training programmes for teachers of deaf children (Joint Standards Committee of the National Council on Education of the Deaf and the Council for Exceptional Children, 1996).

CHAPTER THREE

RESEARCH DESIGN AND METHODOLOGY

3.1 Introduction

This chapter focuses on methodology details appropriate in carrying out this research study. These are discussed under the following sub-topics- research design, variables, location of the study, target population, sampling techniques and sample size, research instruments, data collection techniques, data analysis techniques and ethical considerations/issues.

3.2 Research Design

A research is valid when a conclusion is accurate or true and research design is the conceptual blueprint within which research is conducted (Akhtar, 2016). Research design is not associated to any particular technique of data collection or any particular type of data. When designing research it is necessary that one recognizes the type of evidence required to answer the research question in a reasonable way. Research design can be considered as the structure of research that acts as the “Glue” that holds all of the elements in a research project together, in short it is a plan of the proposed research work (Akhtar, 2016; Tiromp, & Kombo, 2006)). According to Ahuja (2010) a research design is the arrangement of conditions for the collection and analysis of data in a manner that aims to combine relevance to the research purpose with economy and procedure. Research design is the plan, structure and strategy and investigation concaved so as to obtain ensured to search question and control variance (Borwankar, 1995). According to

Kombo, (2009), research design is the structure, scheme or plan that is used to generate answers to research problems.

This study adopted a descriptive design. Descriptive design also known as statistical research and it describes phenomena as they exist. It is used to identify and obtain information on characteristic of a particular issue like community, group or people. In other words, we can say that this type of research describes social events, social structure and social situations. Descriptive research answers the questions, what, who, where, how and when. It is used to study the current situation. It is widely used in the physical and natural science. But it is used more common in the social sciences, as in socio-economic survey and job and activity analysis (Zikmund, 1988).

Descriptive research aim at portraying accurately the characteristics of a particular group or situation, one may undertake a descriptive study about the works in a factory, their age distribution, their community-wise, distribution, their educational level, their state of their physical health and so on also one may study the conditions of work in a factory health, safety and welfare (Akhtar, 2016). A descriptive study may be concerned with the attitude or views (of a person) towards anything e.g., attitudes presidential form of government, right to strike, capital punishment, prohibition, college autonomy etc.

Descriptive survey is used for collecting information about people's attitude, opinions, habits or any of the variety of education or social issues (Gall, Gall & Borg, 2003). The descriptive survey design was appropriate for this study because it enabled the researcher to describe the effects of teaching methods on academic performance in mathematics

among learners with hearing impairment in Meru County Kenya. It was also appropriate because the study did not manipulate any variable under study rather it sought to analyse the existing situation as it pertains the effects of teaching methods on academic performance in mathematics among learners with hearing impairment in Meru County Kenya.

3.3 Variables

3.2.1 Independent Variable

The independent variables of this study were teaching methods of teaching mathematics to learners with hearing impairment. It was expected that inappropriate teaching methods would result to poor performance and vice versa.

3.2.2 Dependent Variables

The dependent variable of the study was academic performance of learners with hearing impairment in mathematics. It was expected that appropriate teaching methods may lead to higher academic performance.

3.4 Location of Study

An ideal setting for the study is the one that is directly related to the researcher's interest and easily accessible, Singleton, (1993). The study took place in Igembe District of Meru County. The location comprised of three constituencies namely Igembe South, Igembe Central and Igembe North. Igembe has special schools/units as follows:-

Constituency	No. of special schools/units	Enrolment of deaf learners	No. of Teachers
Igembe South	6	20	12
Igembe Central	8	110	17
Igembe North	7	25	14
TOTAL	21	155	43

Source – Igembe South EARC’S office

3.5 Target Population

Target population is the universe of interest. It is the total number of subject or environment of interest to the researcher, Kathuri, & Pals, (1993). The target population for this study is Headteachers of special school/units, teachers teaching mathematics in special school/units, and quality assurance and standards officers in Igembe Districts, a total of 67.

3.6 Sampling Techniques and Sample Size

Sampling techniques refers to how cases are to be selected for observation, Kombo, (2009). For this study, purposive sampling technique was applied to select special school/units, Headteachers, and Educational Q.A.S.O’s. A sample of 52% of accessible, population was purposively sampled for this study. That is 11 Headteachers, 23 teachers and 2 District Quality Assurance and Standard Officers (DQUASO). A total of 36 respondents were used for this study.

3.1 Sample size

Group	Target population	Sample size	Percentage %
Head-teachers	21	11	52
Teachers	43	23	53
DQUAZO	03	2	67

3.7 Research Instruments

The researcher used three (3) types of research instruments to collect data, that is, questionnaires, interview guide and observation schedules/checklists. The instruments were constructed to meet the objectives of the study.

