# THE ACADEMIC PERFORMANCE OF STUDENTS WITH VISUAL IMPAIRMENT IN MATHEMATICS AT M.S AND M.C COLLEGES OF EDUCATION

**BY**

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**DECLARATION**

I, Barbara Chisulo declare that the works contained in this thesis are my own except where acknowledgements through citations and references have been made. I therefore declare that this work has not been previously submitted for the award of any degree at Kwame Nkrumah University or any other university.

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**CERTIFICATE OF APPROVAL**

This dissertation by Barbara Chisulo is approved as fulfilling part of the award of the degree of Masters of Arts in Special Education by Kwame Nkrumah University.

**Examiners' signatures**

Signed: ……..... Date: ……

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## DEDICATION

I dedicate my dissertation work to my family and many friends whose words of encouragement and push helped me complete my thesis from the initial stage to the final stage. Secondly, this work is dedicated to the memory of my late mother, Margret Chisulo. I wish to thank you for the positive words of encouragement and advice of hard work.

To my beloved children, Manasseh, Chanda, Chileshe and Ignatius, I thank you for your encouragement and support in the duration of my study. Special thanks to you my husband, Titus for always pushing and supporting me throughout my course of studying.

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**ABSTRACT**

This study is focused on the academic performance of the students with visual impairment in mathematics at colleges of education. The main objectives of the study were, to establish the academic performance of students with visual impairment in Mathematics at colleges of Education, to investigate instructional approaches used to teach Mathematics to students with visual impairment and to establish the best practices for students with visual impairments in terms of their academic performance in Mathematics. The study was conducted at M.Cand M.S colleges of education because the institutions had students with visual -impairment.

This study used a case study research design and data was collected using qualitative methods. Thus the instruments for data collection included the focused group discussion for lecturers, structured interview schedule for students with visual impairment and observation checklist for both students and the lecturers.

The study discovered that students with visual impairment performed poorly in mathematics in class activities despite attending lessons and this was due to lack of sight and that the students were neglected and ignored. The study also revealed that the instructional approaches used during mathematics lessons relied heavily on expository, demonstration, question and answer as well as group discussion method which indirectly demanded the use of the sense of sight. It was discovered from the study that lecturers had no skill to handle the visually impaired students efficiently and this affected the academic performance of the students with visual impairment. This study also unveiled that the instructional materials used during mathematics lessons in colleges of education were not adaptive and Braille was not used as the medium of instruction and the use of prerecorded lessons was totally absent in mathematics lessons. This study also discovered that the lecturers' attitude towards the visually impaired students in learning mathematics was not good and the students' rights were infringed on by the lecturers. With regards the best practices in handling mathematics to these students, the unveiled lecturers needed to develop love for the visually impaired students and help them to develop self-esteem as they learn mathematics lessons. The study recommended that Lecturers should use adaptive instructional teaching and learning materials which involved the sense of touch. Braille should be used as a medium of instruction and the instructional approaches should be modified according to the individual needs of the visually impaired students.

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## ACRONYMS AND ABBREVIATIONS

V I- Visual impairment

S E N- Special Education Needs

**KEY TERMS**

- Challenges
- Learners with visual impairment
- Academic performance
- College of education

# CHAPTER ONE

# INTRODUCTION

## 1.1 Overview

Zambia puts an emphasis on instruction in Mathematics. Students who are visually impaired should not be left out of this national effort. It has been established that children who are visually impaired should learn Mathematical skills at the same level as their sighted peers (Tindell, 2006). However, the acquisition of mathematical skills can be more difficult for students with visual impairment due to the abstract nature of many essential concepts and the highly visual presentation of the subject. This research, therefore, tries to investigate the academic performance of student with visual impairment in Mathematics at M.S and M.CColleges of Education in Luapula and Central Provinces of Zambia.

## 1.2 Background

Students with visual impairment at college level who have been taking Mathematics have not been performing well. This is supported by Lynn (2012) who stated that students who took Mathematics at college level did not perform well because the pass rate indicated that only four percent passed the subject and ninety-six percent did not pass.

There has been a lot of support towards learners with visual impairment at international level. For example, the American Foundation for the Blind (2018) has supported learners with visual loss by removing barriers and creating possibilities so that leaners with visual loss can achieve their full potential. However, the study by the American Foundation for the Blind did not focus their attention on investigating the academic performance of visually impaired students in Mathematics.

In Africa learners with visual impairment are also supported in a number of ways. For instance, the South African National Council for the Blind (2018) supports students with visual impairment by training them at colleges. Nevertheless, the South African National Council for the blind in their study did not highlight the issue of failing Mathematics in colleges by students with visual impairment.

In Zambia learners with visual impairment receive various kind of support. For example, McCall (2015) states that the Zambian inclusive education programs aim at improving quality education for the blind and low vision students. The study by McCall highlighted the support of quality education towards learners with visual impairment but did not talk about the failing of Mathematics by students with visual impairment in the college.

## 1.3 **Statement of the Problem**

There has been support of various ways from the international level. Despite the support being given to learners the issue of failing Mathematics by students with visual impairment has not been investigated. This study investigated the academic performance of the visually impaired students in two colleges of education namely: M.S and M.CColleges of Education.

## 1.4 **Purpose of the Study**

The purpose of this study is to review the academic performance of students with visual impairment in Mathematics at M.S and M.Ccolleges of Education.

## 1.5 **Objectives of the Study**

The study was guided by the following objectives:

i. To establish the academic performance of students with visual impairment in Mathematics at colleges of Education.
ii. To investigate instructional approaches used to teach Mathematics to students with visual impairments.
iii. To establish best practices for students with visual impairment in terms of their academic performance in Mathematics.

## 1.6 **Research Questions**

i. How do the students with visual impairment perform in mathematics?
ii. What instructional approaches do teachers use when teaching Mathematics to students with visual impairment?

iii. What are the best practices for students with visual impairment in terms of their academic performance in mathematics?

## 1.7 **Significance of the Study**

It was hoped that the findings would review the performance of students with visual impairments in Mathematics at college level. It was also hoped that the findings of this study might be added to the board of knowledge on academic performance for visually impaired students at college level.

## 1.8 **Delimitations of the Study**

The study population was comprised of learners with visual impairment lecturers teaching Mathematics to students with visual impairments and lecturers with special education background. The delimitation was that only the students with visual impairments studying at the college and the lecturer teaching the visually impaired students and lecturers with special education background would be involved.

The scope of the study was limited because the study did not involve all the students and all the lecturers lecturing at the college.

## 1.9 **Limitations of the Study**

These study findings could not be generalarised due to the limited number of sample.

## 1.10 **Theoretical Frame Work**

The research was guided by Path-smoothing model designed by Alan (2008). The model stressed the essential methodology of making a smooth path for the learner to learn Mathematics. In this model the teacher stated the kind of problem of a learner in a classroom. In addition to this, when teaching, the teacher attempted to classify the subject matter being taught into a limited number of categories and to present them one at a time. In this model there was an implicit assumption that, from the exposition, pupils recognized and identified with their nature of the problem being posed with. The key principle of this model was to establish secure pathways for the students with visual impairment thus it was important to present ways of solving problems in a series of

steps which was as short as possible, and often only one approach was considered seriously. The model also stressed that pupils work on exercises to practice the methods given aimed at involving learners more actively. This approach was classified by the teacher and was graded for difficulty. The model stated that longer term failure was dealt with by returning to the same or similar subject matter throughout the course.

The model had the following components namely: learners with visual impairment, instructional materials, instructional approaches in teaching Mathematics, academic performance of learners with visual impairment and the lecturer's attitude.

### 1.11 **Instructional Materials**

According to the model by Alan (2008) the instructional materials to be used in a classroom where there are learners with visual impairment should be adaptive in nature. If learners with visual impairment are to perform well in Mathematics, there is need for the lecturer to highlight the most effective methods for delivering mathematics instruction to students with visual impairment. The key accommodations that are absolutely essential are access to embossed textbooks and instructional materials as well as in the appropriate media such as recorded media.

The appropriate instructional materials require a combination of the abacus, braille codes, tactile materials, and concrete materials to teach mathematics skills to students with visual impairment. The use of the braille Nemeth code and abacus has long been established as a beneficial practice to teach mathematical concepts to students with visual impairment. The braille Nemeth code gives students who are blind the opportunity to read and write braille mathematical computations, helping to build a thorough understanding of concepts presented. The abacus is a useful calculation tool whether used alone or in conjunction with other devices because of its speed, accuracy, portability, and flexibility. Students with visual impairment may take longer to learn mathematical concepts, it is essential for lecturers of students with visual impairment to learn how to utilize a variety of tools to complete computations in order to help these students.

