

**FACTORS INHIBITING THE LEARNING OF MATHEMATICAL SKILLS  
AMONG PUPILS WITH HEARING IMPAIRMENTS:  
THE CASE OF SELECTED BASIC SCHOOLS  
IN NDOLA AND LUFWANYAMA DISTRICTS, ZAMBIA**

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## **TITLE**

Factors Inhibiting the Learning of Mathematical Skills among Pupils with Hearing Impairments: The Case of Selected Basic Schools in Ndola and Lufwanyama Districts, Zambia

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## Declaration

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Signature: ..*Chishimba*.....

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## Approval

This dissertation by Christine Chishimba is approved as a partial fulfillment of the requirements for the award of the Master of Education in Special Education of the University of Zambia.

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## ABSTRACT

The purpose of this study was to analyse factors inhibiting the learning of mathematical skills among pupils with hearing impairments. The objectives of the study were to identify mathematical skills taught to hearing impaired pupils in lower basic classes.

The study further looked at the mode of communication used in the teaching of mathematical skills to hearing impaired pupils, establishing instructional strategies used and their impact on the learning of mathematical skills among pupils with hearing impairments. Assessment of the availability of educational resources and their suitability in the learning of mathematical skills among pupils with hearing impairments was also investigated.

Four schools were randomly selected for investigation in 2006. The instruments used in the data collection included structured interviews, semi-structured interviews and observation schedule for the teachers of hearing impaired pupils and focus group discussion guide for pupils with hearing impairments. The collected data provided both qualitative and quantitative information.

The Statistical Package for Social Sciences (SPSS) was employed to analyse the quantitative data. The data were presented in tables, percentages and charts.

Qualitative data from interviews were coded and emerging themes were grouped into categories using constant comparative analysis technique.

The results of the study revealed that there were inadequate specialized teachers to teach pupils with hearing impairments. The study also found out that pupils with hearing impairments faced a lot of problems in learning mathematical skills and these came about as a result of inadequate teaching and learning materials, lack of remedial work to help hearing impaired pupils improve in learning mathematical skills and seconded teachers who were not conversant with sign language.

The factors inhibiting pupils with hearing impairments learn mathematical skills emanated from teachers' poor teaching strategies and non-availability of educational resources suitable in learning and teaching of mathematical skills among pupils with hearing impairments.

The teacher is the key contributor to pupils' learning of mathematical skills and as such, take centre stage in the success or failure in acquiring and developing mathematical skills among pupils with hearing impairments. Further, the pupils' inhibiting factor of not learning mathematical skills was characterized by inadequate teaching skills from teachers, insufficient learning materials, failure of classroom communication, inadequate skills of sign language and the relationship between teachers and pupils. This was especially observed during the time of learning.

The study recommended that schools where the hearing impaired pupils learn be provided with learning aids for them to grasp mathematical skills.

Teachers of the hearing impaired pupils need to be adequately trained to be able to use different methods and strategies. Teachers must be conversant with sign language.

## **Dedication**

To my father, Chishimba P. Chumangulu, who always told me that education was the key to success, had no age limit and it never ended; to my beloved husband, Maybins, who always encouraged me to do further studies; and to my children, Bruno Mwamba, Jimmy Mpange, Christine Chipimpi and Faith Mushilingwa, for their understanding of my being away from home.

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# CHAPTER ONE: INTRODUCTION

## 1.1 Background to the problem

The debate over the best way to teach children with hearing impairments mathematical skills has raged since the 1500s (Skemp, 1989). There is still growing concern on the increasing failure of pupils with hearing impairments to acquire and develop mathematical skills in the school system (Cockcroft, 1982). He further argues that mathematical disabilities in students with hearing impairments have been recognized since early in the twentieth century but they have never received the degree of attention that reading has received. He indicates that no full-length text was written especially on arithmetic problems faced by children with hearing impairments (Gearheart, 1986).

Educating Our Future(1996:66) indicates that '*every individual has an equal right to educational opportunity*'. This means that every individual, regardless of personal circumstances or capacity, has a right of access to and participation in the education system. Ensuring full equality of access, participation and benefit for all pupils necessitates interventions at all levels to support children at risk. In accordance with the concerns that have been expressed about mathematics, schools offering a general academic education will concentrate efforts on effecting significant improvements in this subject.

Many things in our everyday lives have a mathematical basis, whether we are counting money at a supermarket or calculating whether we have enough room to squeeze our car into a particular parking space.

Today's society is technologically oriented and information rich and children need to develop mathematical skills in order to have the confidence and competence to be effective in our technological society (Davis, 1996).

Mathematics is compulsory in many educational systems, including the Zambian educational system. Lacking mathematical qualifications can present barriers to other subjects such as science that relies on branches of mathematics (Ginburg, 1977).

Meadow Orlans (1980) states that mathematical concepts can be learnt by hearing impaired pupils in the same sequence and manner as their peers, provided the teacher is able to facilitate learning experiences through using meaningful resources which allow children's existing knowledge to be built upon.

Haynes (1999: 143) states that *'concept learning should be taught in such a way that children develop the ability to think mathematically and new experiences should allow them to refine their existing knowledge and ideas in constructing new knowledge'*.

Napier (1974) argues that a competent teacher uses a variety of approaches mainly because certain concepts are more communicated via one method than others. He

further indicates that both hearing and hearing impaired pupils have problems in mathematics and some strategies can be put in place to overcome these problems which inhibit hearing impaired pupils from learning mathematical skills. However, in Zambia, little has been done on the problems hearing impaired pupils face in acquiring of mathematical skills in lower basic classes except in reading and language. Hence, the need for research into the subject.

## **1.2 STATEMENT OF THE PROBLEM**

The introduction of classes for pupils with hearing impairments in lower basic schools has brought challenges in the teaching of mathematical skills. However, not much is known from the available literature on factors inhibiting the learning of mathematical skills among hearing impaired pupils in selected schools in Ndola and Lufwanyama districts of Zambia. Therefore, this study was designed to explore factors influencing the learning of mathematical skills among pupils with hearing impairments in lower basic classrooms in selected schools in Ndola and Lufwanyama districts on the Copperbelt Province of Zambia.

## **1.3 PURPOSE OF THE STUDY**

The purpose of this study was to investigate the factors inhibiting the learning of mathematical skills among pupils with hearing impairments in lower basic classrooms.

The study was also intended to find out about mathematical skills learnt and taught, teaching methods and strategies and also educational resources used in teaching

hearing impaired pupils in lower basic classes. The study further aimed at determining support services available in learning mathematics and how the support services enhance the acquisition of mathematical skills among learners with hearing impairments.

#### **1.4 OBJECTIVES OF THE STUDY**

The general objective of this study was:

To investigate factors inhibiting the acquisition and use of mathematical skills among hearing impaired pupils in lower basic classrooms in selected schools in Ndola and Lufwanyama districts of Zambia.

#### **1.5 SPECIFIC OBJECTIVES**

These were:

- 1.5.1 To determine factors inhibiting the learning of mathematical skills among pupils with hearing impairments
- 1.5.2 To identify mathematical skills taught to hearing impaired pupils in lower basic classes
- 1.5.3 To find out the mode of communication used in teaching mathematical skills
- 1.5.4 To establish instructional strategies used and their impact on learning mathematical skills among pupils with hearing impairments
- 1.5.5 To assess the availability of educational resources and their suitability in learning of mathematical skills among hearing impaired pupils

## **1.6 RESEARCH QUESTIONS**

- 1.6.1 What factors inhibit the learning of mathematical skills among pupils with hearing impairments?
- 1.6.2 What mathematical skills are taught to hearing impaired pupils in lower basic schools?
- 1.6.3 What mode of communication do teachers use to teach mathematical skills?
- 1.6.4 What instructional strategies do teachers use and what are their impact on the learning of mathematical skills among pupils with hearing impairments?
- 1.6.5 What teaching resources are there and how suitable are they in the teaching and learning of mathematical skills among hearing impaired pupils?

## **1.7 SIGNIFICANCE OF THE STUDY**

The ability to process mathematical concepts is not only important to hearing pupils alone but also to hearing impaired pupils in the day to day activities of life.

Hearing impaired pupils should be able to learn mathematical skills in order to make correct judgements in life (Reisman, Kaufman, 1980).

Poor performance in mathematics among pupils with hearing impairments can affect their academic success in late life. The problems the hearing impaired pupils will face will always go back to the way they were introduced to mathematics in lower basic school. One aspect, therefore, of long term solutions to the problems must be suitable intervention at lower basic and teacher training levels (Englemann, Carnine 1982). They further indicate that to accomplish this, qualified teachers need to work

with pupils from lower basic onwards. Grade one at lower basic school level is very important because it is the starting point of basic education to the majority of children in Zambia. It is at this level where good foundation should be laid.

It was hoped that the results of this study would help teachers to investigate factors inhibiting the acquisition and use of mathematical skills among hearing impaired pupils in lower basic classrooms in Ndola and Lufwanyama districts schools. Further, it was hoped that the findings would bring more insights on mathematical skills taught to hearing impaired pupils in lower basic classes.