3.6.1 Questionnaires

Questionnaires are defined as any text-based instrument that give survey participants a series of questions to answer or statements to respond to either by indicating a response – by marking a page, writing a number or checking a box on paper or online, for example. (Young, 2016). Questionnaires are advantageous because they are easy to construct, there are many extant questionnaires which can be used or adapted for use, and which are often freely available to researchers, they are portable or can be made available online, they can be used to gather large datasets relatively easily, either through direct contact, by mail, or online via the web or email and the data they gather can be processed and analysed relatively easily compared to spoken data which has to be recorded and transcribed before analysis (Young, 2016).

Questionnaires were chosen because they allowed the researcher to gather data easily and also analyze it effectively. Questionnaires were administered to the sampled Headteachers, and teachers who teach in special school /units in Igembe Districts. All the questionnaires consisted of both open and closed ended questions. Open ended questions allow the respondent to construct and elaborate on their ideas thus providing them an opportunity for their ideas and views to emerge.

3.6.2 Interview Guide

In-depth interviewing was a qualitative research technique that involves conducting intensive individual interviews with a small number of respondents to explore their perspectives on a particular idea, program, or situation (Boyce, & Neale, 2006). For example, it might ask participants, staff, and others associated with a program about their experiences and expectations related to the program, the thoughts they have concerning program operations, processes, and outcomes, and about any changes they perceive in themselves as a result of their involvement in the program. In-depth interviews are useful when you want detailed information about a person's thoughts and behaviors or want to explore new issues in depth. Interviews are often used to provide context to other data (such as outcome data), offering a more complete picture of what happened in the program and why (Boyce, & Neale, 2006). Interview guide allowed the researcher to conduct in-depth interview with QUASO in Igembe District. It allowed the respondents to give their in-depth vies on the effect of teaching methods on performance of learners with hearing impairment in mathematics.

3.6.3 Observation Schedule

An observation schedule is a form prepared prior to data collection that delineates the behavior and situational features to be observed and recorded during observation. Usually taking the form of a single sheet of paper, observation schedules are most frequently used with structured observation (Akhtar, 2016). Observation schedules help in gathering data concerning the status of school facilities, equipment and examining the general situation of learning environment, (Peril 1995). Observation guide had items which helped supplement the two other instruments for adequate data collection. The researcher was able to observe what teachers do under various circumstances, hear their comments and ask for clarity.

3.7 Pre-testing/Piloting

The research instruments were piloted (tried out) on selected samples similar to actual sample that was studied. This helped the researcher to make changes and make improvement on the instruments. Piloting was done in one special unit of the neighboring Tigania District that is Kanjalu special unit in Kanjalu primary school.

3.7.1 Validity

According to Borg & Gall, (1989), validity is the degree to which a test measures what it purports to measure. To ensure validity the research instruments were developed with the consultation of fellow post graduate students and supervisors. Pilot study was carried out to check the appropriateness of the language in the instruments as per research objectives in chapter one. The researcher ensured that all the contents of the objectives /research questions are covered by the instruments.

3.7.2 Reliability

Mugenda & Mugenda (2003) agree that reliability is a measure of the degree to which a research instrument yields consistent results or data after repeated trials. At the pilot stage the researcher applied Test-retest method to establish reliability. Two special units from Tigania district were purposively sampled. Re-test was conducted after collection within an interval of one week. Comparison of the results from both occasions was done by calculating the correlation coefficient using Pearson product moment correlation coefficient formula. A correlation coefficient of 0.78 was obtained and this was considered adequate to judge the reliability of the instrument (Gay1992). The degree of agreement was checked. The procedure was repeated until high degree of agreement was reached.

3.8 Data Collection Procedures

Mangila, (2012) defines data as a collection of facts or figures relating to activity under study. After approval of the research proposal, the researcher obtained an introduction letter from Kenyatta University. The researcher then used the letter to obtain a research permit from National Commission for Science Technology and Innovation. The researcher then visited schools with learners with hearing impairment to establish rapport with the targeted respondents before the actual data collection. The respondents were assured of confidentiality and asked not to write their names on the questionnaires. The researcher personally administered the research instruments to the sampled respondents.

3.9 Data analysis

In order for the data to be useful and provide answers to research problems, it has to be analyzed. The data gathered from the field was sorted out and coded. The researcher used descriptive statistics to analyze data. Data was then presented in form of tables, charts and texts.

3.10 Logistical and Ethical Considerations

The researcher obtained research permission from National commission for science technology and innovation through, the Dean, Graduate school, Kenyatta University before administering the research instruments in the field. The researcher then made preliminary visit to D.E.O's and Headteachers to discuss the relevance of the intended study, informed consent from the respondent and being treated with dignity and high esteem.

CHAPTER FOUR

PRESENTATION OF FINDINGS, INTERPRETATION AND DISCUSSION

4.1 Introduction

The purpose of this study was to find out the impact of teaching methods and strategies employed by the teachers that affects academic performance of mathematics by learners with hearing impairments in special school and units in Igembe District of Meru County. The chapter presents the results and discusses the findings. The following objectives guided the study starting with the demographic information:

- i. To find out teaching methods employed by teachers that has positive impact on academic performance of learners with hearing impairments in mathematics.
- ii. To find out modes of communication used by the teachers while teaching mathematics to learners with hearing impairments.
- iii. To identify environmental factors that has impact on academic performance of mathematics by learners with hearing impairments in special schools and units in Igembe District.
- iv. To find out the remediation strategies used by the teachers to alleviate specific mathematic difficulties in learners.