### 1.12 **Instructional Approaches in Teaching Mathematics**

According to Alan (2008) the model acknowledges that students are led through a method for tackling the problems. This is where instructional approaches serve as a concrete frame in terms

of learning opportunities, classroom interaction and academic performance. The approaches have the main impact on pupils learning and performance. In this case the learners with visual impairment will learn mathematics better if learning approaches or strategies are used to involve other senses other than sight. This means that the approaches to be used must include touch, hearing, taste and smell. For example, a learner can use the sense of hearing to get the instructions from the teacher or lecturer. The learner can also use the sense of touch to feel the embossed or raised numbers. It is not okay for the lecturer to rely on exposition method which mainly benefits learners with sight but he or she need to include the issues of touch. For instance, the learner can use the sense of hearing by getting the learning instructions. He or she can use the sense of touch on embossed aids to explore the numbers to be used during the learning process.

Alan (2008) further states that the approaches to be used in teaching mathematics to learners with visual impairment should engage with children's thinking, give them sufficient time for dialogue and discussion and space to think about their ideas. For example, children with visual impairment should be given ample time to explore the task given and as they explore it they will be able to think critically and find solutions to the task given. The approaches should provide mathematical representations of the real world, focus on underlying concepts and processes with prompting and probing questions. The approaches should demonstrate and promote the correct use of mathematical vocabulary and the interpretation and use of symbols, images, diagrams and models as tools to support thinking, problem solving, reasoning and communication within and outside the classroom.

### 1.13 **Academic Performance of Students with Visual Impairment**

According to the model by Alan (2008) confirms that like all students receiving special education services, the academic performance of students who are visually impaired in the general education classroom is monitored annually and the performance is very good as compared to learners with other impairment. This can only be done if the individual needs of the learners in a classroom are taken care of. Learners with visual impairment can perform extremely well if the instructional materials, teaching approaches are modified or adapted to meet the needs of the individual learner. For example, if the student's educational needs can be met using touch, he or she can perform well if raised or embossed prints are used as a medium of

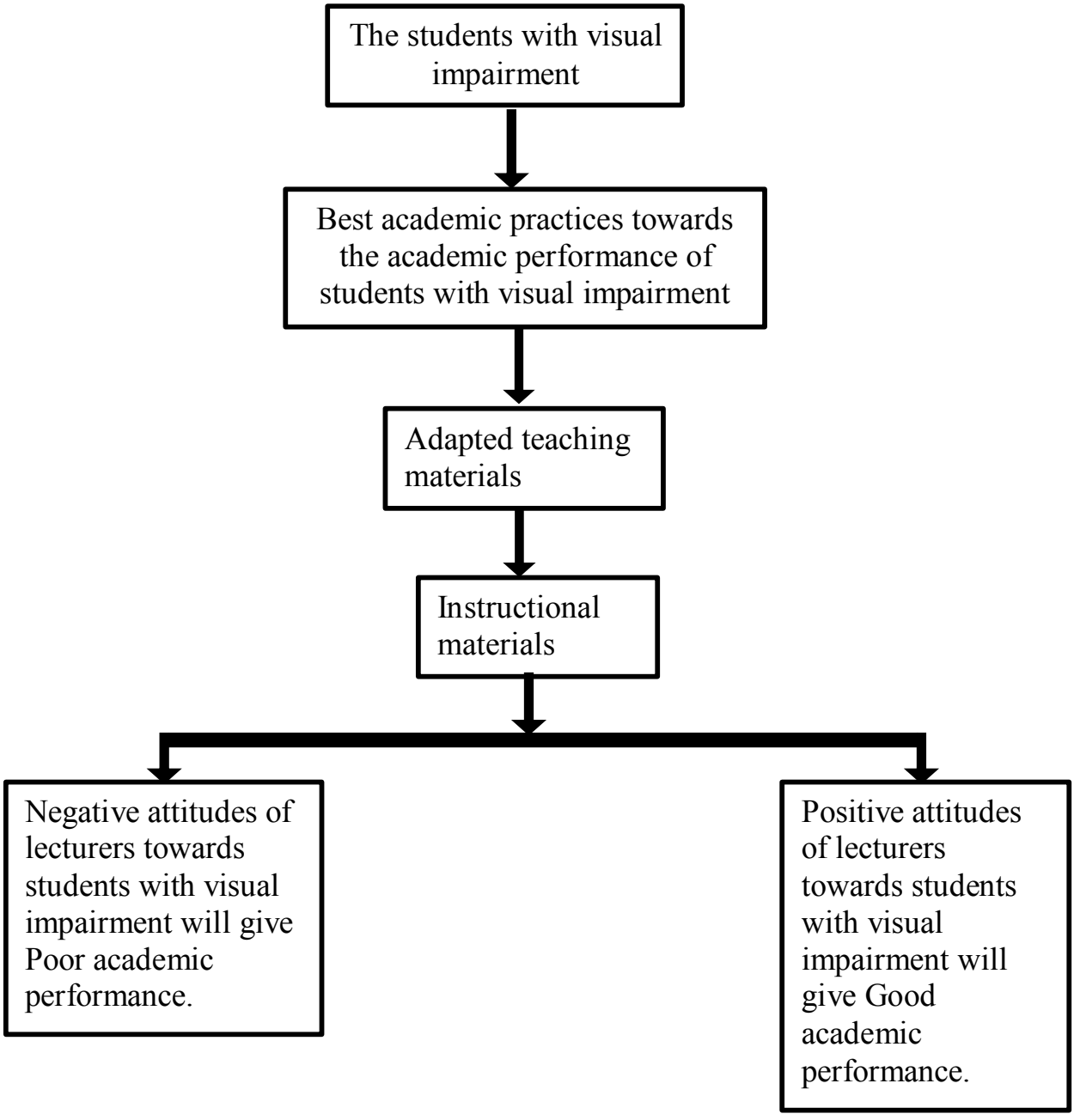
instruction. The teacher or lecturer has an important role to play in order to improve the academic performance of learners with visual impairment. If teachers can remove all the negative prejudices about the learner as required by education for all principle, then learners with visual impairment are likely to excel in their academic circles. However, if the teacher feels that such a learner cannot learn well with his or her condition, then the academic performance for such a learner will be below the expected standards.

### 1.14 **The Lecturer's Attitudes.**

According to the model by Alan (2008) teachers question pupils, but usually in order to lead them in a particular direction and to check that they are following. It is believed that the teacher plays a vital role in academic performance of the learners with visual impairment and even those without impairment. However, if teachers have negative attitudes towards learners with visual impairment and consider them as people who cannot perform well in mathematics it affects their performance. For instance, if students with visual impairment receive little or no attention in classrooms as compared to their sighted counterparts who are actively involved in learning, they may encounter reduced academic performance in mathematics. If for example teachers rate learners with visual impairment low in cooperation, academic competences and having greater problems of behavior than their sighted counterparts, these attitudes deprive the learners' right to education and hinder the self-esteem of the students with visual impairment. In this regard, it is believed that these attitudes may negatively affect the academic performance of learners with visual impairment.

This path smoothing model suits well with the current research that was carried out which was focused in the academic performance of students with visual impairment in mathematics at two selected colleges of education because it helped the researcher in identifying and understanding the academic performance of students with visual impairment at college level. This is because the path smoothing model focuses on instructional materials, instructional approaches in teaching mathematics, academic performance of learners and the lecturers' attitudes which acted as a frame work for this study.

**Diagrammatical representation of a conceptual frame work**




This conceptual framework is on the academic performance of students with visual impairment in mathematics at two selected Colleges of education in Zambia. The arrows show a reflective path that the researcher adopted throughout the research process. The framework begins by looking at the visually impaired students, followed by the best practices in handling students with visual impairment thereafter, instructional approaches, adapted teaching materials and

lecturer's attitude towards students with visual impairment. Then ends with academic performance of students with visual impairment.

### 1.15 **Visually Impaired Students**

Students, who are blind or visually impaired, require adaptations to the environment, materials and instruction in order to have the access to the curriculum. Visual impairment, also known as vision impairment or vision loss is a decreased ability to see to a degree that causes problems not flexible by usual means, such as glasses some also include those who have decreased ability to see because they do not have access to glasses or contact lenses. Visual impairment is a term that experts use to describe any kind of vision loss kid's health (2018). Students with visual impairment require to be handled in a best way.

### 1.16 **The Best Practice in Handling Students with Visual Impairment.**

The best practice in handling students with visual impairment include standards for high quality instructions as was on going professional development to remain current on best practice. Lecturers of students with visual impairment should follow profession standards to address issues Carme (2018). The issues that lecturers should address are such as those falling under mathematics as a course.

## 1.17 **Mathematics as a Course**

Mathematics is the science of structure, order and relation that has evolved from elemental practices of counting, measuring and describing the shapes of objects. It deals with logical reason and quantitative calculation, and its development has involved an increasing degree of idealization and abstraction of its subject matter (Jeremy et al, 2018). Mathematics provides a single integrated, continually expanding system that covers the breadth and depth of technical computing. The standards in mathematics requires the lecturer to use appropriate instructional approaches, adapted teaching materials and should have positive attitude towards students with visual impairment for them to perform well academically.