## **1.8 THEORETICAL FRAMEWORK**

This study was guided by New Sociology of Education Theory provided by Basil Bernstein and Pierre Bourdieu (Karabel and Houlse, 1977). The theory focuses on internal operations of the school and it gives teachers the process of how pupils come to be before and after school. The New Sociology of Education Theory brings about the relationship between the teacher and the pupils. This theory considers the concepts and categories teachers use to define their pupils during academic work. The concepts teachers use e.g. stupid, dull and slow learner will affect pupils' performance. The theory also talks about curriculum, content and organization of knowledge. If the content is not well organized and language not understood by pupils, it will definitely affect their performance. Unless teachers adequately prepare their lesson plans, teach from known to unknown, make the contents be understood

by pupils, instruction will be meaningless. The teacher's failure to relate with pupils, organize curriculum, content and knowledge could inhibit the learning process.

According to Karabel (1977), concepts teachers use to define the hearing impaired pupils have contributed to pupils' failure or success. Some teachers use such negative terms/words as, stupid, slow learner, low achievers and poor.

These remarks cited earlier discourage pupils with hearing impairments from effectively learning mathematical skills.

Mercer and Mercer et al (1981) purport that teachers of the hearing impaired pupils failure to come up with good curriculum, content and organization of knowledge contributes to the pupil's failure to benefit from the learning process.

## **1.9 LIMITATIONS OF THE STUDY**

The study was limited to the hearing impaired pupils in Ndola and Lufwanyama districts. Therefore, generalization of the findings will only be to the hearing impaired pupils.

Financial constraints and lack of time to visit all schools on the Copperbelt where hearing impaired pupils learn also will limit the study. The schools where the hearing impaired pupils learn are scattered in the country. The study was conducted at only four selected schools in Ndola and Lufwanyama districts.

## **1.10 OPERATIONAL DEFINITIONS OF TERMS**

- |                         |                                       |
|-------------------------|---------------------------------------|
| <i>Hearing impaired</i> | - not able to hear what is being said |
| <i>Special classes</i>  | - where hearing impaired pupils learn |

*Factors*

- situations which help or inhibit the learning of mathematical skills

*Sign language*

- a visual way to communicate based on symbols that are seen rather than heard

*Special Education teacher*

- Teacher trained to teach pupils with disabilities

*Communication mode*

- any means which are available to make Communication easier

*Individualised Education Programme*

- a written education plan that specifies pupils with special needs current levels of education performance

*Strategies*

- Methods used by the teacher to make pupils understand the concept of mathematics.

## CHAPTER TWO

### LITERATURE REVIEW.

This chapter reviews literature on factors inhibiting the learning of mathematical skills among pupils with hearing impairments. The chapter identifies mathematical skills taught to hearing impaired pupils, mode of communication used in teaching mathematical skills, instructional strategies used and their impact on learning mathematical skills and assessing the availability of educational resources and their suitability in learning of hearing impaired pupils.

Gearheart (1986) has observed that hearing impaired pupils have problems in learning mathematical skills. He further observes that although mathematics has a prime importance in our daily life, the aspect of normal and abnormal development of mathematical skills has received very little attention compared to reading and writing skills. While it is true that mathematics has not received much attention, studies that have been conducted have yielded a wealth of insights into the nature and prevalence of mathematical difficulties (Barton, 1994).

Available literature reveals that the teaching of mathematics to hearing impaired pupils is important. Mathematical skills should be taught so that hearing impaired pupils can gain the ability to solve real life problems. So, hearing impaired pupils like any other pupil should learn mathematical skills. Smith (1928) argues that mathematical skills are important in our world of economy to day and it should be mastered by every citizen.

Spens (1938) also states that, without acquaintance with mathematics taught, much that is fundamental in modern life is unintelligible. Today's society is technologically oriented and information – rich and children need to develop mathematical skills in order to have the confidence and competence to be effective participants in our technological society.

To deny hearing impaired pupils access to mathematical skills is a severe handicap in their dealing with social issues that are based on mathematical operations.

Ahmed (1987) indicates that most school age children face problems in learning mathematical skills. While Mannigel (1992) argues that mathematical problems emerge early in life and require early intervention if children are to overcome their mathematical handicaps later in life.

Ahmed (op cit) states that if improvement in learning of additional mathematics are to be widespread, it is inevitable that sustained change must begin with teachers themselves. Ahmed further argues that teachers' beliefs about the nature of mathematics, how children learn about their own roles, are critical factors in determining what actually happens in the classroom and therefore, determining the quality of pupils' mathematical skills acquisition and development.

The understanding of how children learn mathematical skills and what they know at various stages of their development has been a driving force behind the life long work of many educational researchers and practitioners. Teachers should be

encouraged to develop the understanding and knowledge by reflecting on children's learning and their own teaching of mathematics (Mannigel, 1992).

Mannigel further indicates that to become better teachers of mathematics, it is crucial that teachers continue to broaden their knowledge of how children come to understand mathematical concepts.

Cornelius (1982, 132) in a supportive view states that '*inevitably, the key to good, successful learning of mathematics is the teacher*'. The teacher is the key contributor to pupils' learning of mathematical skills, and as such, it is taken as centre stage in pupils' failure or success in acquiring and developing mathematical skills. There are a number of factors influencing the learning of mathematical skills among pupils with hearing impairments. These include, mathematical skills, inadequate teachers, instructional skills, educational resources, mode of communication, inadequate skills of sign language and relationships between teachers and pupils.

## **2.1 Mathematical skills**

Mathematics is a complex subject which involves among other things, evaluating pupils' weak and strong learning points so that remedial work is immediately provided. For pupils, what they already know has some influence on their learning as some new material may not make sense without previous knowledge. Learning mathematical skills involves reasoning, developing problem-solving skills and remembering facts about different concepts and theories (Davis, 1996). Unless the

hearing impaired pupils are able to use these skills together independently, it may be difficult to find solutions to problems.

Baroody (1987) notes that hearing impaired pupils need to acquire skills in reading and writing numbers, counting objects, use of the four basic mathematical operational skills i.e. addition, subtraction, multiplication and division and then apply these skills in counting. Bobis (2004) indicates that the number concept focuses on early number learning that is counting, patterning, matching number with objects and counting tables are presented through examples of assessment tasks, children's responses and learning frameworks in number. The learning of number facts is presented through mathematical strategies of addition. This may mean that children in their first year of school are already working with abstract counting skills, knowledge of number facts which will promote basic counting strategies.

Bobis (ibid) further states that recognizing and creating patterns are fundamental to developing number concepts and relationships. This will help hearing impaired pupils immediately recognize how many items are in a small group. Identifying the quantities on dot cards can be extended to include many aspects of learning by requiring children to match patterns with objects.

Ginsburg (1977) has identified the initial intuitive stages of mathematics learning as the 'informal stage'. A young child learns the language of magnitude (more, less, bigger, smaller) and equivalence (same) at home long before schooling begins. In

much the same way, a child learns to chant the alphabet before knowing how to use it. Children also learn the sequence at home. This sequence is a kind of song they discover and it must go in a particular order. This does not happen to hearing impaired pupils, they normally move from basic skills of counting to more complex counting. For example, when the hearing impaired pupil sees the problem

$4 + \underline{\quad} = 6$ , they often respond with an answer 10. In this problem, the hearing impaired pupil first counts four objects then six objects and adds the two together.

The teacher should help the hearing impaired pupils by teaching them '4 + what missing number equals 6?' The explanation will help the pupils to explore different approaches to solving a problem and become independent thinkers (Baroody, 1987).

Orton (1993) states that mathematics is all about problem-solving. One of the best ways to help pupils learn mathematical skills is to present them with a problem in which they have to devise their own strategies to find the solution. He further states that for hearing impaired pupils to understand basic operation skills, they need to start with simple counting strategies and develop mastery at the basic facts and eventually become competent users of mathematical skills. Failure to develop mastery is likely to impede learning of higher order mathematical skills.

## **2.2 Inadequate qualified teachers**

It is worth acknowledging from the start that teachers play a major part in creating the right environment in which pupils can best learn mathematical skills. The significance of their beliefs about mathematics, mathematics teaching and how

pupils learn mathematics, have great influence on their classroom behaviour and significantly contribute to pupils' improvement.

Maybin Siwale (1995), carried out a survey on the teaching of mathematics on the Copperbelt of Zambia. His findings revealed that most of the teachers who teach mathematics at upper basic schools are seconded teachers who have not gone through secondary school teacher training in mathematics. He further states that, unqualified teachers impede proper pupil mathematics development and this leads to inappropriate teaching such as lack of continuity in topics. Teaching where meaning and purpose of teaching mathematical skills are not made clear to hearing impaired pupils contributes to lack of enjoyment and pleasure that there is in mathematical skills.

Other researchers such as Burnett and Irons (1998) felt that hearing impaired pupils need to appreciate and to know that mathematical skills is useful in other subjects, in games and in their daily lives. They further indicate that lower basic classes should have qualified and competent teachers who can fulfill hearing impaired pupils' needs in mathematical skills.