4.2 General and Demographic information

This section provides general information and demographic data.

4.2.1 General Information

The study sampled 11 head teachers, 23 teachers and 2 DQUAZO. Out of these only four head teachers, 16 teachers and all DQUAZO responded to the research instruments. Thus,

return rate for head teachers was 36.4%, for teachers was 69.6% and for DQUAZO was 100%. The overall return rate was 61.1% which was deemed adequate.

4.2.2 Demographic Data

The respondents (head teachers and teachers) were drawn from special school/units in public primary schools. The study sought to establish demographic characteristics of teachers. The results are summarized in Table 4.1

Table 4. 1. Demographic characteristics of teachers on several specific variables

Several specific variables		Frequency	Percent
Educational qualification	O level	14	87.5
	A level	2	12.5
Working experience	1-5 years	12	75.0
	6-10 years	3	18.8
	Above 10 years	1	6.2
Professional qualification in SNE	Diploma in special education	6	37.5
	BED special education	9	56.3
	MED special education	1	6.2
Area of specialization	Hearing impairment	4	25.0
	Inclusive education	12	75.0
Gender of the teacher	Male	8	50.0
	Female	8	50.0

The results in Table 4.1 indicated that most (87.5%) of teachers sampled are O-level holders. The information in Table 4.1 also pointed out that all the teachers sampled had training in special needs education with the 37.5 % of them being diploma holders, 56.3 % of them being bachelor's degree holders and 6.2 % being master's degree holders in special education. Therefore, it can be argued that all the teachers sampled were qualified

to teach the learners having undergone a teaching training. The study also established that most (75%) of the teachers have specialized in inclusive education while 25 % of them have specialized in hearing impairment. This implies that majority of the teachers can instruct learners with hearing impairment in an inclusive environment that has both regular learners and learners with hearing impairment. Table 4.1 indicates that the researcher sampled an equal number of teachers either gender. The information in the table also indicate that most (75%) of teachers sampled had a teaching experience of between one and five years. This implies that majority of the teachers teaching learners with hearing impairment have teaching experience of less than five years which could be an indication of being young in the teaching profession. This could also be a pointer to being fresh college graduates who are equipped with current teaching methods. The study also collected data on the demographic characteristics of the head teachers. The results are summarized in Table 4.2

Table 4. 2. Demographic information of head teachers

Variable		Frequency	Percent
Gender of the teacher	Male	4	100.0
	Female	0	0.0
Educational qualification	O level	3	75.0
	A level	1	25.0
Duration as head teacher in current school	1-2 years	2	50.0
	3-4 years	1	25.5
	5 years	1	25.5
Professional qualification in SNE	Diploma in special education	1	25.0
	BED special education	2	50.0
	BED general	1	25.0

Results indicate that all the head teachers from the sampled schools were males. The information in the table also indicates that all the head teachers had been in their current schools for five and below years. The results further indicated that most (75%) of head teachers sampled are O-level holders. The information in the Table also pointed out that only 75 % of the head teachers sampled had training in special needs education with the 25 % of them being diploma holders and 50 % of them being bachelor's degree holders. This implies that majority of the head teachers understands the needs of the learners with hearing impairment and hence are in a better position to ensure that the necessary curriculum is implemented. The head teachers were further requested to state the number of learners with hearing impairment in their schools. The results are shown in Table 4.3.

Table 4. 3. Number of learners with hearing impairment

Number of learners with hearing impairment	Frequency	Percent
3	1	25.0
4	1	25.0
21	1	25.0
28	1	25.0
Total	4	100.0

The results show that in two schools, learners with hearing impairment were less than five while in the other two schools sampled learners with hearing impairment were above 20.

The head teachers were also requested to state whether their schools had adequate teachers. All the head teachers affirmed that they had adequate number of teachers. This implies that the schools sampled were well equipped in terms of manpower.

The demographic characteristics of QASOs were also gathered. It was established that both QASOs had experience of more than 10 years. One of the QASO was a holder of bachelor's degree in education while the other was a holder of master's degree in education. Both QASOs had no formal training in special needs education. Whereas one of the QASO indicated that he assessed teaching in special school/units two to three times a year, the other QASO indicated that he does not assess such units/schools at all.

4.3 Findings for Objectives

4.3.1 Teaching methods employed by teachers in teaching mathematics

The first objective of the study sought to find out teaching methods employed by teachers that have positive impact on academic performance of learners with hearing impairments in mathematics. Teachers were requested to outline some of the teaching methods they use while teaching mathematics to learners with hearing impairment.