## 1.18 **Adapted Instructional Materials**

Material adaptation refers to the application of some strategies to make the text book more effective and flexible. It can also mean an education technology that is used in adaptive learning, for example, the use of computer algorithms, braille, stylus and other adapted materials. Students with visual impairment will typically need adaptations to access printed information that will allow the students to access all areas of the curriculum. It is the role of lecturers of students with visual impairment to determine the adaptations that the student needs. Lecturers may use the tactile boards to encourage students to open their clenched hands to facilitate their learning to utilize their tactile receptors in their fingertips. Large print books can also be used. Lecturers with students who have low vision can use large prints. Lecturers should use braille code to teach students with visual impairment. Namath code Perkins Braille computers, tape recorders and television sets, Carmen (2018).

## 1.19 **Instructional Approaches**

Instruction approaches are techniques teachers use to help students become independent. These approaches become learning strategies when students independently select the appropriate ones and use them effectively. Proficiency in mathematics is necessary because it is critical to functioning adequately in the context of daily life situations. Lecturers teaching students with visual impairment should focus on using different instruction approaches such as tactile method

and other methods in which other senses are used such as hearing, taste and smell, in order to reduce some challenges, the visually impaired students encounter in mathematics. The approaches should include the correct use of vocabulary and interpretation and use of symbols, images and diagrams as tools to support thinking. The approaches should also include mathematical representations of the real world, for example the use of tactile graphics. These are graphics intended to be read principally by touch rather than vision students may use the sense of touch instead of hearing. The use of both student and teacher centered methods should be applied. Cooperative learning, group work and discovery methods should be used. Lecturers teaching the students with visual impairment should engage their students by providing visual and auditory information. They convey their mood through touch expressions, tone of voice, giving directions and touching or holding their hands, Zebehazy (2014).

### 1.20 **Academic Performance**

Academic performance in this study is the evidence of a student with visual impairment concrete or abstract thinking skills, literacy skills such as reading and writing skills, attention focus, academic success, language development, and proficiency with sequencing. This is supported by Penda, (2012) who stated that, academic performance is noticed in a learner with visual impairment as accuracy or correct manifestation of performance in oral and written work in terms of brailed literacy of reading and writing skills, critical thinking, remembering, understanding, applying, analyzing, evaluation and creativity.

### 1.21 **Lecturers' Attitudes towards Students with Visual Impairment**

Attitude means manner, disposition, feeling, with regard to a person or thing or it can be defined as a settled way of thinking or feeling about something. The teaching of students with visual impairment requires lecturers to have positive attitudes towards them and students with visual impairment should be provided with counselling in the process of solving their problems. Mushome et al (2013).

### 1.22 **Definition of Operational Terms**

The following terms that appear in the study will be used as defined below:

**Adapted Curriculum**- Modification of regular curriculum to fit learners with visual impairment

**Blind**- A person/people with complete visual loss

**Braille** - A system of writing using dots

**Challenge** - Difficult task that tests somebody's ability and skill.

**College of Education** - A college that trains teachers

**Lecturer** - A person who teaches at a college or university

**Leve**l - A particular education standard achieved

**Factor** - Things that cause or influence something

**Partial Sight** - Reduced vision

**Special Education** - The education of learners who have physical or learning challenges

**Special Needs** - Needs that a person has because of a disability.

**Visual Impairment** - Difficulties in sight because of the defects in the eye

**Instructio**n- Detailed information about how something must be done.

**Approach-** a teaching method comprising of principles and methods.

**Material** – The matter from which a thing can be made.

**Adapted-** Changed slightly for a particular purpose of use.

**Curriculum** – The totality of student's experience that occur in the education process.

**Tactile** – Something relating to somebody's sense of touch.

**Functioning** – An activity that is natural to a person for which something is designed from.

**Computation –** The action of mathematical calculation**.**

**Skill –**The ability to use one's knowledge effectively

**Assumption -** Idea that is formed without evidence**.**

**Summary**

Chapter one was an introduction to the study and it covered a brief background and highlighted that the students with visual impairment performed poorly in mathematics at colleges of education. In view of this poor academic performance, the study adopted the Path-smoothing model designed by Alan (2008) which stressed the essential methodology of making a smooth path for the learner to learn Mathematics. The chapter highlighted the background, statement of the problem, purpose of the study, the objectives of the study, the research questions, and the significance of the study, delimitation of the study, limitations of the study and how to address them. The chapter also adopted the Theoretical framework of the path smoothing model which focused on instructional materials, instructional approaches in teaching mathematics, academic performance of learners and the lecturers' attitudes which acted as a frame work for this study.

# CHAPTER TWO

# LITERATURE REVIEW

## 2.1 **Overview**

Chapter two presents the literature of what other scholars have written on the same topic being researched on. The literature will be presented according to the research objectives and these are: To establish the academic performance of students with visual impairment in mathematics at colleges of education, to investigate instructional approaches used to teach mathematics to students with visual impairment and to establish the best practices for students with visual impairment in terms of their academic performance in mathematics.

## 2.2 **Instructional Materials**

Brawand and Nicole (2016) conducted a research on effective methods for delivering mathematics instruction to students with visual impairment in Kutztown Canada .The researchers disclosed that some challenges that students with visual impairment encounter when learning mathematics can be overcome when the content is taught in an appropriate manner, such as by using adaptive materials. The researchers pointed out that the use of adaptive materials such as the abacus, the Nemeth Code for braille mathematics and the tactile graphics, or "graphics intended to be read principally by touch rather than vision. In line with the two researchers, the findings of these researchers might be correct but they failed to take into account other factors such as instructional approaches in teaching mathematics to the learners with visual impairment. However, this study brought in other teaching materials such as embossed text books which this study accounted for.

Adino (2015) conducted a research entitled 'factors influencing students' performance in mathematics in Kenya certificate of secondary education in public secondary schools in Butere sub-county' in Kenya. The researcher disclosed that there were inadequate Brailed Mathematic textbooks in the school as well as raised teaching and learning materials and this had a very big impact on pupils' performance in mathematics. The researcher adds that most of the time, both learners and teachers got brailed materials late and the Braille materials were not enough to cater for all learners and this adversely affected teaching and learning of mathematics thereby yielding poor results. The research revealed that few calculation tools and apparatus were availed to the

learners during their teaching process and this lessened pupils' manipulation of the said tools and apparatus. The findings of this researcher might be correct, however, other materials like the use of abacus to students with visual impairment and other instructional materials were not taken into consideration. Hence this current study put all these factors into consideration.

Akakandelwa and Munsanje (2012) conducted a study in Zambia on provision of learning and teaching materials for pupils with visual impairment in basic and high schools of Zambia: Results from a National Survey. The findings of the previous study demonstrated that most schools in Zambia did not provide adequate and suitable learning and teaching materials to pupils with visual impairment. However the study did not account for the best practices towards the way students with visual impairment could learn mathematics as done by the current study.

Kerri (2017) carried out a study on educating students with visual impairment in the general education setting in Mississippi. The study unveiled that the use of assistive technology devices such as voice recorders and audiotapes can be useful to students with visual impairment more especially if the general education classrooms are not designed with sighted students in mind. The study the revealed that the formats of the educational materials are presented in a variety of visual formats: posters, charts, diagrams, videos, models, demonstrations, and print materials and the students with visual impairments often have difficulty benefiting from these materials. However, the researcher only looked at the effects of using these materials on learning of the students with visual impairment but did not pin point the remedies to such instructional materials as done by the current study.

### 2.3 **Instructional Approaches in Teaching Mathematics**

Malasig and Dake, (2015) conducted a research on review of literature: mathematics instruction for students with visual impairments' in New Jersey in the United States of America. The researchers revealed that students with visual impairment have the potential in mathematics achievement on par with their non-disabled peers if educated appropriately for their needs. The researchers further disclosed that instructional practices or strategies have been key to good academic performance by students with visual impairment in mathematics. The researchers might be right in some way but they did not look at other parameters such as the lecturers'

attitudes towards students with visual impairment and the instructional materials which this research put into consideration.

Gyimah et al (2009) conducted a research on Inclusion of children with special educational needs in mainstream schools in Ghana: influence of teachers' and children's characteristics. The study provides evidence that students with visual impairment learn effectively when the appropriate adaptive instructional strategies are used to provide instruction in the classroom situation. The study further highlighted that these students often must learn through alternate mediums, using his or her other senses and instruction should be designed to promote learning that is best for the student's unique abilities and learning needs. Effective teachers of students with visual impairments employ strategies that support the child's multisensory capabilities (visual, auditory, and tactile) in the classroom environment. In order to meet students' educational needs of students with visual impairment, the previous researcher maintained that specialized services, appropriate instructional books, and materials (including Braille), as well specialized equipment and technology should be integrated in teaching. Nevertheless, the researcher did not put into consideration the impact of teachers' negative attitudes towards these students and how it could hamper learning as done by the current study.

Kiarie (2004) carried out a research on education of students with visual impairments in Kenya. The findings of the study indicated that obstacles also exist in the area of adaptations of instructional approaches for students with visual impairments and some subjects such as biological sciences and mathematics, studied in the secondary schools have had instructional approaches used stressing the use of the sense of sight and this made it extremely hard for students with visual impairments to access the general education curriculum. The previous study only focused on general perspective of the education of the students with visual impairment but failed to talk about the best practices that could make these learners learn mathematics effectively.