It is worth noting that there are different types of teachers such as, trained graduate teachers with mathematics as a specialty, trained graduate teachers with mathematics as a second subject, graduate teachers in mathematics without teacher training and non- graduate teachers with teacher training (Diploma and Certificate holders as the

case is in Zambia). Whatever they are, the worst type of teachers are those whose career are not teaching but whose interests are only to teach for their living. The teachers who are not trained to teach hearing impaired pupils have no heart for these pupils and have no regard for hearing impaired pupils' learning difficulties in mathematical skills.

In Zambia, through Action In teaching English, Mathematics and Science (AIEMS, 1994), programme a survey was conducted on the teaching of mathematics, English and Science. The results identified one factor contributing to problems in mathematics. The problem was not only the high proportion of unqualified mathematics teachers but also the lack of well-qualified specialized teachers. This view was also observed by Wright et al (2002: 101) report in England and Wales which says that, '*the teaching of mathematics in schools has for many years suffered through an acute shortage of qualified teachers*'. This view is in line with Coates and Mittler (1989) who are quoted to have claimed that research suggests that the teachers with little experience of teaching pupils with hearing impairments are likely to have negative attitudes in teaching mathematical skills to hearing impaired pupils.

### **2.3 Instructional strategies**

In order for teachers to apply their teaching methods effectively, they need to know what hearing impaired pupils already know, different pupils' learning abilities and needs, what pupils find difficult and why they it difficult. As teachers of lower basic classes find themselves teaching pupils with varying mathematical backgrounds, it is

proper that they employ different strategies that would assist all hearing impaired pupils learn better mathematical skills.

Napier (1974) states that a competent teacher uses a variety of methods to help hearing impaired pupils grasp the concept of mathematical skills. Bobis (2004) states that teaching mathematical skills at lower basic to hearing impaired pupils requires the use of different strategies and varied methods by a well trained teacher who has been exposed, for example, the use of flash numerical cards, large and small numerical cards, counters (number concept), number line and dot pattern cards. Cornelius (1982) argues that the key to good successful learning of mathematical skills among the hearing impaired pupils in lower basic classes is the teacher. The teacher has the responsibility of interpreting contents of a syllabus and other instructional materials into sign language for pupils to make sense of their classroom instructions.

David (1996) states that some mathematics teachers, both specialist teachers and ordinary teachers express the view that there is no need to consider how they impart mathematical skills to hearing and hearing impaired pupils since, as it deals with universals, pupils are bound to pick up necessary skills and develop them.

Mathematics is, however, viewed as socially neutral and its content is held to be independent of material world hence the need for hearing impaired pupils to receive more systematic instructions in mathematics during their formative stages in

education. Researchers such as Cockcroft (1982) have shown that teachers and pupils have problems in mathematics; it is up to the teacher to come up with strategies and a variety of teaching methods to overcome these problems. The specialist teachers need to be creative and innovative in their teaching strategies and techniques in order to help the young hearing impaired pupils grasp initial mathematical skills, concepts, operations and language necessary for future mathematical tasks. An effective teacher should also know how to select appropriate learning tasks to go with different skills.

According to Doorag (1987), selection of the learning task is a critical instructional decision. No matter how excellent the teaching procedures, instruction is ineffective if the task selected is inappropriate for the learner. The selection of the learning task is even more critical for hearing impaired pupils because they may acquire new learning more slowly than the hearing. Mager (1984) states that the breaking down of tasks into smaller sub-tasks is necessary. He further argues that when the components of the task are identified, they can be presented to hearing impaired pupils in a systematic fashion. An example of a task that can be broken down into steps is addition of two-digit numbers; first, the numbers in the ones column are added, and then the numbers in the tens column. Mercer (1987) in a supportive view states that sub-tasks allow the teacher to make decisions about the order in which skills and information will be presented. With tasks that are sequential in nature, sub-tasks are generally taught in order in which they occur.

In order for teachers to assist hearing impaired pupils to achieve positive mathematical learning outcomes, they must be fully conversant with mathematics curriculum (Educating Our Future, 1996), mathematical thinking and requirements for creating holistic learning environments which facilitate mathematical learning. The knowledge of mathematical curriculum, together with an insight into specific learning styles and developmental needs of hearing impaired pupils, will reduce the factors inhibiting the learning of mathematical skills among hearing impaired pupils. Many teachers who join the profession and had no knowledge about special education needs provision usually have problems in identifying children with special educational needs. UNESCO cited Vaughn and Schumm (1994) who in their study established that the general education teacher in their sample did not even know who the special education pupils were until the second or third month of school. This could be attributed to the fact that many teachers seconded to special classes to teach pupils with educational needs have no basic skills.

#### **2.4 Learning materials and their suitability in learning mathematical skills**

Bobis (2004) observed that lack of teaching and learning materials hinders hearing impaired pupils from learning mathematical skills. Whatever appropriate teaching objects a teacher may use is as good as a teacher himself. A good and effective teacher uses concrete objects for maximum learning effect, of course depending on teacher effectiveness and special assistance. A varied approach in teaching is more effective and learning that goes on is more usable later.

Concrete objects are diversified (Helen Coper, 1969). Without concrete objects, whatever is being verbally taught to hearing impaired pupils will all be abstract. Hearing impaired pupils find it boring, tough and most of the time tend to dislike mathematics. It is therefore extremely important that those at lower basic, hearing impaired pupils are given the best type of teaching with the use of concrete objects in teaching mathematical skills. Cruckshank et al (1967) also stress the need for concrete objects. In their findings, it was reported that teachers need to use such real life natural objects familiar to the hearing impaired pupils to accelerate learning and for learning to be meaningful to pupils. It also creates interest in learners because they are dealing with the abstract. It is easier for the hearing impaired pupils to understand when real objects are used in teaching. It arouses their interest and enthusiasm to learn. Horton (1988) postulates that quality education depends more on qualified teachers and availability of teaching and learning materials made from local resources. Chantaman (1992) points out that one area which needs a lot of attention is the provision of educational resources to the hearing impaired pupils. He further points out that special teaching facilities are required to meet the needs of exceptional children.

Brennan (1985) states that children with special educational needs show greater variation in learning and to meet their needs, the teacher must have a greater variety of teaching and learning materials. If the teacher is not supported in the provision of teaching and learning materials, he/she may resent pupils with disabilities. This is the

view taken by Shea and Bauer (1994) who claim that general education teachers may not be ready to meet the needs of learners with disabilities without some support.

Charles et al (1983) purport that although problems of understanding mathematics differ from pupil to pupil, deafness and loss of hearing among children are believed to be the hindrance towards inability to learn mathematical skills among pupils with hearing impairments. In teaching mathematical skills, teachers have to bear in mind that hearing impaired pupils learn better with concrete objects. The teacher believed it to be paramount for hearing impaired pupils to experience mathematical skills in a concrete and meaningful way in order to develop an understanding of mathematical concepts / processes.

Paul (1995) states that the use of mathematical resources is an area that needs further input in terms of the training of teachers of the hearing impaired pupils. He further argues that professional development should include strategies for teachers to focus on the resources suitable for hearing impaired pupils in particular and the best ways of using resources to generate mathematical thinking. In teaching mathematical skills, teachers have to bear in mind that, hearing impaired pupils learn better with concrete objects. Napier (1974) argues that a competent teacher is one who uses a variety of approaches and concrete objects to bring about success in learning mathematical skills. Teaching and learning materials are extremely important in boosting levels of performance in hearing impaired pupils. Bobis (ibid) states that

hearing impaired pupils who have been provided with opportunities in learning mathematical skills develop self confidence in the manipulation of concrete objects.

Cruckshank et al (1976) also stress the need for concrete objects. They state that teachers need to use concrete objects familiar to the hearing impaired pupils to accelerate learning and for learning to be meaningful to hearing impaired pupils. Real concrete objects have long been identified as enhancing the learning of mathematical skills, yet problems continue to persist. Perhaps Cockcroft (1952) could be right when he argues that mathematics is a difficult subject to teach and learn. However, Cornelius (1982) holds a different view. He is of the view that problems in mathematics could persist as long as there are new developments in mathematics and the shortage of well qualified teachers continue as has been the case for many years. The findings of the study indicate that inadequately qualified and seconded teachers teach pupils with hearing impairments. However, the teachers were not competent enough to meet learning needs of hearing impaired pupils. The findings are consistent with those of Mannigel (1992) who indicates that to become better teachers for pupils with hearing impairments teachers should be well qualified. He further states that to become better teachers of mathematics, it is crucial that teachers continue to broaden their knowledge of how children come to understand mathematical concepts.

Problems hearing impaired pupils faced in learning mathematical skills would be overcome only if trained teachers with good skills to meet their learning needs would teach them.

## **2.5 Mode of communication**

Fraser (1992) defines total communication as the right of a child who is deaf (hearing impaired) to learn the use of all forms of communication available to make him/her understand the knowledge put across. This allows meaningful interaction which involves sign and spoken language between the hearing and the hearing impaired pupils. This is why the teacher of the hearing impaired pupils need to be conversant with sign language in order for him/her to teach mathematical concepts, operations and language skills effectively. The relationship between the teacher and the hearing impaired pupils should also be sound for the teacher to teach and for pupils to learn effectively. It is also paramount for the teacher to be well trained and totally understand and communicate with the hearing impaired pupils.