The results indicated that teachers employ a variety of methods such as demonstration/illustration, question and answer method, peer tutoring, developing concepts in steps from simple to complex, use of many visual aids such as charts and counters, discussion, oral practice based on addition, subtraction, multiplication and division facts, group work where pupils with different levels of competency are grouped together to uplift one another, teach test where learners are given exercises to work on to gauge their competence and task analysis. The results from teachers corroborates information gathered from head teachers who indicated that demonstration, use of real objects, approach and attach response and explaining key words/items in advance as some of the teaching methods employed to teach mathematics to learners with hearing impairment. The use of teach test as a method of enhancing learning of mathematics supports the finding of Morgan (1998) which indicated that the use of routine practice is the strongest educational practice that teacher can use in their classrooms to promote achievements in mathematics. The findings also supports MOEST (2001) which argues that teachers should employ an important strategy which is to create an environment in

which students are engaged in practical activities from which mathematics can be learnt in an interesting and meaningful way.

The finding that use of many visual aids such as charts and counters impact on performance in mathematics corroborates Herold (2008) findings which indicated that engaging varied and meaningful interaction that incorporate basic mathematics concepts such as number counting, quantity, time/sequence and categorization into day-to-day routine enhances performance in mathematics. This implies that teachers strive to ensure that all learners learn mathematics effectively. This is based on Morgan (1998) argument that the use of a combination of teaching methods, that is, the use of hands-on-materials and the use of traditional methods, ensure that both struggling learners and brighter students learn mathematics effectively. The finding also support Ansell and Paglioro, (2008) research finding that problems in mathematics requires more than, simply using the correct operation. Unlike teachers and head teachers, QASOs indicated that teachers only employ teacher centered approach to teach mathematics to learners with hearing impairment.

4.3.2 Modes of Communication Used by the Teachers While Teaching Mathematics to Learners with Hearing Impairments

The second objective of the study sought find out modes of communication used by the teachers while teaching mathematics to learners with hearing impairments. The results from teachers are summarized in Figure 4.1

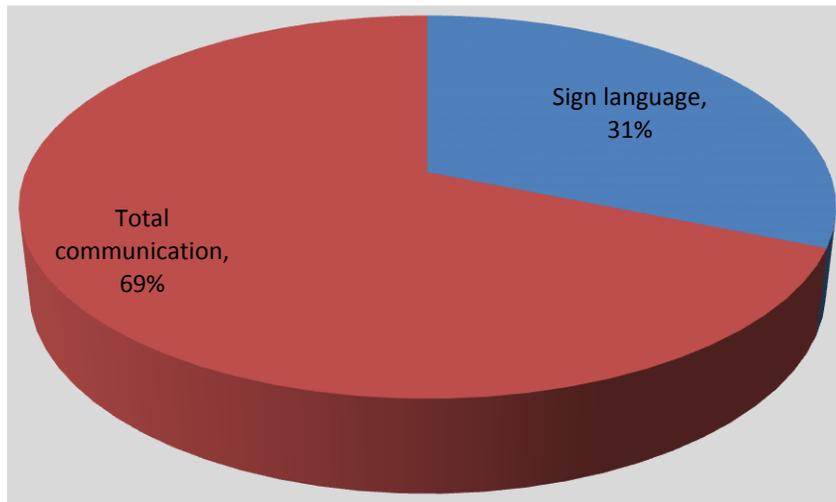


Figure 4.1: Mode of Communication

The results indicated that majority (69%) of the teachers used total communication while teaching mathematics to learners with hearing impairments. This implies that majority of learners with hearing impairment benefit from the use of a combination of variety of teaching methods such as sign language, hearing aids, learners' friendly set up classrooms with variety of learning resources and audio logical services. Thus it is possible that majority of teachers ensure that learners understand them and that they are also understood as argued by Itansen (1990). In support Sharilyn, (2009) at University of Sheffield, observed that effective communication is vital with hearing impaired students to ensure success. The head teachers were also requested to state the language of instruction in school. The results are shown in Table 4.4

Table 4.4. Language of Instruction in School

Language of instruction in school	Frequency	Percent
English	2	50.0
Kenyan sign language	1	25.0
Total communication	1	25.0
Total	4	100.0

The results indicated that in 50 % of the schools English is the language of instruction, in 25 % of the schools Kenyan sign language is the language of instruction while in another 25 % of the schools total communication is the language of instruction. This implies that some teachers are not competent enough to use sign language to instruct learners with hearing impairment. This supports Omutsani, (2012) finding that many teachers are unable to properly teach Deaf children in Kenya because they cannot communicate with them.