Penda et al, (2015) conducted a research on the challenges in teaching learners with visual impairment in Zambia. Based on the findings of this study, using traditional teaching methods impeded the way learners with visual impairment acquired academic skills. For example, expository method yielded forgetfulness and passiveness among learners. The researchers failed

to establish best practices for students with visual impairments in terms of their academic performance in Mathematics. However, this current study intended to bring this out.

### 2.4 **Academic Performance of Students with Visual Impairment**

Megan (2012) carried out a research in Michigan in the United States of America on "students with visual impairments and math: 'impact of practice on achievement and attitude". The researcher reveals that the achievement in mathematics among blind and severely visually impaired persons is, and always has been extraordinarily low" compared to students with sight. There are many reasons why this is so, including the visual nature of math, delayed development of concepts needed to understand math and lack of necessary knowledge among teachers of students with visual impairments. However, students with visual have the capacity to learn mathematics if all the necessary logistics are put in place. The findings of the researcher might be true but the researcher mainly focused on the student's achievements in mathematics leaving out other factors such as lecturer's positive attitudes towards students with visual impairment as well as the use of adaptive instructional materials and how they can aid these learners to perform well in mathematics. This research put all these parameters in place and saw how best learners with visual impairments could improve their academic performance in mathematics in the selected colleges of education.

Mbulaheni (2015) carried out a research in Gauteng and Pioneer in Western Cape in South Africa and the research was based on 'teaching science and mathematics to students with visual impairments: Reflections of a visually impaired technician'. The study tells us that blind and partially sighted learners find it difficult to pursue mathematics because the resources are limited and teachers are not prepared to do their best to resolve the problems they encounter in putting the subject matter across to their learners. It was also revealed that the visually impaired learners themselves have no volition to improve their circumstances, because their total learning environments fail to assist them optimally (Fraser & Maguvhe, 2008:86). Blind and partially sighted learners need to be proactive to improve their performance in mathematics and science.

Akakandelwa and Munsanje (2012) conducted a research on the provision of learning and teaching materials for pupils with visual impairment: Results from a National Survey in Zambia. The researchers discovered that most children with visual impairment appeared to perform poorly in their studies and are required to drop mathematics subjects due to lack of teaching and

learning materials. The researcher here stressed issues of teaching materials and pupils' performance but failed to talk about lecturer's attitudes towards learners with visual impairment which this study intended to bring out.

### 2.5 **The Lecturer's Attitudes towards Learners with Visual Impairment**

Eagly and Chaiken, (1993) defined attitude as 'a psychological tendency that is expressed by evaluating a particular entity with some favour or dis-favour'. Concerning the lecturer's attitudes towards learners with visual impairment, studies have been conducted in Macedonia, South Africa and Zambia.

Athanasius etal, (2009) conducted a research on 'students with visual impairments in higher education institutes in Thessaloniki, Macedonia. The study indicates that students with visual impairments face several structural and attitudinal barriers from teachers when entering higher education and this could result in academic failure or withdrawal from a course or school. The researcher's findings did not explain the other factors that can affect the performance of learners with visual impairment in mathematics but only concentrated on teachers' attitudes towards learners with visual impairment but failed to look at other aspects such as instructional strategies which the current study will bring out**.**

Mushome and Munobe (2015) carried out a study on "the attitude of lecturers towards visually impaired students: A case study of one of the Universities in the Limpopo Province in South Africa". From the research findings, lecturers indicated that it was challenging to teach visually impaired students, because they were never trained on how to teach the visually impaired students and that lecturers were bound by the constitution, which does not allow them to chase the visually impaired students away, because they have the rights to learn and the university registers them. Without this constitutional right, these learners cannot be allowed in the University because it is a big burden to the lecturers especially those without special education skills. The researchers might be right in one but lecturer or teacher attitude alone is not the only factor which can impede the performance of learners with visual impairment. This study included other factors such as instructional materials and instructional strategies and how they can negatively affect performance of learners with visual impairment in mathematics.

Chengeti, (2015) conducted a research in Kalulushi and Kitwe, Zambia and his research was on the perception of students and teachers on learning mathematics by students with visual

impairment in secondary schools. The research reveals that traditionally, the general attitude for the visually impaired people in many societies had negative connotations. In a classroom situation, the researcher disclosed that there is a social stigma on students with visual impairment an attribute which impedes their academic, social and economic welfare. The students with visual impairment and the blind have been made to suffer more by being brought in a regular program where lecturers and teachers feel they are just an utter wastage of time and mostly visually impaired student are treated like abnormal students in these schools and colleges. The researcher might be correct but much attention was based on stigmatization as a major challenge in learning. However, this research included factors like teaching materials, instructional approaches and academic performance of learners with visual impairment which the previous research did not cater for.

Brown, J .E and Wendi, B. (2016) conducted a research on the changing role and practice of teachers of students with visual impairments: practitioners' views from Australia, Queensland. The findings of the study indicated that teachers have an important role of molding the academic performance of the students with visual impairment and if the playing ground is leveled, students with visual impairment will perform extremely well. However, the previous study did not look how best the playing ground can be leveled and what lecturers ought to in order to make the students with visual impairment perform well. Nevertheless, this study pointed out some best practices which the lecturer can use to make the students with visual impairment perform well in mathematics.

## 2.6 **Summary**

It had been observed from the reviewed literature on the academic performance of students with visual impairment in mathematics at selected colleges of education that most studies that have been conducted revealed that students with visual impairment can perform at the same level with their sighted peers when exposed to instructional approaches and instructional materials which are adaptive and when braille is used as a medium of instruction. The literature discovered that these students were subjected to non-adaptive approaches and materials by unskilled lecturers. However the literature from the previous studies did not point the best practices that could enhance academic performance of the visually impaired students as it was done in the current study.

# CHAPTER THREE

# METHODOLOGY

## 3.1 Overview

This chapter discusses the overview, research paradigm, research design, population, sample technique/procedure, data collection instruments/methods, data collection procedure, data analysis, ethical consideration, validity and reliability, chapter outline, time frame (schedule of activities) and budget.

## 3.2 Research Paradigm

According to Flick (2000) the term research paradigm refers to 'an integrated cluster of substantive concepts, variables and attached with corresponding methodological approach and tools. This study used an interpretive paradigm which is considered as constructivist, naturalist and humanistic. The researcher chose to use this paradigm because it is based on the interpretation of human and social reality. Interpretive paradigm is concerned with subjective meanings as it seeks to recognize the individuals. This paradigm was used because it also allowed the researcher to view an in depth understanding of the topic under discussion.

## 3.3 Research Design

Many scholars have defined research design differently. According to Orodho (2003), a research design is a plan that is used to generate answers to research problems and questions. The research design also involves the description of words which will be mainly non-statistical and its naturalistic approaches takes into account decisions, actions, beliefs, values and thoughts of the respondents. In this regard, data was collected, described and some numerical aspects were employed. The researcher used a case study research design. This is because the researcher intended to understand a single situation about the academic performance of learners with visual impairments at colleges of education. The researcher attempted to understand an in depth analysis of the learners with visual impairment in relation to their academic performance.

## 3.4 Population

The term population in research can be defined in different ways. According to Banerjee and Suprakash (2011) a population is a complete set of people with a specialized set of characteristics. Kasonde (2013) also describes a population as a group of individuals from which samples are taken for measurement. In research, the term population refers to the total population of interest to the person carrying out research where data can be generated from. In this regard, the study target population was 18 and it comprised of the Head of Department (HOD - Mathematics), lecturers teaching Mathematics, lecturers with Special Education background and students with visual impairments at M.S and M.CColleges of Education.

## 3.5 Sample

Banerjee and Suprakash (2011) defined a sample as any part of the fully defined population and it is a subset of the population. The study targeted eighteen respondents from two selected colleges of education and this sample included the 2 heads of section in the mathematics department, 4 lecturers with special education background, 2 lecturers of mathematics and 4 learners with visual impairment at each selected college of education. This sample was chosen for the study because it is believed to have the information necessary for the current study.

## 3.6 Sampling Technique/Procedure

According to Majid (2013) sampling is the process of selecting a representative sample of individuals from the population of interest. The researcher used quota sampling technique to select students with visual impairment while purposeful sampling technique was used to select lecturers handling the students with visual impairment. Purposeful sampling technique was used to select lecturers because they were directly working with the students with visual impairment and they were believed to have adequate data required for the study. Quota sampling technique was used to select 10 students with visual impairment as it gave the researcher chances to group students according to grades. The researcher found it easier to use quota sampling because young students might have felt intimidated in the midst of their lecturers. The selected students were grouped according to first, second and third year students.

### 3.7 **Data Collection Instruments**

In order to collect the data which is necessary for the current study, two main instruments namely the interviews and observation checklist were used. In this research, the use of these instruments provided a triangulation of the data collected for the study and this in turn helped the researcher to collect data that was valid and reliable. Moreover, any gap left by one of the research instruments could be supplemented by the other research instruments.