David (1988) argues that it remains possible that if communication between the teacher and the hearing impaired pupils is lacking, it will in a way make the hearing impaired pupils not to learn effectively. Hearing impaired pupils need love and care. So, for the teacher to communicate with them, they need to be tolerant and accommodating. Once the hearing impaired pupils find out that communication and interaction is not good between them and the teacher, they will tend to withdraw and lose interest in learning and most of all, dislike the teacher and mathematics. It is

paramount to know how to relate with the hearing impaired pupils because they need someone who should understand and accommodate them.

Hughes (1986) states that communication and total communication (sign language) by the teacher in introducing mathematical skills to the hearing impaired pupils is a matter of effective transmission of what is being taught.

Hearing-impaired pupils are said to live in silent world. They are cut off from the world of sound and many are never able to learn to speak through sign language. Children suffering from hearing impairments often find themselves living in isolation from the rest of the world because of communication problems. The communication problems they face seem insurmountable. So, total communication in this context implies an approach to creating a successful and equal communication between human beings and different language perception and production (Freeland, 1989). From the literature review, it can be seen clearly that there are factors inhibiting the hearing impaired pupils from learning mathematical skills. The researchers who have written about the factors inhibiting hearing-impaired pupils from learning mathematical skills have good reasons as to why they think so. The reasons given by the same researchers for their views are paramount and highly supported by some authorities who have taken studies on the subject especially in developed countries.

## **CHAPTER THREE**

### **METHODOLOGY**

This chapter discusses the methodology of the study, the study design, the sample and the sampling procedures, the instrumentation for data collection and methods of data processing

#### **3.1 RESEARCH DESIGN**

The study employed both qualitative and quantitative methods. The terms qualitative and quantitative are used in different approaches to research. These refer to distinctions about the nature of knowledge, how one understands the world and the ultimate purpose of the research. They also refer to research methods where data is collected, analysed, presented and their interpretations. Research methods rest on an axiom: The nature of the data and the problem for research dictate the research method. Robson (1993) states that qualitative research methods deal with data that are principally verbal and it helps in the understanding of the way in which the individual and other data that can be transformed into numbers. Quantitative research deals with numbers, creates, modifies and interprets the world in which he/she finds him/herself.

#### **3.2 STUDY POPULATION**

The population of the study was restricted to hearing impaired pupils at lower basic schools in Ndola and Lufwanyama districts on the Copperbelt Province of Zambia.

The lower basic classes were selected because this is the starting point of basic education to the majority of children in Zambia.

Lower basic was also selected because, at this stage, it was enough to group the concept of mathematical skills and therefore, problems experienced in learning may easily be identified (Skemp, 1987). The total number of hearing impaired pupils in all four schools under the study was forty (40). Hearing-impaired pupils were not many in schools, so, all the forty pupils were taken. The schools from which the sample was drawn were ranked into the following categories: urban and rural. This was done to provide equal representation.

### **3.3 STUDY SAMPLE**

The study consisted of forty (40) hearing impaired pupils in four selected schools in Ndola and Lufwanyama districts on the Copperbelt Province and ten(10) teachers of the hearing impaired pupils, also from the four selected schools. The teachers selected were just a proportion of the total population. Two teachers were selected from Kamba, two from Chilengwa, two from Kansenshi and four from St. Joseph school. The teachers were selected from the schools because some have undergone training in special education. This was so, so that the researcher could obtain the insider's view of the situation. Lower grades were selected due to the small number of hearing impaired pupils in schools.

### **3.4 SAMPLING PROCEDURE**

The sample was drawn from four (4) government schools of the hearing impaired pupils in Ndola and Lufwanyama districts on the Copperbelt Province. The schools

from which the sample was drawn were ranked in two categories; three (3) schools were from urban area and one (1) school from a rural area. This was done for easy generalization. A total of forty (40) hearing-impaired pupils were involved. These pupils were drawn from four (4) lower basic schools. Ten (10) specialist teachers already in the field were drawn from classes where the researcher observed mathematics lessons.

### **3.5 RESEARCH INSTRUMENTS**

A review of literature on factors inhibiting the learning of mathematical skills among hearing impaired pupils prompted the researcher to use three data collection instruments

#### **3.5.1 Questionnaire for teachers of Hearing Impaired Pupils**

A semi-structured questionnaire was developed for the teachers of the hearing impaired pupils in selected schools. The questionnaire had both closed and open-ended questions. The closed questions allowed the specialist teachers to tick appropriate information about the subject of investigation. The open-ended questions were meant to give teachers an opportunity to give detailed information about the subject of investigation.

#### **3.5.2 Observation Schedule**

Observations of mathematics lesson preparation, instructional strategies and pupils' participation were done in four schools in the study.

The lesson observations were done. Three mathematics lessons were observed at each of the four schools. The lesson observations were aimed at observing the mode of communication and teaching resources teachers used. The lesson observations were also aimed at finding out the impact

learning resources had on hearing impaired pupils to learn mathematical skills at lower basic schools. The focus was on the topic being taught and the instructional strategies, whether or not these were helping pupils with hearing impairments learn mathematical skills.

### **3.5.3 Focused Group Discussion Guide**

Focused Group Discussions were conducted using an interview guide. The discussion focused on whether pupils were interested in learning mathematical skills and the type of mathematical skills pupils with hearing impairments used to learn. The focused group discussions looked at the mode of communication pupils used to learn mathematical skills and the instructional strategies teachers of the hearing impaired pupils used to help pupils with hearing impairments learn mathematical skills. The focused group discussions also aimed at finding out how teachers of the hearing impaired pupils grasp the concepts of mathematical skills and whether pupils had enough resources to help them in the learning of mathematical skills. The topic also focused on how suitable educational resources were in the learning of mathematical skills. For pupils who were not learning mathematics, the same guide was used with the major focus on what problems inhibited the hearing impaired pupils from learning mathematical skills and what should be done to help the hearing impaired pupils reduce difficulties they face in learning mathematical skills.

### 3.6 DATA COLLECTION

Data was collected from teachers who taught pupils with hearing impairments. Three instruments were used in this study to come up with the in-depth findings about factors inhibiting the learning of mathematical skills among pupils with hearing impairments.

Data was collected between February and March 2007. At the four schools the researcher visited, the head teachers helped to mobilize teachers and pupils to assist carry out her work. Before the focused group discussions could begin, the researcher explained to pupils the purpose of the study and assured them that the information obtained was going to be used for academic purposes only and would be kept in confidence.

There were four discussion groups which comprised ten pupils. The four study groups would provide varied answers to compare responses although pupils were of mixed ability. If responses appeared to be the same, the likely conclusion would be that problems faced by all pupils were similar and needed a common intervention. The focused group discussions were done in sign language and the discussions were written down for the researcher to use during data analysis. The discussions lasted about one hour and observations were done after having made arrangements with the class teacher.

The questionnaires for the teachers of hearing impaired pupils had instructions on how to complete them, for example, *'tick the appropriate answer or write in the space provided'* question like, *'are you trained to teach hearing impaired pupils?'* Yes or No and if the answer to the preceding question is No, give reasons.

Teachers were not allowed to write names on the questionnaires to ensure confidentiality.

### **3.7 DATA ANALYSIS**

Data collected in the study were analysed using both quantitative and qualitative methods. Qualitative methods involved data cleaning, reduction and editing in readiness for analysis. The data were analysed and put in themes and categories as they emerged. These themes were presented as sub-headings of findings. The data from the focused group discussions were listed and transcribed as and presented as emerging categories in the ten research questions. The quantitative data were computed and presented as percentages using Statistical Packages and Social Sciences (SPSS).

### **3.8 ETHICAL CONSIDERATIONS**

The researcher obtained permission from the University of Zambia, School of Education, Department of Educational Psychology, Sociology and Special Education (EPSSE) for carrying out this research. The letter was taken to the Provincial Education Officer, and then to the District Board Secretary to allow her do the research in their schools. Finally, the letter was taken to schools managers before conducting the study so that they would grant the researcher permission to carry out the research at their schools.

## CHAPTER FOUR

### PRESENTATION OF RESULTS

This chapter presents the research findings according to the five main objectives. Firstly, to identify mathematical skills taught to hearing impaired pupils in lower basic classes, secondly, to find out the mode of communication used in teaching mathematical skills, thirdly, to establish instructional strategies used and their impact on learning mathematical skills and fourthly, to assess the availability of educational resources and their suitability in learning mathematical skills among hearing impaired pupils and lastly, to determine factors inhibiting the learning of mathematical skills among pupils with hearing impairments.

#### Data from the Teacher Questionnaire

In this study, the researcher tried to get information of teachers who were trained and who were not trained.

**Table 1: Teachers trained to teach mathematical skills to hearing impaired pupils**

Teacher Trained or not	School L		School K		School M		School N		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%
Yes	1	10	7	70	9	90	6	60	23	57.5
No	9	90	3	30	1	10	4	40	17	42.5
Total	10	100	10	100	10	100	10	100	40	100

In table 1 above, 57.5% of the teachers reported that they were trained to teach mathematical skills to pupils with hearing impairments while 42.5% were not trained.

**Table 2: Duration of training of teachers**

In this study, the researcher tried to find out the period of training undertaken by teachers to teach hearing impaired pupils.