4.3.3 Environmental Factors That Has Impact on Academic Performance of Mathematics by Learners with Hearing Impairments

The third objective of the study sought to identify environmental factors that had impact on academic performance of mathematics by learners with hearing impairments in special schools and units in Igembe District. Teachers were requested to state other factors that have impact in academic performance in mathematics by learners with hearing impairments. One of the factors that was pointed out was that most learners are unable to acquire concepts on basic operation on numbers and this negatively impacts on their ability to interpret and solve mathematics questions and hence impact on performance in mathematics. This assertion was supported by results from the head

teachers who indicated that it takes longer for learners with hearing impairment to understand mathematical concepts since the involves use of concrete material for teachers to explain well. The results are supported by Govindan and Ramaa (2014) who indicated that learning mathematics is not an easy task and difficulties in mathematics prevent the children from enjoying the world of numbers. Govindan and Ramaa (2014) further pointed out that this difficulty is experienced not only by typically developing children but more by learners with hearing impairment (Govindan & Ramaa, 2014). The difficulties faced by children include symbol imagery or numeral imagery, concept imagery, difficulty in learning multiplication tables and math facts, grasping mathematical relationships, general computations, solving word problems and difficulty with higher mathematics.

Inadequate mathematics resources such as text books and visual aids were another factor that was pointed out by teachers that affect performance in mathematics. The teachers indicated that lack of resources limits the teachers on the variety of homework and practice that is given to the learners. This view was supported by head teachers who indicated that lack of enough resources such as books and teaching aids affects the academic performance of learners with hearing impairments in mathematics. QASOs also indicated that availability of teaching/learning resources affects the academic performance of learners with hearing impairments in mathematics. This supports Brew (2011) findings which indicated that mathematics learning can be effective if appropriate teaching and learning materials are employed in the teaching process. This was evident when teachers were asked to indicate on the frequency use of teaching/learning aids/resources when teaching mathematics as summarized in Table 4.5

Table 4. 5. Frequency of Teaching/Learning Aids/Resources use when Teaching Mathematics

How frequent	Frequency	Percent
Always	11	68.8
Rarely	5	31.2
Total	16	100.0

From the table it is evident that majority (68.8%) of the teachers always use teaching/learning aids/resources when teaching mathematics while 31.2 % rarely use them. This could be an indication that some schools have limited resources which deter teachers to employ them regularly. This view is supported by the findings from head teachers who indicated that lack of enough teaching and learning aids and resources such as books and charts are some of the challenges teachers face when teaching mathematics to learners with hearing impairment. The findings corroborates Omutsani (2012) study results which indicated that teachers did not make use of instructional materials and even do not improvise materials to make use of the other active senses when one has hearing loss. The teachers indicated that some of the teaching/learning aids/resources used when teaching mathematics include abacus, real objects, seeds, counters, chalkboard, charts, jigsaw puzzles, flash cards and number cards.

The teachers also indicated that communication difficult impact on performance in mathematics. They indicated that communication difficult often affect mathematics concepts and skill development and reasoning capability which ultimately results in poor performance in mathematics. It was also argued that communication difficulties limit

learners' ability to acquire varied strategies for solving mathematical problems especially when experiencing difficulties in sign language for various mathematical concepts. The results corroborate the finding from head teachers who argued that communication barrier affects the academic performance of learners with hearing impairments in mathematics. The findings support Omutsani (2012) who established that communication/language was one of the factors that hinder performance of hearing impaired learners in KCPE.

Teachers also indicated that lack of teacher training in sign language may impact negatively on performance in mathematics by learners with hearing impairment. This view is supported by QASOs argument that inadequate skilled personnel in special needs affect the academic performance of learners with hearing impairments in mathematics. This finding concurs with El-Zraigat and Smadi (2012) who pointed out that the vast majority of the teachers who teach at schools for students who are deaf and hard-of-hearing come from regular schools. These teachers are prepared and trained to be regular teachers and not special education teachers. El-Zraigat and Smadi (2012) also indicated that most teachers don't receive sufficient in-service training and support and supervision. In addition, El-Zraigat and Smadi (2012) indicated that most teachers are not aware of validated and effective teaching practices used with students with hearing loss. This could be hampering effective teaching and learning of mathematics for learners with hearing impairment.

The study also indicated that negative attitude by learners with hearing impairment towards mathematics negatively impacts their performance in the subject. The teachers

indicated that such learners find it hard to conceptualize mathematical concepts and often have difficulties to master difference between language signs (alphabets) and mathematical (numeral) signs. It was also established that such learners have poor concentration in class and are often discouraged very fast when they get a sum wrong and often lose interest. The view was supported by head teachers who argued that negative attitude towards mathematics affects the academic performance of learners with hearing impairments in mathematics.

Observation schedule indicated that the schools had adequate furniture, standard classrooms, fair lighting, rough and tidy floors, inadequate textbooks, adequate teaching aids, inadequate charts, inadequate dustbins and poor drainage. The observation schedule also indicated that the schools had refuse disposal pits which were in use. All the schools lacked fire extinguisher and only 50 % of the schools had piped water while the rest depended on bore hole or river water. All the schools had volleyball, soccer and netball pitches in addition to athletic track.