### 3.8 **Observation Check List**

This is a tool which is used by a researcher to have a look at the target population and make observations concerning the topic under the study. Participant observation is the process enabling a researcher to learn about the activities of the people under study in the natural setting through observing and participating in those activities (Kawulich, 2005). Observation checklist was used in both colleges and all mathematics lessons were observed. The lesson observations was aimed at having a true picture of the situation in the classroom and obtained data that could not be obtained through questionnaires.

### 3.9 **Interview Guide**

According to Kvale (2009) the qualitative research interview seeks to describe the meanings of central themes in the life world of the subjects. The main task in interviewing the respondents was to understand the meaning of what the interviewees or participants say about the topic under study and sought to cover both a factual and a meaningful level of the themes under study. The interview guide was used because it was particularly useful for getting the story behind a participant's experiences and the researcher pursued in-depth information around the topic. The interviews were useful to the researcher as a follow-up to certain responses from the focused group discussions. The interview questions were prepared according to the f research objectives.

### 3.10 **Focused Group Discussion**

A focused group discussion guide is an informal tool used to generated qualitative data and collected through a discussion among selected groups of individuals about specific topics relevant to the situation. According to Penda (2015) a focus group discussion guide is an informal discussion among selected individuals about specific topics relevant to the situation.

Focus group discussion is a group of participants who are interviewed together and encouraged to share their opinion on the specific topics which is focusing on the interview (Laue 2006)..

### 3.11 **Data Collection Procedure**

The study took place in two selected colleges of education that host students with visual impairments in two districts of central and Luapula Provinces. Permission was sought from the college principals to carry out the research. The researcher was then introduced to the head of department by the principal and then to lecturers in the mathematics department. Consent forms were signed by all participants before the distribution of the research instruments. The observation technique was included in order to understand the level of preparedness among lecturers to teach, resources at their disposal and teaching methods, as well as student participation and their comprehension of mathematical concepts. The process was an opportunity to examine what was happening in the classroom situation. This enabled the researcher to gather data on the physical, human interactional settings and program of learning.

### 3.12 **Data Analysis**

Data that was obtained in this study was non-statistical but descriptive in nature and descriptive analysis was employed using computer excel. Data collected was coded and edited. According to Sikazwe etal (2003) editing is checking that every question has an answer; all questions are answered accurately and instructions are interpreted adequately. Data to be collected was analyzed according to themes which are in relation to the study questions and objectives. In order to analyze data, charts and tables were used.

### 3.13 **Ethical Considerations**

Resnik (2011) defines ethics as rules for distinguishing between right and wrong. In the first place the researcher started by getting clearance from the Kwame Nkrumah University ethics committee. The researcher then sought permission from the two education board secretaries where these two colleges are located. The researcher later sought permission from the two college principals to allow her carry out the research at the said institutions. All the participants in this study were required to sign consent forms and they were assured of confidentiality and

anonymity. Confidentiality was observed and maintained by not requesting for identities of the respondents and by ensuring that the information they provided has no direct connection to them.

### **3.14** 11 **Measures of Trustworthiness**

According to Guba and Lincoln (2017) trustworthiness refers to the way in which qualitative research workers make sure that transferability, credibility, dependability, and confirmability are evident in the study. The purpose of trustworthiness in qualitative research was to support the argument that the inquiry results are worth paying attention to (Guba and Lincoln, 2017). The measures of trustworthiness in this research were credibility and dependability.

#### 3.11.1 **Credibility**

According Irene and Albine (2018) credibility is the equivalent of internal validity in quantitative research and is concerned with the aspect of truth-value. Credibility established whether the research findings represent plausible information drawn from the participants' original data and is a correct interpretation of the participants' original views. To ensure credibility the researcher used the strategy of triangulation where three instruments were used namely; semi-structured interview, focus group discussion and observation checklist. A gap in one instrument was supplemented by the other.

#### 3.11.2 **Dependability**

Dependability relates to the primary challenge that the way in which a research is carried out needs to be consistent across time, researchers and analysis techniques (Irene and Albine 2018). To ensure dependability the researcher used inquiry audit of the research process from data collection through analysis to interpretation as well as involve participants' evaluation of the findings and recommendations of the study such that all were supported by the data as received from participants of the study. Additionally, dependability ensured through semi-structured interview, focus group discussion and observation checklist.

## 3.15 **Summary**

This chapter looked at the methodology which was used in this study. The study employed and used a case study research paradigm because it allowed the researcher to view the behaviour in a natural setting thereby increasing the researcher's in depth understanding of the topic under discussion. In this research a descriptive research design was employed due to the fact that the design chosen involved the description of words which were non-statistical. The chapter also looked at a population sampled from the two selected colleges of education, sampling techniques and procedure, data collection instruments, data collection procedure, data analysis, ethical considerations as well as reliability and research validity

# CHAPTER FOUR

# PRESENTATION OF THE FINDINGS

## 4.1 **Overview**

This chapter provides the findings of the study according to different categories of themes which were in line with the objectives which were set for this study. The objectives of the study were to: establish the academic performance of students with visual impairment in Mathematics at colleges of Education, to investigate instructional approaches used to teach Mathematics to students with visual impairments and to establish best practices for students with visual impairment in terms of their academic performance in Mathematics. The presentation of the study findings was confined to the questions which appeared in the interview guide, a semi-structured focus group discussion as well as those in the observation checklist. The chapter ends with a summary.

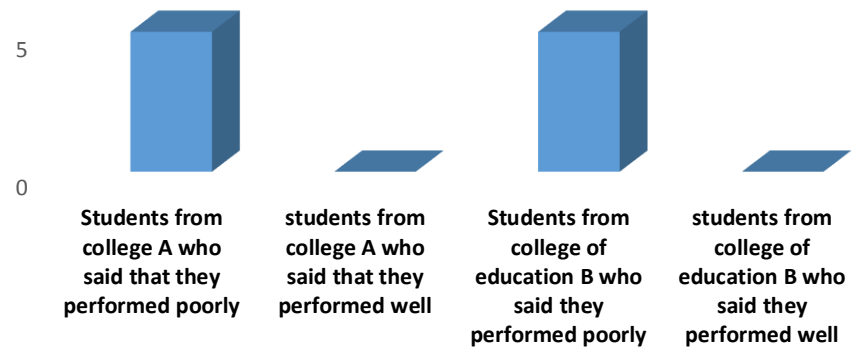
### 4.1.1 **Established Academic Performance of Students with Visual Impairment in Mathematics at College of Educatioon**

In order to establish the academic performance of the students with visual impairment in mathematics at the two colleges of education under study, the researcher used interviews, focused group discussions and observation checklist. Data was obtained from the students with visual impairment, Heads of department (HODs mathematics), Heads of section (HOS mathematics) as well as from the lecturers with special education background handling these students. Data was presented using the subthemes namely, instructional materials and instructional approaches in teaching mathematics, academic performance of learners with visual impairment and the lecturers' attitudes towards students with visual impairment. The findings of the study discovered that the students with visual impairment performed poorly in mathematics education at the two selected colleges of education.

When the researcher asked ten students with visual impairment during an interview about whether they performed well or poorly in mathematics, the findings indicated that all the students with visual impairment gave common responses and agreed that they performed poorly in mathematics during classroom activities as well during public examinations. This was

indicated in their responses. For example, one student with visual impairment from College of education [A] indicated that *'I have not scored above 40% in all the mathematics tests I have written so far.'* Another student from College of education [A] said that *'I don't perform well in mathematics.'* One student from College of education [A] added that *'I perform poorly in mathematics during both class exercises and tests.*' A student from College of education [A] indicated that '*passing mathematics is my dream which I have never achieved to pass ever since I came into this college.'* Another student from College of education [B] narrated that *'I cannot remember the time I passed a test in mathematics from the time I was enrolled into this college.'* A student from College of education [B] stated that *"I pass mathematics tests with marks not exceeding 41%.'* Another student from College of education [B] indicated that *"my results in mathematics are I only pass through markup tests and assignment.'* One student from College of education [B] added that *'I don't think the blind students and those without proper sight can pass mathematics.'* The responses of the students were summarized in the chart below.

**Figure 4.1: Students' Responses to their Academic Performance in Mathematics**




In figure 4.1, all the ten students from both colleges of education [A] and [B] confirmed that they did not perform well in mathematics

During focused group discussions with 2 Heads of department, the 2 Heads of mathematics section as well as 4 lecturers handling students with visual impairment, the question was posed to

lecturers whether the students with visual impairment performed well or poorly in mathematics. Their answers are summarized and shown in figure 4.2

Figure 4.2. Responses from Lecturers on Whether Students Performed well in Mathematics or not.