Duration of training	School L		School K		School M		School N		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%
1 year	9	90	4	40	7	70	8	80	28	70
2 years	1	10	6	60	3	30	2	20	12	30
3 – 4 years	0	0	0	0	0	0	0	0	0	0
Total	10	100	10	100	10	100	10	100	40	100

In table 2 above, 70% of the teachers were trained for one year while 30% were trained for two years.

**Table 3: Competences of teachers in teaching mathematical skills to the hearing impaired pupils besides being trained**

In this study, the researcher tried to find out how teachers taught mathematical skills to pupils with hearing impairments

Competences in teaching mathematics	School L		School K		School M		School N		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%
Using experience	2	20	2	20	1	10	2	20	7	17.5
Using teachers' handbook	6	60	1	10	6	60	0	0	13	32.5
Using own knowledge	2	20	7	70	3	30	8	80	20	50
Total	10	100	10	100	10	100	10	100	40	100

In table 3 above, the majority of the teachers relied on or using the knowledge received from initial training.

## **4.2 factors inhibiting the learning of mathematical skills among pupils with hearing impairments**

### **4.2.1 Data from Focused Group Discussions**

To get first hand information on factors inhibiting pupils with hearing impairments from learning mathematical skills, focused group discussions were held. At each school, pupils mentioned the factors that inhibit them from learning mathematical skills. This method of data collection revealed in-depth experiences in learning mathematical skills.

Pupils were able to identify factors which inhibited them from learning mathematical skills.

#### **4.2.2 Adequately qualified teachers**

Pupils at the four schools in the study stated that they were able to learn mathematical skills because they had enough qualified teachers. Pupils at schools L, K, M, and N agreed that topics in mathematical skills taught were understood but became difficult as they moved from one lower grade to one higher.

#### **4.2.3 Teachers using sign language**

Pupils at schools K and L reported that most of the teachers showed ignorance on the use of certain mathematical signs in sign language. Teachers tended to learn from pupils who did not enough vocabulary. This affected the way they taught.

At schools M and N, pupils agreed on teachers needed to know sign language and be resourceful in order to teach effectively. In their own voice, they said:

*'Teachers should be conversant with sign language. No sign language, no learning'.*

#### **4.2.4 Inadequate resources**

Pupils at schools L and N reported that although they had qualified teachers, skills become difficult to understand without teaching and

learning resources. Pupils at schools K and M said that teachers did not use teaching and learning resources to help them understand the concept of mathematical skills.

#### 4.2.5 Instructional strategies used

The results from focused group discussions (FGD) revealed that most pupils could not grasp the concept of mathematical skills because teachers used teacher-centred methods of teaching.

At schools K and M, although pupils were interested in learning mathematical skills, mathematics became complicated because the teacher always called on them to the chalkboard to look at him giving example. They lamented:

*'Teacher, I learn better when I am involved in doing mathematical skills with real concrete objects'.*

In this study, the researcher tried to find out whether pupils were interested in learning mathematical skills or not interested.

**Table 4: Pupils interested in learning mathematics**

Teacher Trained or not	School L		School K		School M		School N		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%
Yes	10	100	10	100	10	100	10	100	40	100
No	0	100	0	100	0	0	0	100	0	0
Total	10	100	10	100	10	100	10	100	40	100

According to table 4 above, 100% of the pupils in the study said that they were interested in learning mathematical skills and none said that they were not learning mathematical skills. However, some inhibiting factors were identified and mentioned by pupils in their learning of mathematical skills as table 5 below indicates:

**Table 5: Factors inhibiting the teaching of mathematical skills to pupils with Hearing-impairments**

Factors inhibiting the teaching of mathematics	School L		School K		School M		School N		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%
Language	4	40	5	50	6	60	2	20	17	42.5
Teaching methods	5	50	4	40	2	20	2	20	13	32.5
Time limitation	1	10	1	10	2	20	6	60	10	25
Total	10	100	10	100	10	100	10	100	40	100

Table 5 shows that 42.4% of the teachers lacked sign language, 32.5% lacked teaching methods and 25% showed that they were limited by time. In order to get a clear picture of what actually happened in a classroom situation in the four schools in the study, the following were inhibiting factors identified, problems encountered and suggestions made for the improvement of the teaching of mathematical skills to hearing impaired pupils presented in table 6:

**Table 6: Data from lesson observations**

<b>Inhibiting factors</b>	<b>Problems</b>	<b>Suggestions</b>
Teaching/learning resources	<ul style="list-style-type: none"> <li>* No teaching/learning resources</li> <li>* Pupils failed to make images</li> <li>* Learning was total abstract</li> </ul>	<ul style="list-style-type: none"> <li>* Teachers to make more teaching/learning materials for them to teach effectively and help pupils develop the ability to think independently</li> </ul>
Instructional strategies	<ul style="list-style-type: none"> <li>* Five teachers from the four schools used teacher-centred method</li> </ul>	<ul style="list-style-type: none"> <li>* Teachers should use different types of teaching methods for hearing impaired pupils to build on existing knowledge</li> </ul>
Sign language	<ul style="list-style-type: none"> <li>* Three teachers at school L had problems with sign language. They asked pupils for help.</li> </ul>	<ul style="list-style-type: none"> <li>* Teachers must be fully conversant with sign language in order to help pupils achieve positive outcomes</li> </ul>
Inadequate qualified teachers	<ul style="list-style-type: none"> <li>* In school K, two teachers were not qualified. They were seconded teachers</li> </ul>	<ul style="list-style-type: none"> <li>* Lower basic classes must have well qualified teachers competent enough to meet learning needs of hearing impaired pupils</li> </ul>

#### **4.2.6 Overcoming Problems faced in learning mathematical skills**

Pupils at the four schools indicated that problems faced in learning mathematical skills could be overcome by first having trained teachers who were conversant with sign language. Pupils at school K reported that mathematical skills became difficult when teachers could not communicate with hearing impaired pupils. At school L, 90% of the pupils said that the problems they faced would be overcome only if trained teachers with good skills in sign language taught them.

At schools M and N, 100% of the pupils reported that teachers lacked methods of teaching. Most of the work was teacher-centred and no activities for pupils.

Some of the reports to the researcher by some pupils are listed below:

*“Some teachers just call us to the chalk board without explaining how to go about it”.*

*“Some topics need us to be involved with real concrete objects, then we would be able to come up with good work”.*

#### **4.2.7 Reducing difficulties that pupils with hearing impairments face in learning mathematical skills**

Results from the focused group discussions revealed that, to reduce difficulties that pupils with hearing impairments faced in learning mathematical skills, the teacher should show interest in pupils' academic and social problems. The teacher should show concern about pupils' emotional state and also that teaching should be on a one-to-one basis.

Some of the sentiments expressed by some pupils are listed below:

*“Teacher should always tell pupils what to do and how best it can be done”.*

*“Teacher who can teach and sign has a positive influence on performance in lower basic schools”.*

### 4.3 Mode of communication used to teach mathematical skills to hearing impaired pupils.

Table 7: The researcher wanted to find out the mode of communication used to teach mathematical skills to hearing impaired pupils

Mode of communication	School L		School K		School M		School N		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%
Sign language	9	90	6	60	9	90	6	60	30	75
Oral language	0	0	2	20	0	0	1	10	3	7.5
Total communication	1	10	2	20	1	10	3	30	7	17.5
Total	10	100	10	100	10	100	10	100	40	100

In table 7, 75% of the teachers said that they used sign language to teach mathematical skills to pupils with hearing impairments. 7.5% used oral language only while 17.5% use total communication.

#### **4.4 Instructional strategies used to learn mathematical skills**

Results from focused group discussions revealed that teachers used pupil-centred methods accompanied by teaching and learning aids. This method helped pupils with hearing impairments learn mathematical skills. The following were some of the responses from pupils in this study when asked how they understood mathematical skills they learnt.

*“Teacher, I learn better with real concrete objects”.*

*“Teacher, I understand better when I count with concrete objects”.*

#### **4.5 Assessing the availability of educational resources and their suitability in the learning of mathematical skills**

Pupils at schools L and N reported that mathematical skills became difficult to understand without teaching and learning aids. They said:

*“Teachers do not use teaching aids to help us understand the concept of mathematical skills”.*

At school K, pointed out that most teachers just walked into a classroom and asked pupils to go to the chalkboard and learn together.

It was observed that most pupils just walked to the chalkboard and stood while others went at the back doing nothing. While at the back, some pupils did not concentrate but just made noise, at times, they even fought.

#### **4.6 Suitability of education resources in learning mathematical skills**

Results from focused group discussions revealed that most teachers used teaching and learning aids in line with the topic at a particular day. Pupils at school N reported that they used bottle tops, sticks, stones and number line to work out solutions to some mathematical problems in addition, subtraction, division and multiplication. To this effect, they stated:

*“Teachers do not allow us to use our fingers, because hearing impaired pupils tend to be slow and easily get mixed up”.*

At school K, 40% of the pupils could not learn mathematical skills due to lack of teaching and learning aids.

#### **4.7 Helping pupils grasp the concept of mathematical skills**

Pupils at school K reported that some teachers used real concrete objects when teaching mathematical skills. However, at the same school, pupils said that some teachers did not use concrete objects and this affected pupils with hearing impairments to grasp the concept of mathematical skills.