4.3.4 Remediation Strategies Used By the Teachers to Alleviate Specific Mathematic Difficulties in Learners

The fourth objective of the study sought to find out the remediation strategies used by the teachers to alleviate specific mathematic difficulties in learners. The teachers were requested to state some of the remediation strategies they use to alleviate specific mathematic difficulties in learners. It was established that various strategies are used. They include assisting learners with lower abilities to catch up with other learners; giving many exercise for mastery of mathematical concepts; forming mathematics groups so that the weak ones may benefit from the fast learners; extra-tuition when

others are away especially in the afternoon for slow learners; giving more work on an area that the learner has difficulties in extra time; giving appraisals (token) to a learner who sail through the concept which she or he had not mastered and internalized; group discussion; attending to individual learners; repetition and drilling more to acquire a concept; learner to learner group teaching where they help one another; peer coaching/tutoring; use of real objects after lesson; providing self-connecting teaching aids after teaching concept or skill; and simplifying the problem to the level of learners understanding.

Head teachers also indicated that their schools have remedial programs for learners with mathematics difficulties. They argued that such programs help learners with difficulties to catch up with the rest; to remind the learners the areas which are difficulty during class or lesson hours; to make sure the learners understands the concept which difficult; and enables weak learners to learn from the fast learners.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

The study investigated the impact of teaching methods and strategies employed by the teachers that affects academic performance of mathematics by learners with hearing impairments in special school and units in Igembe District of Meru County. The chapter presents a summary, conclusions and recommendations derived from the study findings. The chapter also provides suggestions for further studies.

5.2 Summary

The study objectives were to:

- i. Find out teaching methods employed by teachers that has positive impact on academic performance of learners with hearing impairments in mathematics.
- ii. Find out modes of communication used by the teachers while teaching mathematics to learners with hearing impairments.
- iii. Identify environmental factors that impact on academic performance of mathematics by learners with hearing impairments in special schools and units in Igembe District.
- iv. Find out the remediation strategies used by the teachers to alleviate specific mathematic difficulties in learners.

5.2.1 Methods of Teaching Mathematics

The study found out that teachers employ a variety of methods such as demonstration/illustration, question and answer method, peer tutoring, developing

concepts in steps from simple to complex, use of many visual aids such as charts and counters, discussion, oral practice based on addition, subtraction, multiplication and division facts, group work where pupils with different levels of competency are grouped together to uplift one another, teach test where learners are given exercises to work on to gauge their competence and task analysis. It was also established that the use of a variety of methods enhances academic performance of learners with hearing impairment in mathematics.

5.2.2 Modes of communication used by the teachers while teaching mathematics

The study established that sign language and total communication are the main modes of communication in special schools/units with learners with hearing impairment.

5.2.3 Other factors that have impact on academic performance of mathematics

The study established that communication, learning/teaching resources, teacher training and student attitude impact on academic performance of mathematics by learners with hearing impairments in special schools and units in Igembe District.

5.2.4 Remediation strategies

The study established that assisting learners with lower abilities to catch up with other learners; giving many exercise for mastery of mathematical concepts; forming mathematics groups so that the weak ones may benefit from the fast learners; extra-tuition when others are away especially in the afternoon for slow learners; giving more work on an area that the learner has difficulties in extra time; giving appraisals (token) to a learner who sail through the concept which she or he had not mastered and internalized; group discussion; attending to individual learners; repetition and drilling more to acquire

a concept; learner to learner group teaching where they help one another; peer coaching/tutoring; use of real objects after lesson; providing self-connecting teaching aids after teaching concept or skill; and simplifying the problem to the level of learners understanding help to alleviate mathematic difficulties in learners.

5.3 Conclusions

The following conclusions were made based on the study findings:

- i. The use of a varied teaching methods enhances academic performance of learners with hearing impairment in mathematics
- ii. Total communication and sign language are the main modes of communication used by the teachers while teaching mathematics to learners with hearing impairments
- iii. Effective communication, availability of learning/teaching resources, effective teacher training and student attitude impact on academic performance of mathematics by learners with hearing impairments in special schools and units in Igembe District.
- iv. Interactive teacher – learner teaching/learning such as personalized teaching and interactive learner – learner teaching/learning such as peer tutoring are used by the teachers to alleviate specific mathematic difficulties in learners.

5.4 Recommendations

Based on the study findings the following recommendations are made:

- i. Teachers should be employing varied teaching methods such as demonstration, participatory, educational technology and peer tutoring while teaching learners

with hearing impairment in order to enhance their academic performance especially in mathematics.

- ii. Total communication should be encouraged while teaching learners with hearing impairment in order to enhance their academic performance especially in mathematics.
- iii. School management should strive to enhance learning/teaching environment through provision of both physical and human teaching/learning resources to learners with hearing impairment in order to enhance their academic performance.
- iv. Teachers should strive to use interactive teaching/learning in order to alleviate specific mathematic difficulties in learners.