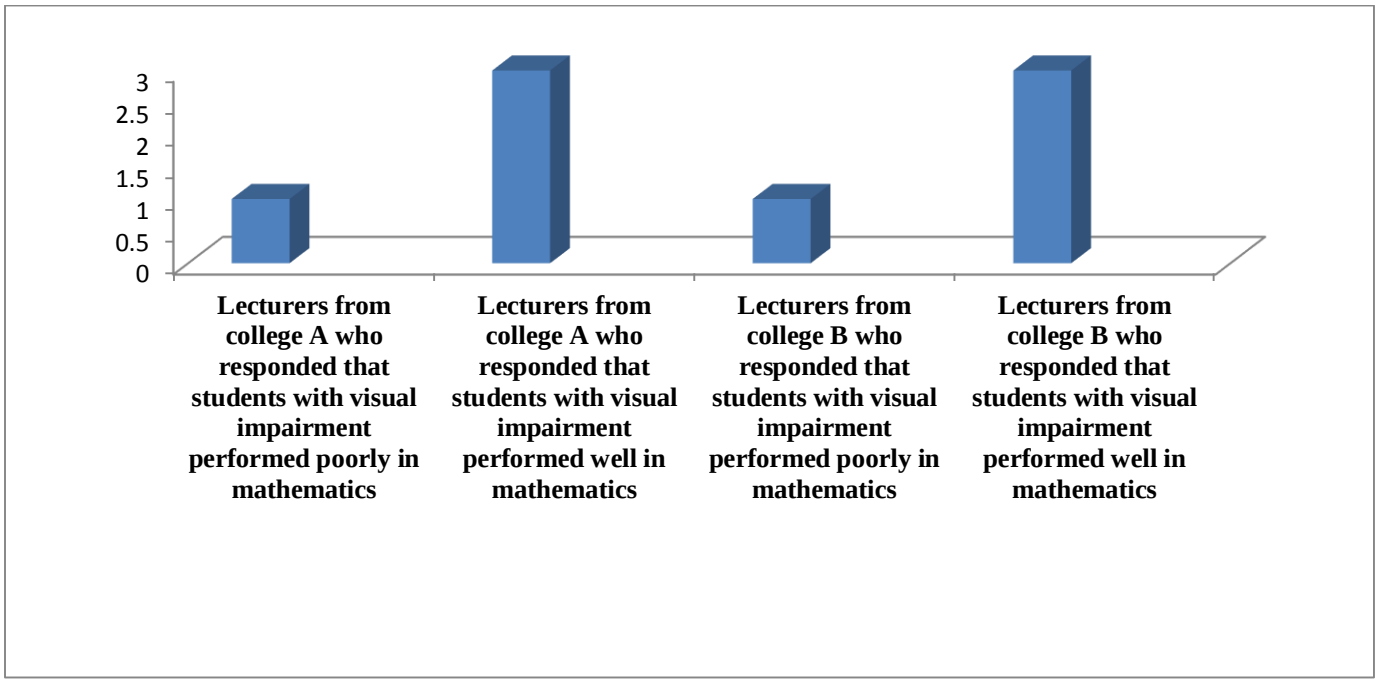



Figure 4.2 indicates that the two lecturers, one (1) from college A and one (1) from college B mentioned that students with visual impairment performed poorly in mathematics. The other two lectures one from college A and another from college B said that learners with visual impairments performed well in mathematics.

The study found that lecturers had two contrasting responses concerning whether the students with visual impairment performed well or poorly in mathematics at college level. One lecturer from College of education [A] had this to say; *'the performance of students with visual impairment cannot be compared to their sighted peers because they don't see anything during mathematics lessons and this is the reason they are experiencing poor academic performance.'* A lecturer from College of education [A] said that *'students with visual impairment in my class don't perform well in mathematics.'* Head of section from College of education [A] said that '*these students cannot perform well because they cannot see and mathematics demands the use of eyes.*' Another head of department from College of education [B] confirmed that *'generally*

*students with visual impairment perform poorly in mathematics.'* One lecturer handling students with visual impairment from College of education [B] added that 'these students perform poorly in mathematics mainly due to their loss of sight.' Another lecturer from College of education (B) explained that 'if the performance for those with sight can perform poorly, equally the performance of the students with visual impairment in mathematics is not well.'

On the other hand, the two lecturers who indicated that these students performed well, their views were noted through the responses as presented in the following statements. For example one lecturer from College of education [A] said that *'some of the students with visual impairment perform well in mathematics.'* Another lecturer from College of education (B) added that *'the performance of students with visual impairment in mathematics is not bad.'* 'In order to clarify the findings on the two contrasting statements from the lecturers, the researcher further asked a question to clarify on the two answers which were contradicting with each other. The final resolution during a focused group discussion was that students with visual impairment performed poorly in mathematics at colleges of education. The reasons advanced for poor academic performance by a college 'B' lecturer was that '*if students who have sight cannot perform well in mathematics, the students with visual impairment are not exceptional*.'

In order to find out whether the students with visual impairment performed well in mathematics or not, the researcher had to observe classroom activity where the class with visual impairment at College of education [A] were learning 'sub sets'. The lecturer started the lesson by making a recap of what the students talked about in the previous lesson. The recap was in form of question and answer technique. The sighted students provided correct answer to all the questions asked by the lecturer.

Afterwards, the lecturer introduced a new topic 'subsets' and wrote it on the chalk board. The lecturer explained that 'a subset is a set within another set.' The lecturer gave examples of some common subsets. It was explained that College of education [A] was a subset of colleges of education in Zambia and Zambia was a subset of countries in Africa. Furthermore the lecturer displayed a chart which had some examples of sets and the students were required to form subsets individually.

It was observed that no sighted students had challenges when making subsets. However, students with visual impairment had to strive to copy the work from the chart especially that the chart was in small prints. The lecturer and the researcher went round to check what the students were doing. It was discovered that only one student with visual impairment out of the three who were in that class formed the correct sets. When it was time to conclude the lesson, the lecturer confirmed that mangoes, oranges, apples and lemons were a subset of fruits while cat, dog, goat and sheep were a subset of domestic animals.

During class exercise, the lecturer took another chart which had jumbled words and students were asked to sort the words into their main sets.

**EXERCISE**

| **Main sets** | **seven, rice, malaria, marasmus, nshima, negative two, sugar, cholera, sweet potatoes, twelve, eight, zero, typhoid, leprosy, cassava, ten, positive 2, maize** |
|---|---|
| **1. Carbohydrates** | |
| **2. Whole numbers** | **Using the words listed above put the listed items in their respective main sets** |
| **3. Diseases** | |

The students with visual impairment strived to copy the work on the chart into their exercise books because the chart was in small prints and the words were clustered. The exercise was to be done in thirty minutes and it appeared the work was very simple to the sighted students because they completed the work within ten minutes. However, the students with visual impairment took time to complete the task and with help from their sighted peers. After marking, two students with visual impairment got one out three while the other student with visual impairment got two out of three. It was also observed that the lecturer did not mind about the condition and needs of the students with visual impairment but concentrated much on the sighted students. It was observed that the lecturer's attitude towards the students with visual impairment was not good and this could be the reason why the students did not do well in their class exercise.

### 4.1.2. **Instructional Materials**

In order to ascertain the best practices concerning instructional materials which could be used to teach mathematics to the students with visual impairment and how it affected their academic performance, a question was posed to the students with visual impairment and responses given were found in the following statements. For example, a student with visual impairment from College of education (A) said that '*the instructional materials used are not of great help to me during mathematics lessons and they make learning of mathematics difficult.'*

Another student from college of education [B] said that '*the use of teaching and learning materials which involve the use of sense of sight are not helping in experiencing the real learning of mathematics concepts.'* A student with visual impairment from College of education [A] maintained that '*instructional materials used at this college are very small and I can't manage to read them from the charts and because of that learning of mathematics is becoming very challenging to me.*

Additionally, one student with visual impairment from college of education [A] echoed that "*for me to learn mathematics with learning materials which are not in Braille is a sheer waste of time because I totally can't see anything.* Another student from college of education 'B' narrated that "*learning mathematics has become difficult because the instructional materials used because they sighted oriented.*' A student with visual impairment from college of education 'A' said that *"learning of mathematics at this college using the sense of sight combined with the sense of hearing is not very helpful for me and I am failing to learn mathematics.*

Nevertheless, the heads of department, heads of section and lecturers handling students with visual impairment were asked during a focused group discussion about the instructional materials used during mathematics lessons and how they affected the academic performance of the students with visual impairment. The responses of these participants were shown in the following statements. For instance, a lecturer from college of education [A] stated that "*there is need to use instructional materials that can suit the students with visual impairment because the materials used are not user friendly and they don't stimulate learning among the students with visual impairment."* Another lecturer from college of education 'A' mentioned that "*the use of instructional materials which involve the use of other senses apart from sight are benefitting*

*more the students with visual impairment especially that some of them are not able to see anything.*

The head of section from college of education [A] stated that *'the instructional materials used in mathematics lessons pose a challenge to students with visual impairment because they are neither in Braille nor large prints.* Another lecturer participant from college of education [A] explained that '*the instructional materials we are using don't make any sense to the students with visual impairment because they do not involve 'touch' and this makes them lose truck during mathematics.'*

A lecturer from college of education [B] also indicated that *"instructional materials can be a beneficial thing to them if they are in Braille but the non-embossed instructional materials do not give a true reflection of what the students are talking about."* One Head of department from college of education [B] outlined that *'the instructional materials used during mathematics are not big enough to make the students with visual impairment learn mathematics well because they are a mockery to these students."* Another lecturer from college of education [B] stated that '*the instructional materials used in all the mathematics lessons are in very small prints and they don't give chance to students with visual impairment to perceive them thereby making learning of mathematics very difficult.* Another lecturer from college of education [B] said that *'the best instructional materials for the students with visual impairment are those which involve the use of 'touch' but the instructional materials we use in mathematics lack this component and as such students fail to learn mathematics effectively.'*

Basing on the empirical findings of the study on the instructional materials on the academic performance of the visually impaired students in mathematics, the students did not score above 40%, the lecturers did not use braille when teaching them, students were not given recorded materials, and the students had no opportunity to touch the teaching materials. In this case the academic performance of students with visual impairment was poor at the college level.