At school L, pupils said:

*“Teachers fail to explain the concept of mathematical skills to pupils with hearing impairments. They should have different types of teaching and learning aids to be able to teach mathematical skills effectively”.*

## **CHAPTER 5**

### **DISCUSSION OF THE FINDINGS.**

In this chapter, findings on the factors inhibiting the learning of mathematical skills among pupils with hearing impairments are discussed. Mathematical skills taught at lower basic, mode of communication used in teaching mathematical skills, instructional strategies and availability of educational resources and their suitability in the learning of mathematical skills among the hearing impaired are also discussed.

#### **5.1 Factors inhibiting hearing impaired pupils from learning mathematical skills**

According to Riddel et al (1991), the general factor identified as contributing to failure in learning mathematical skills among all pupils and pupils with hearing impairments in particular, is not only a high proportion of unqualified mathematics teachers in the school system but also the insufficiently qualified specialized teachers in special classes.

In this study, only 50% of the teachers said that they were trained and used knowledge obtained from their initial teacher training. 32.5% used teachers' handbooks and 17.5% used their teaching experience. Both groups of teachers who used their teaching experience and teachers who used teachers' handbooks faced problems in teaching pupils with hearing impairments.

Pupils would not understand their teaching because a lot of factors such as teaching resources, teaching strategies and sign language were lacking from these teachers.

A major finding from the lesson observed was that teachers had inadequate lesson plans. Most of the teachers failed to come up with proper lesson plans which would help hearing impaired pupils come up with mental pictures of mathematical skills. The findings from the observation schedules revealed that some factors inhibiting the learning of mathematical skills by pupils with hearing impairments were the inadequate lesson preparations.

## **5.2 Mode of communication used in teaching mathematical skills**

The findings from this study revealed that most teachers faced problems of sign language. These findings are in line with those found by Cornelius (1982) who states that the key to successful learning of mathematical skills among pupils with hearing impairments is sign language. Teachers who are not conversant with sign language are unable to interpret contents of the syllabus and instructional materials for pupils to understand. Pupils with hearing impairments face a lot of problems in learning mathematical skills without sign language as the work is very abstract. In this study, 75% of the teachers reported being conversant with sign language and 25% not conversant.

Pupils with hearing impairments would only learn mathematical skills if they were in a talking environment. This allows for meaningful interaction which involves sign language and spoken language between the hearing impaired pupils and the hearing pupils.

This is the reason why the teacher for the hearing impaired pupils need to be conversant with sign language and a lot of varied methods in order to teach mathematical concepts, operations and language skills effectively.

Pau (1995:4) has suggested that “*verbal arithmetic problems contain certain linguistic forms which are particularly difficult for hearing impaired subjects*”. One teacher noted that without basic communication, hearing impaired pupils have no idea what questions are being asked of them and thus what is expected of them.

Barton (1995:158) states that for children learning mathematical skills: in early days of their mathematical development, the teacher should select words to use so that hearing impaired pupils understand mathematical concepts rather than present a new item to be learnt.

The inhibiting factor hearing impaired pupils encounter with regard to communication in learning mathematical skills were also evident during observations of the teachers, when it became apparent that hearing impaired pupils did not understand concepts in addition, subtraction and multiplication. One teacher felt that with limited communication, it was difficult for hearing impaired pupils to solve mathematical problems beyond basic level.

Mousley and Kelly (1998) suggest that several factors contribute to difficulties because of limited sign language both from seconded teachers and hearing impaired pupils. However, Flexer (1999) suggests that hearing impaired pupils, whether slight or profound in nature, if unmanaged, can have a negative impact on the development of mathematical skills in future grades. One teacher noted that hearing impaired pupils overall learning, including mathematical learning, is generally delayed because of a limited sign language base. In this study, specialist teachers confirmed that hearing impaired pupils need to receive constant repetition of mathematical concepts in sign language in order to retain them.

Engaging in mathematical process such as problem-solving, developing logic and reasoning and communicating mathematical ideas depends upon hearing impaired pupils having good communication. It is crucial, therefore, that hearing impaired pupils should learn in a talking environment because this allows for ease of communication. Problem-solving requires hearing impaired pupils to use their observations to make predictions which in turn requires a sound sign language base.

Lesson observations, revealed that when displaying statistical thinking, i.e., sorting pictures of clothing, food and animals into categories, the hearing impaired pupils did not understand what was being asked of them. They followed the direction of the teacher's eyes in order to correctly categorise their pictures, or required a lengthy and repeated explanation in sign language from the teacher before they began to grasp the concepts.

Johnson (1993, cited in Davis, 1996) suggests that hearing impaired pupils would develop logical thinking when sign language skills are sufficiently developed to allow the hearing impaired pupils to construct chains of casual thought. Hearing impaired pupils' ability to successfully interpret mathematical information and use of symbols in a mathematical context would be disadvantaged by their levels of development of communication skills. Communicating mathematical ideas involves hearing impaired pupils using their own language that is sign language and the language of mathematics to express mathematical ideas.

As already discussed, Barton (1995) believes that learning mathematical skills is like learning a language. For some hearing impaired pupils, the language of mathematics

features as their third or fourth language, after sign language. This is challenged by Barton's idea that

*The process of using more than one language to express mathematical ideas is additive in itself. That is given sufficient proficiency in both languages, hearing impaired pupils are liable to have better understanding because they have two modes in which to think and communicate(p. 159).*

Respondents in the study claimed teachers showed ignorance in the use of sign language. This affected the way teachers taught. The findings are in line with those of Kirk and Gallagher (1983) who purport that sign language (total communication) use variety of methods to assist hearing impaired pupils in expressing, receiving and developing language. They further indicate that hearing impaired pupils would learn mathematical skills from a teacher who is able to explain things in sign language. This will enable hearing impaired pupils understand the knowledge put across. One respondent said,

*Teachers should be conversant with sign language, this will help them teach effectively.*

These findings are in line with David (1988) who states that if communication between the teacher and the pupils is lacking, it will in a way make the hearing impaired pupils not learn effectively. This view is supported by Hughes (1986) who indicates that sign language by the teacher in introducing mathematical skills to hearing-impaired pupils is a matter of effective transmission of what is being taught.

The study revealed that it was important that there be on-going communication in sign language between teacher and hearing impaired pupils so that mathematical vocabulary is

being repeated and re-enforced in as many different situations as possible. One teacher felt that because hearing impaired pupils take so long to understand mathematical concepts due to lack of language, it is crucial for the hearing impaired pupils to have those concepts repeated in a variety of contexts.

Haynes (1999:142) states that *“in order to maximize learning the teacher must ensure that purposeful play experiences within an enriched environment offer challenges and opportunities for exploration and problem-solving”*. Hearing pupils are likely to hear mathematical concepts mentioned incidentally during any given day but for hearing impaired pupils the concepts have to be deliberately brought to their attention in as many ways and as often as possible.

Teachers and hearing impaired pupils need to work together as a team to re-enforce mathematical vocabulary and concepts. In order to achieve this, communication has to be on-going between teachers and hearing impaired pupils.

### **5.3 Instructional Strategies used and their impact on learning mathematical skills**

The findings in this study also revealed that 32.5% of the teachers lacked teaching methods. This is in line with those findings found by Napier (1974) where it was revealed that a competent teacher is one who uses a variety of teaching methods to bring about success in learning mathematical skills.

Teaching mathematical skills at lower basic school to hearing impaired pupils requires the use of different strategies and varied methods by a well trained teacher who has been exposed.

Hughes (1986) states that pupils with hearing impairments learn by seeing and manipulation of objects. Although teachers encounter problems in mathematics, mathematical skills are still being taught to pupils with hearing impairments.

In this study, 77.5% of the teachers used one-to-one teaching strategy. This strategy seems to work in that the teacher would sit with individual pupils and help them according to their levels of understanding and needs in grasping the concept of mathematical skills.

It can be clearly seen from the results that teachers trained as specialist teachers were able to teach effectively because they used different strategies and teaching and learning resources.

One of the respondents put it this way:

*“The pupils with hearing impairments are best handled by specialist teachers who have been trained to handle them and who know the strategies to use and the type of teaching and learning materials to use”.*

Their argument has been that effective teaching goes with the use of different strategies and use of proper teaching and learning materials. Although some teachers had their initial training from pre-service colleges, they felt that they were not capable of handling pupils with hearing impairments. The findings agree with those of Napier (1974) who discovered that a competent teacher is one who uses a variety of teaching approaches to bring about success in learning mathematical skills.

The study revealed that hearing impaired pupils were interested in learning mathematical skills despite having problems. 100% of the hearing impaired pupils said that they were interested in learning mathematical skills. The findings also revealed that 42.5% of the

respondents claimed that sign language was among the factors which inhibited the teaching of mathematical skills to pupils with hearing impairments. 32.5% were found to be lacking in teaching methods to make hearing impaired pupils understand mathematical skills. The findings are consistent with those of Haynes (1999) who states that the concept – learning should be taught in such a way that hearing impaired pupils develop the ability to think mathematically.