5.5 Recommendations for Further Study

Based on the study findings the following suggestions for further study were made:

- i. A study should be conducted on the impact of teaching methods on academic performance of learners with hearing impairment in other subjects other than mathematics
- ii. A study should be conducted on the role of interactive teaching/learning on general academic performance of learners with hearing impairment

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6. What mode of communication do you use when teaching mathematics to learners with hearing impairments

Sign Language

Signed Exact English

Total communication

Others Specify _____

7. Are you trained in sign language?

Yes

No

8. Which teaching methods /strategies do you use to teach mathematics to learners with hearing impairments?

9. List other factors that have impact in academic performance in mathematics by learners with hearing impairments.

10. How often do you use teaching/learning aids/resources when teaching mathematics

Use Always

Use Rarely

Never use

11. List the teaching/learning resources you use when teaching mathematics to learners with hearing impairments.

12. What challenges do you face when teaching mathematics to learners with hearing impairments?

13. What is your attitude towards teaching of mathematics?

14. Do you have remediation strategies for mathematics difficulties?

Yes

No

15. What are some of the remediation strategies for mathematics difficulties used by you?

APPENDIX 1(B)

QUESTIONNAIRES FOR THE HEAD TEACHER

This interview is used to collect data on impact of teaching methods on academic performance of mathematics by learners with hearing impairment in special school /units in Igembe Districts. The information will be treated with confidentiality during and even after the study.

Please answer all questions as accurately as possible.

1. What is the name of your school

2. Gender Male Female

3. Academic qualification

O level A level

4. Professional training (SNE)

3 Months training

Diploma

B'ED special needs

M'ED Special needs

Others specify

5. For how long have you been a head teacher in this school? _____

6. How many children with hearing impairment are in this school?

7. Does your school have enough teachers?

Yes

No

8. What is the language of instruction in your school

English

Kenyan sign language

Total communication

9. How do you gauge your learner willingness/ attitudes towards learning mathematics?

Poor

Fair

Good

Excellent

Briefly explain your answer above?

10. What teaching methods do teachers use when teaching mathematics to hearing impaired learners in this school?

11. What challenges do teachers face when teaching mathematics in this school?

12. Does this school have remedial programs for learners with mathematics difficulties?

Yes

No

If yes what are the benefits of remedial programs?

13. In your opinion what affects the academic performance of learners with hearing impairments in mathematics in this special schools / units.

APPENDIX I (C)

**INTERVIEW SCHEDULE FOR QUALITY ASSURANCE AND STANDARDS
OFFICER (QUASO)**

The aim of this questionnaire is to find out the impact of teaching methods on academic performance of learning impaired learners in mathematics in social school/units

Please write your answers' clearly, honestly and as accurate as possible. This information will be confidential and will be used for research only.

1. Gender Male Female

2. For how long have you been a QUASO? _____

3. Professional qualification

Diploma in education

B'ED

M'ED

Others specify

4. Highest special needs education training?

None

Certificate

Diploma in SNE

B'ED in SNE

M'ED in SNE

Others specify _____

5. How often do you assess teaching in special school /units in this district? How many times per term/ school /unit?

Once

(2-3) Times

Over 3 times

Not at all

6. Indicate the adequacy of teaching /learning resources in special schools/units

Adequate

Family adequate

Inadequate

Not Available

7. Do all teachers prepare professional records in special school/units you have visited?

All teachers

Majority

Some

None

8. Indicate the teaching methods /strategies used by teaches when teaching

mathematics to learners with hearing impairments

9. In your own opinion what do you think affect the academic performance of mathematics of learners with hearing impairments in this district? _____

APPENDIX I (D)

SCHOOL OBSERVATION SCHEDULE

1. School Name : _____
2. Zone: _____
3. Constituency : _____
4. County : _____
5. Classification of school

Education level	Type of school	Residence	Gender
<input type="checkbox"/> E. C. D.E	<input type="checkbox"/> Regular	<input type="checkbox"/> Boarding	<input type="checkbox"/> Boys
<input type="checkbox"/> Primary	<input type="checkbox"/> Special school	<input type="checkbox"/> Day	<input type="checkbox"/> Girls
<input type="checkbox"/> Secondary	<input type="checkbox"/> Special Unit	<input type="checkbox"/> Boarding day	<input type="checkbox"/> Mixed

6. Classroom learning environment

Category for observation	Observation schedule
Ventilation	<input type="checkbox"/> Poor <input type="checkbox"/> Fair <input type="checkbox"/> Good
Lighting	<input type="checkbox"/> Poor <input type="checkbox"/> Fair <input type="checkbox"/> Good
Classroom size	<input type="checkbox"/> Small <input type="checkbox"/> Standard <input type="checkbox"/> large
Furniture	<input type="checkbox"/> Not adequate <input type="checkbox"/> Adequate
Floor	<input type="checkbox"/> Rough and tidy <input type="checkbox"/> Rough and untidy <input type="checkbox"/> Smooth and tidy <input type="checkbox"/> Smooth and untidy
Textbooks	<input type="checkbox"/> Enough <input type="checkbox"/> Not enough
Teaching aids	<input type="checkbox"/> Available <input type="checkbox"/> Not available
Charts	<input type="checkbox"/> Available <input type="checkbox"/> Not available