### 4.1.3. **Instructional Approaches**

In order to probe from the respondents about the instructional approaches used in teaching mathematics to the students with visual impairment and how they affected the academic performance of the students with visual impairment, the question was posed to the students in an

interview and their responses reflected in the following statements. For instance, one student from college of education [A] indicated that '*the approaches to be used in mathematics lessons should involve the use of the sense of sight and this prevented us from learning because we don't have the eyes.'* Another student from college of education [A] said that '*using demonstration approach alone in teaching mathematics because the approach favours those students with sight.*

A student with visual impairment from college of education [A] explained that *"lecturers use approaches which stressed the use of the sense of sight, for example, demonstration which makes me lose contact.'* Another student with visual impairment from college of education [B] said that *'lecturers use approaches which use terms like "look at this" while they are pointing to something on the board and yet we are not able to see what the lecturer was talking about. This makes learning of mathematics very difficult"* Another student from college of education 'B' mentioned that "*learning mathematics has become difficult because the instructional approaches used by our lecturers do not involve the use of other senses apart from the sense of touch."*

A student with visual impairment from college of education [B] said that *'approaches which rely on lecturers' explanation are not good for me and this is the reason why I am performing poorly in mathematics.'* Another student from college [B] stated that '*I don't enjoy instructional approaches used by our lecturers which involve putting us in groups with those who are able to see because we are disadvantaged.'* Furthermore, another student from college of education [B] mentioned that *'I wouldn't like to learn from a lecturer who likes explaining the concepts but I would rather learn from someone who can give us time to analyze our tasks and allow us to think critically on our own. The current situation in learning mathematics is demotivating.'*

On the other hand lecturers were asked during a focused group discussion about the instructional approaches used in teaching mathematics at colleges of education and the approaches help affect the students and their responses are outlined below. For instance, a lecturer from college of education [A] said that *"the instructional approaches used are not multisensory and students rely on using the sense of sight to learning mathematics."* Another lecturer from college of education [A] mentioned that '*the lecturer based approaches such as exposition and demonstration are not helpful to the students with visual impairment they confuse the students*

*who can't see.'* The head of section from college of education [A] argued that '*I use demonstration and teacher exposition and the students are able to understand the concepts.'*

Another lecturer from college of education [B] said that *'demonstration is a good method to be used when teaching mathematics to the students with visual impairment because the students are able to follow demonstrations without necessarily using their sight.* Another lecturer respondent from college of education [B] outlined that *"I use instructional approaches such question and answer accompanied by exposition and two approaches make students understand the concepts taught.*

*Another lecturer from college of education [B] said that 'these students cannot learn mathematics well because we heavily depend on the methods which stress the use of sense of sight and as such they depend on the sighted peers who might not be there every time they may need them.'* A lecturer from college of education [B] stated that *'instructional approaches used in teaching mathematics are well but the students with visual impairment have challenges in acquiring knowledge and skill.*

Basing on the evidence of this finding concerning the best instructional approaches used on the academic performance of the visually impaired students during mathematics lessons, the study findings showed that lecturers used approaches which stressed the use of sight, the exposition and demonstration method did not favor the visually impaired students. Instruction approaches did not involve the use of other senses apart from touch, the explanation was not good, putting them together with the sighted students made them not to think critically, approaches used were not multisensory. In this case the instructional approaches used by lecturers contributed to poor performance of students with visual impairment when learning mathematics.

#### 4.1.4. **Academic Performance of Learners with Visual Impairment**

When the researcher asked ten students with visual impairment during an interview about whether they performed well or poorly in mathematics, the findings indicated that all the students with visual impairment performed poorly in mathematics during classroom activities as well during public examinations. The responses of the students with visual impairment were in the following statements.

For example one student with visual impairment from College of education [A] indicated that *'I have not scored above 40% in all the mathematics tests I have written so far.'* Another student from College of education [A] said that *'I don't perform well in mathematics.'* One student from College of education [A] added that *'I perform poorly in mathematics during both class exercises and tests.'* A student with visual impairment from College of education [A] indicated that '*passing mathematics is my unfulfilled dream in my learning.'*

Another student from College of education [B] narrated that *'I cannot remember the time I passed a test in mathematics.'* A student from College of education [B] stated that *'I fail to pass any mathematics test given in this college.'* Another student from College of education [B] indicated that *''my course work marks in mathematics are not good.'* One student from College of education [B] added that *'we the blind students and those without proper sight fail mathematics despite attending lessons.* Additionally, a student with visual impairment from college of education [B] stated that *'I am personally not dull but I fail mathematics in class based assignments and tests.'*

When the lecturers were asked about the academic performance of students with visual impairment, the lecturers had the following to say. A lecturer from College of education [A] said that *'the performance of students with visual impairment is pathetic.'* A lecturer from College of education [A] stated that *'students with visual impairment in our classes continues performing poorly in mathematics.'* One head of section from College of education [A] mentioned that '*these students with visual impairment are performing poorly and I totally neglect and ignore them in mathematics lessons.*'

Another head of department from College of education [B] confirmed that 'generally students with visual impairment perform poorly in mathematics.' One lecturer handling students with hearing impairment from College of education [B] added that *'these students perform poorly in mathematics mainly due to their loss of sight.*' Another lecturer from College of education (B) explained that '*if the performance for those with sight can perform poorly, equally the performance of the students with visual impairment in mathematics is not well*.' Furthermore, another lecturer from college of education [B] indicated that *'these students are not performing well in mathematics but we should encourage and motivate them fully*.'

Basing on this research findings concerning the academic performance of student with visual impairment in mathematics during classroom activities as well during public examinations it was discovered that some students got below 40%, did not perform well in class activities, marks were not good, they failed despite attending lessons and due to lack of sight, the performance was pathetic, they were neglected and ignored. In this case the academic performance of students with visual impairment was poor. The research findings also indicated that if given individual attention, monitored their progress in classroom activities, allowed to use 'touch' in their learning, if the instructional materials and approaches were modified according to the students' needs, the performance of the students with visual impairment in mathematics could improve.

### 4.1.5 **The lecturers' Attitudes**

In order to find out from the respondents about their experience on the attitudes the lecturers had on the students with visual impairment and how it affected or helped the performance of the students with visual impairment and learning of mathematics at colleges of education, the researcher used, interviews, focused group discussion and ended with the observation of classroom activities. The study findings unveiled that the lecturer had negative attitude towards the learners with visual impairment and this affected the way students with visual impairment learnt mathematics at colleges of education as well as their academic performance in mathematics.

During an interview with students with visual impairment at college of education [A], a question was posed about the lecturers' attitudes towards the students with visual impairment and how it helped or affected the academic performance or learning of mathematics. The responses concerning the lecturers' attitudes were in the following statements.

For instance, the students from college of education [A] stated that **"**lecturers *don't look at us as people who can learn mathematics and as such we feel like we are second class citizens in our learning.'* Another student from college [A] confirmed that *'the lectures don't regard us as normal people and all they do is to concentrate on our sighted friends in mathematics lesson and learning and consequently we miss out a lot.* Another student from college of education [A] said that *'I would personally say that my rights are infringed upon by the lecturers because they*

*don't consider me as an active member of the class just because I don't answer oral questions and I am really neglected by the lecturers.'*

A student from college of education [A] mentioned that *'I can just say that the lecturers have no love for the students with visual impairment and this is the reason why we cannot perform very well in mathematics*. Another student from college of education [A] mentioned that *'I have not received any help from our mathematics lecturers but other students with visual impairment and I need to be loved and be treated equally as our sighted peers.'*

During an interview with students with visual impairment at college of education [B], a question was posed about the lecturers' attitudes towards the students with visual impairment and how it helped or affected their academic performance and learning of mathematics. The responses concerning the lecturers' attitudes were in the following statements. A student with visual impairment from college of education [B] said that *"I don't learn mathematics properly because our lecturer has negative attitudes towards me and I am rated by him to be a person who cannot learn mathematics."* Another student from college of education [B] added that *"lecturers should develop a positive attitude towards students with visual impairment and not see them as people who cannot do mathematics."*