The focused group discussions revealed that, to reduce the difficulties that pupils with hearing impairments face in learning mathematical skills, the teacher should show interest in pupils' academic and social problems and teaching should be on one-to-one individual basis. Some of the sentiments expressed by some pupils are listed below:

*“Teacher should give one example on the chalk board, then let pupils be involved in doing other examples”.*

This finding is in line with that of Orton (1993) who states that mathematics is all about problem-solving. He further indicates that one of the best ways to help hearing impaired pupils learn mathematical skills is to present them with a problem in which they have devised their own strategies to find a solution.

The findings on duration of training of teachers showed that 70% of teachers were trained to teach pupils with hearing impairments and 80% were not trained to handle special needs classes. One respondent explained:

*“The one year course I have undergone has not helped me teach effectively but rather learn some of the things I did not learn while I was at college”.*

The respondents claimed that they had not undergone adequate training besides being trained for one year. The one year training was not enough and they were not very conversant on how to handle hearing impaired pupils. The findings agree with those by Kalabula (2000) whose findings showed that teachers in the mainstream were ill prepared for the success of children with disabilities. Teachers lacked skills, methods and strategies to meet the diverse needs of all pupils in ordinary schools and that some teachers use traditional methods and are not ready to meet the needs of the diversity of learners because they have been trained in homogenizing approach. This may be the more reason why the ordinary school teachers are reluctant to teach pupils with disabilities.

50% of the teachers used the knowledge they received from initial training. The study revealed that most respondents lacked competences in teaching pupils with hearing impairments. The teachers had no knowledge and methods of handling pupils with special educational needs, hearing impaired pupils in particular. 32.5% of the teachers had no competence in teaching mathematical skills to hearing impaired pupils. Instead, they used teachers' handbooks. One respondent pointed out that:

*“Although we are trained as primary school teachers, we need to undergo training in special education. This would enable us teach effectively”.*

17.5% of the respondents claimed that they used their own experience gained after teaching for so many years. The findings are in line with those of Chantamani (1992) who pointed out that pupils with special educational needs need to be handled by a teacher who has a clear concept of special education. Chantamani (ibid) further states that teachers like those of the

hearing impaired pupils have special roles in schools, besides some additional qualities. They must have the primary aim of teaching and guidance. The teachers of pupils with hearing impairments or disabilities do not only give guidance to pupils with disabilities but also give guidance to their parents, siblings and the community. One respondent said:

*“Hearing impaired pupils are short tempered, so they should be handled by specialist teachers who understand them better”.*

It was discovered from the study that inadequately trained teachers was among the factors which inhibited pupils with hearing impairments from learning mathematical skills.

One respondent said:

*“Teacher we learn better when we are taught by teachers who can handle us properly”.*

This finding is consistent with that of Cornelius (1982) who pointed out that the key to good successful learning of mathematical skills is the teacher.

#### **5.4 Educational Resources and their suitability in learning mathematical skills**

Engagement in mathematical skills such as developing logic and reasoning and communicating mathematical ideas depends upon hearing impaired pupils using a lot of learning resources. The development of mathematical logic and reasoning in young hearing impaired pupils generally begins with manipulation of objects, numbers and ideas within a range of meaningful contexts.

The findings in this study revealed that 35% of the teachers used teaching resources such as number charts, number-line charts, counting sticks, numeral cards and flash cards. 65% did not use teaching resources when teaching mathematical skills to hearing impaired pupils. For hearing impaired pupils to grasp the concept of mathematical skills, they should move with the teachers using a lot of learning and teaching resources. The teachers are believed to be paramount for hearing impaired pupils to experience mathematical skills in a concrete and meaningful way in order to develop an understanding of mathematical concepts / processes. If the teachers lack the desire to make teaching and learning resources, they deny pupils the chance to develop self-confidence and positive attitudes towards the learning of mathematical skills.

Bobis (2004) writes that hearing impaired pupils who have been exposed to learning and teaching resources have been provided with pleasure and enjoyment and this boosts levels of performance in the hearing impaired pupils. Poor mathematical skills for the learners have been due to non-availability of learning and teaching resources. The teacher cannot impart knowledge in pupils with hearing impairments without teaching and learning resources. Hearing impaired pupils will learn mathematical skills when the teacher is resourceful and comes up with a lot of teaching and learning resources. These findings are supported by Cruckshank (1967) who revealed that a resourceful teacher should come up with real life natural objects familiar to the hearing impaired pupils to accelerate learning and for learning to be meaningful. This study revealed that 52.5% of the teachers reported that teachers should be resourceful for learning to be meaningful.

Teachers who teach pupils with hearing impairments should make teaching and learning resources by using local materials, even if there are no manufactured resources. Although teachers find it difficult to make teaching and learning resources, they still have to do it because ears of pupils with hearing impairments are in their eyes, and they learn better by manipulating concrete objects. Once they see and manipulate, the teaching and learning resources, they would be able to learn and grasp the concept of mathematical skills. Findings in this study show that pupils with hearing impairments would only learn when they are involved. This means that the teacher should have a lot of teaching and learning resources with different varieties of teaching methods. This also means that pupils with hearing impairments will experience fewer difficulties in grasping the concept of mathematical skills.

Respondents in the study claimed that they did not have appropriate resources to effectively help them learn mathematical skills. Although they had qualified teachers, skills become difficult to understand without teaching and learning resources. One respondent said:

*“Teachers do not use teaching and learning resources to help us understand the concept of mathematical skills”.*

The findings agree with those of Shea and Bauer (1994) and Kalabula (2000) who found that the schools do not have appropriate teaching and learning resources. Most of the schools fail to provide the needed resources for the ordinary pupils for effective teaching to be carried out and it would be very difficult to provide the resources to pupils with disabilities, as the

needed resources are more expensive than those of the able-bodied. One respondent had this to say:

*“I learn better when I see and manipulate real concrete objects.*

*The real concrete objects help me to develop the sense of addition and subtraction”.*

The focused group discussion revealed that most pupils could not grasp the concept of mathematical skills because teachers used teacher-centered methods of teaching. One respondent pointed out:

*“Teacher, I learn better when I am involved and count with real concrete objects like stones and sticks”.*

This study revealed that the teachers believed that some teachers did not make efficient or frequent use of the mathematically – rich resources available to them in their classrooms. One teacher noted that too often resources were ignored because of the time involved in using them and energy needed. The findings agree with those of Haynes (2000) that the use of mathematical resources is an area that needs further input in terms of the training of teachers of the hearing impaired. Professional development should include strategies for teachers to focus on resources suitable for hearing impaired pupils in particular, and the best ways of using resources to generate mathematical thinking.

Pagliari & Roudybush (1998:373) write that research results reveal that there is an ‘insufficient level of mathematics preparation among hearing impaired education teachers’. They found that few teachers of the hearing impaired hold qualifications with a focus in a

mathematics – related field and only a moderate number has sought professional development in that discipline. They believe that it is imperative that

*“Researchers should investigate mathematics instructions and learning within hearing impaired education with more frequency and depth so as to provide a better education to hearing impaired pupils(p.27)”.*

To enhance even further the pupils’ mathematical learning through appropriate use of resources, both teachers believed that the onus was on teachers to take every opportunity to use mathematical vocabulary alongside appropriate resources to consciously provide richer opportunities for mathematical learning.

The results of this study from lesson observations showed that for teachers to teach effectively, they should make more teaching and learning resources to help pupils develop the ability to think mathematically. The findings of the study also revealed that teachers should use different types of teaching methods for hearing impaired pupils to build on existing knowledge.

The findings of the study for inadequate qualified teachers were that some teachers were seconded to teach pupils with hearing impairments. However, the teachers were not competent enough to meet learning needs of hearing impaired pupils. The findings are consistent with those of Mannigel (1992) who indicates that, to become better teachers for hearing impaired pupils, teachers should be well qualified. Mannigel (ibid) further states that to become better teachers of mathematics, it is crucial that teachers continue to broaden their knowledge of how pupils come to understand mathematical concepts. 90% of the pupils in

the study said that the problems the hearing impaired pupils faced in learning mathematical skills would be overcome only if trained teachers with good skills to meet their learning needs would teach them. Some of the sentiments expressed by some pupils are listed below:

*“When teaching, teachers call us to the chalk board without explaining how to go about the concept of mathematical skills being taught”.*

Another respondent said:

*“Teacher, some topics need us to be involved with real concrete objects, then we would be able to come up with good work”.*

Horton (1988) postulates that quality education depends more on qualified teachers and availability of materials made from local materials. One area which needs a lot of attention is the provision of educational resources to the hearing impaired pupils. Chintamani (1992) points out that special teaching facilities are required to meet the needs of exceptional children. Brennan (1985) states that children with special educational needs show greater variation in learning and to meet their needs the teacher must have a greater variety of teaching and learning resources. If the teacher is not supported in the provision of teaching and learning resources, he/she may resent the pupils with disabilities. This is the view taken by Shea and Bauer (1994) who claim that general education teachers may not be ready to meet the needs of learners with disabilities without some support.

## **SUMMARY OF FINDINGS**

The challenges hearing impaired pupils encounter when learning mathematical skills are many and far-reaching, and several issues have been identified which act as inhibiting

factors to the hearing impaired pupils' mathematical learning. Hearing impaired pupils find it difficult to develop mathematical learning because they generally have insufficient sign language skills upon which to base mathematical language. Without sign language skills, hearing impaired pupils become isolated in the learning environment and are unable to participate mathematical discussions.