7. School Environment

Categories for observation	Observation scale		
a) Waste management			
Dustbins	<input type="checkbox"/> Not available	<input type="checkbox"/> Available	
Drainage	<input type="checkbox"/> Not available	<input type="checkbox"/> Available and not in use	<input type="checkbox"/> Available and in use
Refuse disposal pits	<input type="checkbox"/> Not available	Available and Not use	<input type="checkbox"/> Available and in use
b) Land remain	<input type="checkbox"/> Not available	Available and in use	<input type="checkbox"/> Available and in use
c) Path in school	<input type="checkbox"/> Hilly	Hilly but flat	<input type="checkbox"/> Flat
d) Ramps	Path without pavements	Narrow parent	Wide paramount
e) Security /safely	Gate	<input type="checkbox"/> Yes	<input type="checkbox"/> No
	Fence	<input type="checkbox"/> Yes	<input type="checkbox"/> No
	Fire extinguisher	<input type="checkbox"/> Yes	<input type="checkbox"/> No
	Security Personnel	<input type="checkbox"/> Yes	<input type="checkbox"/> No

8. Social amenities

i) Source of water: Pipe Rain Bore hole River
 others

ii) Sources of lighting in the school:

Electricity Generator Solar power Lamps

Others _____

iii) Means of travel for pupils:

Bicycles Motorbikes Matatu Foot

9. Recreational Facilities

Soccer pitch	<input type="checkbox"/> Not available	<input type="checkbox"/> Not available
Netball pitch	<input type="checkbox"/> Not available	<input type="checkbox"/> Not available
Volleyball pitch	<input type="checkbox"/> Not available	<input type="checkbox"/> Not available
Athletic track	<input type="checkbox"/> Not available	Not available
Others specify		

Wall finishing	<input type="checkbox"/> Mud /clay	<input type="checkbox"/> wood	<input type="checkbox"/> cement
	<input type="checkbox"/> Iron sheets	<input type="checkbox"/> Others	
Netball pitch	<input type="checkbox"/> Not available	<input type="checkbox"/> Available	
Learning centres shops, our garden curiosity table/ corner	<input type="checkbox"/> Not available	<input type="checkbox"/> Available	

APPENDIX II: RESEARCH AUTHORIZATION FROM NACOSTI



NATIONAL COMMISSION FOR SCIENCE, TECHNOLOGY AND INNOVATION

Telephone: +254-20-2213471,
2241349, 3310571, 2219420
Fax: +254-20-318245, 318249
Email: dg@nacosti.go.ke
Website: www.nacosti.go.ke
when replying please quote

9th Floor, Utalii House
Uhuru Highway
P.O. Box 30623-00100
NAIROBI-KENYA

Ref. No:
NACOSTI/P/16/20423/11519

Date:

10th June, 2016

Nabea Mpanda Kathare
Kenyatta University
P.O. Box 43844-00100
NAIROBI.

RE: RESEARCH AUTHORIZATION

Following your application for authority to carry out research on *“Effect of teaching methods on academic performance in mathematics among learners with hearing impairment in Meru County, Kenya,”* I am pleased to inform you that you have been authorized to undertake research in **Meru County** for the period ending **10th June, 2017**.

You are advised to report to **the County Commissioner and the County Director of Education, Meru County** before embarking on the research project.

On completion of the research, you are expected to submit **two hard copies and one soft copy in pdf** of the research report/thesis to our office.


BONIFACE WANYAMA
FOR: DIRECTOR-GENERAL/CEO

Copy to:

The County Commissioner
Meru County.

The County Director of Education
Meru County.

National Commission for Science, Technology and Innovation is ISO 9001:2008 Certified

APPENDIX III: RESEARCH PERMIT FROM NACOSTI

CONDITIONS

- 1. You must report to the County Commissioner and the County Education Officer of the area before embarking on your research. Failure to do that may lead to the cancellation of your permit**
- 2. Government Officers will not be interviewed without prior appointment.**
- 3. No questionnaire will be used unless it has been approved.**
- 4. Excavation, filming and collection of biological specimens are subject to further permission from the relevant Government Ministries.**
- 5. You are required to submit at least two(2) hard copies and one(1) soft copy of your final report.**
- 6. The Government of Kenya reserves the right to modify the conditions of this permit including its cancellation without notice**



REPUBLIC OF KENYA



National Commission for Science, Technology and Innovation

RESEARCH CLEARANCE PERMIT

Serial No. A9475

CONDITIONS: see back page

THIS IS TO CERTIFY THAT:
MR. NABEA MPANDA KATHARE
of KENYATTA UNIVERSITY, 436-60600
Maua, has been permitted to conduct
research in Meru County

on the topic: EFFECT OF TEACHING METHODS ON ACADEMIC PERFORMANCE IN MATHEMATICS AMONG LEARNERS WITH HEARING IMPAIRMENT IN MERU COUNTY, KENYA.

for the period ending:
10th June, 2017



Applicant's Signature



Director General
National Commission for Science, Technology & Innovation