The study has revealed that 32.5% of the teachers used teachers' handbooks and 17.5% used their teaching experiences. Both teachers had problems in teaching. The study also revealed that most of the teachers faced problems with sign language. The study has shown that irrespective of being seconded to teach pupils with hearing impairments, both teachers and pupils had the same view that seconded teachers who teach hearing impaired pupils should undergo a two-year training course, for them to provide effective teaching to the pupils with hearing impairments. The findings also show that 65% of the teachers did not use teaching resources. The teachers preferred to teach without teaching and learning resources. They claimed that hearing impaired pupils were difficult to handle and needed to be handled by specially trained teachers. This study indicated that hearing impaired pupils will learn mathematical skills when the teacher is resourceful and comes up with a lot of teaching and learning resources. The study further revealed that teaching and learning resources should go with different varieties of teaching methods. This means that pupils with hearing impairments would experience fewer difficulties in grasping the concept of mathematical skills.

## **CHAPTER SIX**

### **CONCLUSION AND RECOMMENDATIONS**

#### **6.1 CONCLUSION OF THE STUDY AND ITS KEY FINDINGS**

The study showed that teachers not trained in special education have problems in teaching mathematical skills to pupils with hearing impairments. The hearing impaired pupils also had problems in obtaining knowledge from teachers who were not conversant with sign language, teachers who had no instructional materials, teachers who had inappropriate teaching skills and inadequate lesson preparations.

The study revealed that when teachers are conversant with sign language, they have no interest in making learning and teaching aids. Similarly, instructional strategies were limited. The study revealed that lack of sign language books in schools makes the teaching of mathematical skills very difficult. Since the content is not written in sign language, teachers translate spoken and written English into sign language. Translating written English into sign language makes lesson preparation more difficult.

In the study, pupils felt that it was difficult to master mathematical concepts without the use of sign language, otherwise, all learning would be abstract.

The syllabus hearing impaired pupils and the hearing pupils are exposed to is the same, so it is up to the teacher to see to it that the content is translated into sign language. Although the teachers taught, the lessons were abstract and teacher-

centred. The teacher is the key contributor to pupils' learning of mathematical skills. Lesson plans help in making meaningful links with previous lessons.

The study has also revealed that teachers had negative attitudes towards the making of teaching and learning aids, hence they did not encourage hearing impaired pupils to learn mathematical skills. The study has further revealed that teachers failed to come up with objectives that would correlate with topics, as a result of this, teachers spent more time talking to themselves than involving pupils in the lessons. The objectives of mathematical skills should be in conformity with the topics and be able to provide hearing impaired pupils with knowledge and skills. The teacher should always make hearing impaired pupils see the significance, usefulness and appreciation of learning mathematical skills. As teachers of the hearing impaired pupils, it is proper that they employ different strategies that would assist at least all the hearing impaired pupils.

Lack of teaching strategies and learning resources makes teaching mathematical skills complicated. The findings from lesson observations showed that hearing impaired pupils take long to grasp the concepts of mathematical skills. Teachers were required to move with hearing impaired pupils slowly with examples and with concrete objects repeatedly for pupils to understand.

The use of teaching and learning resources and different strategies would establish understanding and inter-connections with the rest of hearing impaired knowledge

which would motivate and stimulate pupils' learning, are likely to improve the factors inhibiting the learning of mathematical skills. Hearing impaired pupils need to be involved in mathematical skills activities. In this way, hearing impaired pupils would enjoy and appreciate mathematical skills and see it as a tool for use in their everyday lives and in other subjects.

When mathematical skills are taught by well informed and appropriately qualified teachers, all the current problems will disappear. The study revealed that hearing impaired pupils would need qualified teachers who will interpret the contents of a syllabus and make them learn. So, Special Education Teacher training should go up to three (3) years so that they would know how to handle contents of a syllabus competently.

## **6.2 RECOMMENDATIONS**

The following recommendations are proposed in view of the issues that the study has revealed:

### **6.2.1 Pupils**

6.2.1.1 Pupils should be taught sign language at grade one basic school level

6.2.1.2 Pupils should be provided with learning aids for them to grasp the concept of mathematical skills.

### **6.2.2 Teachers**

6.2.2.1 Teachers should provide teaching and learning aids to pupils with hearing impairments. This will help teachers improve on poor background in learning mathematical skills

- 6.2.2.2 Teachers should be provided with sign language books to enhance the learning process
- 6.2.2.3 The duration of training for teachers must be increased from twelve (12) months to thirty six (36) months.
- 6.2.2.4 Teachers should use a one-to-one type of teaching strategy. This would help the teacher to look at individual needs of pupils.
- 6.2.2.5 Teacher to use different teaching strategies in teaching pupils with hearing impairments.
- 6.2.2.6 Teachers conversant with sign language should be allowed to teach pupils at lower basic schools.
- 6.2.2.7 Teachers need to give more remedial teaching. This would help pupils with hearing impairments who are slow learners
- 6.2.2.8 Seconded teachers should not be allowed to teach pupils with hearing impairments

### **6.2.3 Ministry of Education**

- 6.2.3.1 More teachers should be trained and sent to schools with hearing impairments
- 6.2.3.2 More teaching and learning materials should be provided to all pupils regardless of personal circumstances or abilities.

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## APPENDIX A

### QUESTIONNAIRE FOR TEACHERS OF THE HEARING IMPAIRED PUPILS

Dear Respondent,

I am a student carrying out a study on factors inhibiting the learning of mathematical skills among pupils with hearing impairments for a Master's Degree in Special Education at the University of Zambia.

You have been selected to participate in the study. The information you would provide will be used for academic purposes only and will be treated with strictest confidence.

Tick the appropriate answer or write in the space provided.

1. Are you trained to teach hearing impaired pupils?

Yes / No

2. If the answer to question 1 is YES, how long did the course take?

(a) 1 year      (b) 2 years      (c) 3 – 4 years

3. Name the Institution where you went for training.

(a) ZAMISE      (b) UNZA      (c) TVTC

4. If the answer is NO, how are you able to teach mathematical skills to pupils with hearing impairments despite being untrained?

(a) Using experience      (b) Using teachers' handbook

(c) Using my knowledge from initial training

5. What factors inhibit the teaching of mathematical skills among pupils with hearing impairments?

- (a) Language      (b) Teaching methods      (c) Time limitations

6. What mode of communication do you use to teach hearing impaired pupils grasp concepts in mathematics?

- (a) Sign language    (b) Oral language    (c) Total communication

7. If the answer to question 6 is sign language, are you able to use sign language in teaching mathematical skills to pupils with hearing impairments?

Yes / No

8. If the answer to question 7 is NO, give reasons

.....  
.....  
.....  
.....

9. Do you have enough resources for teaching mathematical skills to hearing impaired pupils?

Yes / No

10. If the answer to question 9 is YES, what type of teaching resources do you use?

.....  
.....

.....  
.....

11. What teaching strategies do you think should be used to teach mathematical skills to pupils with hearing impairments?

- (a) One-to-one      (b) Pair teaching      (c) Whole class teaching

12. What type of assessment do you give to pupils with hearing impairments?

- (a) Test      (b) Class exercise      (c) Cognitive thinking

13. Mention any problems you encounter as you teach mathematical skills to pupils with hearing impairments.

- (a) Language      (b) Teaching resources      (c) Lack of hearing aids

14. What measures have you put in place to help pupils with hearing impairments to learn mathematical skill?

- (a) Resourcefulness      (b) Use of different strategies      (c) Remedial teaching

15. Make suggestions for the improvement of learning mathematical skills by pupils with hearing impairments

.....  
.....  
.....  
.....

## **APPENDIX B**

### **OBSERVATION SCHEDULE**

1. Look at the lesson plan and check for the following
  - (a) Lesson preparation
  - (b) The Instructional strategies
  - (c) Pupils' participation
2. Observe the mode of communication the teacher uses
3. Check the availability of teaching resources
  - (a) What teaching resources is the teacher going to use?
  - (b) Do hearing impaired pupils have learning resources?
  - (c) What impact do they have on hearing impaired pupils to learn mathematical skills?
4. In the absence of teaching resources, the researcher will find out
  - (a) What instructional strategies the teacher is using
  - (b) Whether the instructional strategies are helping pupils with hearing impairments learn mathematical skills.

## **APPENDIX C**

### **FOCUS GROUP DISCUSSION GUIDE FOR PUPILS WITH HEARING IMPAIRMENTS**

1. Are you interested in learning mathematical skills?
2. What type of mathematical skills do you learn?
3. What mode of communication do you use to learn mathematical skills?
4. What are some of the instructional strategies does the teacher use to help you learn mathematical skills?
5. How are teachers helping you to grasp the concept of mathematical skills?
6. Do you have enough resources to help you learn mathematical skills?
7. How suitable are the educational resources in learning mathematical skills?
8. What problems inhibit you from learning mathematical skills?
9. How do you overcome the problems you face in learning mathematical skills?
10. What do you think should be done to help you lessen the difficulties that you face in learning mathematical skills?