Another student with visual impairment from college of education [B] said that *'I don't like the way we are treated by our lecturers during mathematics lessons.'* Another student with visual impairment from college of education [B] said that *'the relationship which lecturers have developed with students with visual impairment is sour and it doesn't promote learning.'* Furthermore another student from college [B] suggested that "*as students with visual impairment, we are not well accommodated in the classrooms and our individual needs are neglected.*

On the other hand, when lecturers handling students with visual impairment were asked about the lecturers' attitudes towards the students with visual impairment and it affected or helped the students to learn mathematics. The lecturers responded to this question with different views. For example a lecturer from college of education [A] suggested that *"the students with visual impairment are not treated well by most of the lecturers and demoralize them from learning mathematics."* A lecturer from college of education [A] confirmed that *'these students would*

*waste someone's time because they find it difficult to learn.* Another lecturer from college of education (A) said that *'these students cannot learn mathematics well because we heavily depend on the sighted friends who might not be there at certain times.''* The head of department from college of education [A] further explained that *'lecturers become irritated when students with visual impairment are enrolled in their classrooms because they feel that these learners impose more problems on the lecturers.*

When the lecturers handling students with visual impairment at college of education [B] were asked about the lecturers' attitudes towards the students with visual impairment and it affected or helped the students to learn mathematics, the lecturers' responses to this question were reflected in the following statements. For example a lecturer from *college of education [B] said that 'the student with visual impairment can only learn mathematics if they had partial vision.'* In addition, another lecturer from college of education (B) mentioned that *"the lecturers' attitudes towards students with visual impairment is sour.'* One head of department from college of education [B] added that '*these students cannot learn mathematics because they are not encouraged and motivated by their lecturers*.

Basing on the empirical findings concerning the academic performance of the visually impaired students in learning mathematics and the lecturers' attitudes, the research findings indicated that the relationship and attitudes of lecturers towards students with visual impairment was rather negative, student rights were infringed upon by the lecturers, lecturers had no love for the visually impaired students and hence lecturers did not help students in mathematics lessons. In this case individual needs were neglected and consequently students' performance was poor.

### 4.2. Investigated instructional approaches used in teaching and learning mathematics to Students with visual impairment at colleges of education

With regards to the instructional approaches used in teaching mathematics at colleges of education, data was collected from eight lecturers and ten students with visual impairment through focus group discussion, structured interviews as well as from lesson observations. When asked during a focused group discussion about the instructional approaches which were used to make students with visual impairment learn mathematics better, lecturers responded to this question with different views. For instance one of the eight lecturers from college of education

[B] explained that, "the instructional approaches used during the learning process were dependent on the use of sight which is absent in the students with visual impairment.
One lecturer handling students with visual impairment stated that, *"I usually use expository method to teach these students because I know that everyone has got ears.* Another lecturer mentioned that *'I teach them by way of explanation or through exposition because every learner in my class has got the sense of hearing I and leave the rest of the work to their specialist lecturer'.* A lecturer respondent indicated that*" I don't use group method but I use instructional approaches like demonstration and exposition which conserve time, especially that I have very few students with visual impairment in my class.*

Another lecturer narrated that *"I am aware that some of the challenges which these students face while learning mathematics are coming from the learning instructional approaches but I have no skills to handle these students efficiently".* One head of section from college [A] who is also handling students with visual impairment mentioned that "*I use the demonstration method when teaching students with visual impairment because all the students can hear my voice."*

One head of department from college of education [B] echoed that "*the students are subjected to the four learning instructional approaches namely exposition, demonstration, question and answer and class/group discussion without bringing in the multisensory approaches."* The other lecturer responded that he used an eclectic method.

The consensus and the resolution from the lecturers' focused group discussions are reflected in their responses as follows; one lecturer stated that most of the lecturers relied heavily on expository and demonstration methods. Another lecturer narrated that question and answer method are used especially when giving classroom activities. The other lecturer reported that group discussion is used which posed challenges to students with visual impairment and the approaches hindered academic performance of the students with visual impairment.

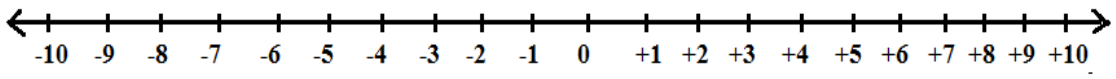
When the students with visual impairment were asked during an interview about the instructional strategies or approaches they were exposed to during mathematics lessons, their responses were reflected in the following statements. For example one student from college 'A' stated that 'our lecturers are found of explaining the concepts for so long without using the methods which can allow us to use other senses.' Another student from College of education [A] mentioned that's

One student from College of education [A] explained that '*the instructional approaches our lecturers use does not involve the use of other senses other than the use of sense of sight.'*

Another student from College of education [A] added that 'the instructional approaches used during mathematics are a demonstration method. A student from College of education [B] said that '*our lecturers like explaining things and they would ask the students questions like have you seen what we had done here and it makes us not to perceive objects with our eyes.'* Another student with visual impairment from college of education [B] explained that 'the methods used during mathematics lessons are depended on demonstration and as such we fail to grasp mathematical concepts.'

Some of the lecturers' and students' responses were confirmed in a mathematics lesson observed at college of education [A] on a topic 'Addition of integers." The lesson was presented to a class of second year students pursuing primary teachers' diploma and the class had two students with visual impairment. The lecturer started by introducing the topic "integers". The lecturer told the students that the term integer refers to the negative and positive numbers including zero. He further explained that these numbers are put on the number line and zero is in between the positive and negative numbers. The lecturer explained that despite a bigger value of a negative integer, it is smaller than zero or positive one. Thereafter, the lecturer demonstrated to the students how to add integers and he was writing whatever he was talking about on the white marker board. Unfortunately the students with visual impairment were not able to see what the lecturer was demonstrating. Further the lecturer took a chart where the number line was drawn and he was referring to it when demonstrating the concepts about addition of integers. Figure 4.3 shows the number line which was used by the lecturer.

**Figure 4.3: The number line used during the lesson observation on integers**



After his demonstration, he assigned one student to find the answer for the question -6 + (-3) on the board using the number line. The student also demonstrated how to find the answer to the given question but the two students with visual impairment were not able to grasp any concept from their sighted peer who was demonstrating on the board. After a demonstration from a student the lecturer created five groups of six students and two groups had one student with visual impairment each. The group assignments were as follows;

Group 1. -5+ (-1+5) + (+5) =

Group 2. -9 + (-1) + (-7+12) =

Group 3. +4 + (-3) + (-4) =

Group 4. -2 + (-7+5) + (- 6) =

Group 5. +3 + (-4 + 3) + (5) =

To do this work, the students were given five minutes and after five minutes, group representatives were called to do the reporting and from the six students who came in front, there was no student with visual impairment. Each group representative had to show how the group arrived at the answer and all the working was to be shown on the board. The following answers were given by respective groups:

Group 1. -5+ (-1+5) + (+5) = **+**9

Group 2. -9 + (-1) + (-7+12) = - 5

Group 3. +4 + (-3) + (-4) = **-7**

Group 4. -2 + (-7+5) + (- 6) = -6

Group 5. +3 + (-4 + 3) + (+5) = **+7**

The lecturer concluded the lesson by asking the students oral questions and none of the two students with visual impairment participated in answering oral questions. All the students in class

kept on laughing and the lecturer interjected by saying that 'let's take our books and write our exercise. A class activity was given to the students and the lecturer went round as the students were writing their exercise. He kept on marking each student as they raised up their hands to indicate that they had completed the class exercise. Most of the sighted students did very well, except the students with visual impairment who had challenges in using the number line to find their answers.

When the lecturers handling students with visual impairment were asked during focused group discussions about the instructional approaches they use during their lessons, their responses were confirmed that four approaches were used and these were exposition, question and answer, group discussion, demonstration. For example one lecturer from college of education [A] said that *'I combine the lecture method and question and answer in my teaching*.' Another lecturer from college of education [A] said that '*I use demonstration and group discussion because students are actively involved in learning.'* A lecturer from college of education [A] mentioned that *'I always make my teaching active by using question and answer method.*' Another lecturer participant from college of education added that '*I use question and answer, demonstration and group discussion method to teach mathematics because they help the students understand what I am talking about.'*

Furthermore, the lecturer from college of education B mentioned that *'I usually combine three methods when teaching mathematics and these are exposition, demonstration and question and answer because they help me explain mathematical concepts very well.'* Another lecturer stated that *'I mostly use exposition and demonstration methods accompanied by question and answer which helps in probing the students' understanding.'* A lecturer from college of education [B] added that *'exposition and demonstration are the best methods because they make students understand what you are talking about.'* The head of department for mathematics maintained that *'most of these lecturers use four methods when teaching mathematics and these are exposition, demonstration, question and answer and group discussion methods.'* The researcher observed that the lecturer used the following methods; the lecture method, demonstration, group discussion and question and answer method. When the lecture method was used it was observed that the students with visual impairment never contributed to the discussion but they just received the answers precisely that they were not able to see how addition was done on the

number line. It was observed that during demonstration students with visual impairment did not participate.

***Figure 4.4: Instructional Approaches Applied by Lecturers in Teaching Mathematics at Colleges of Education***

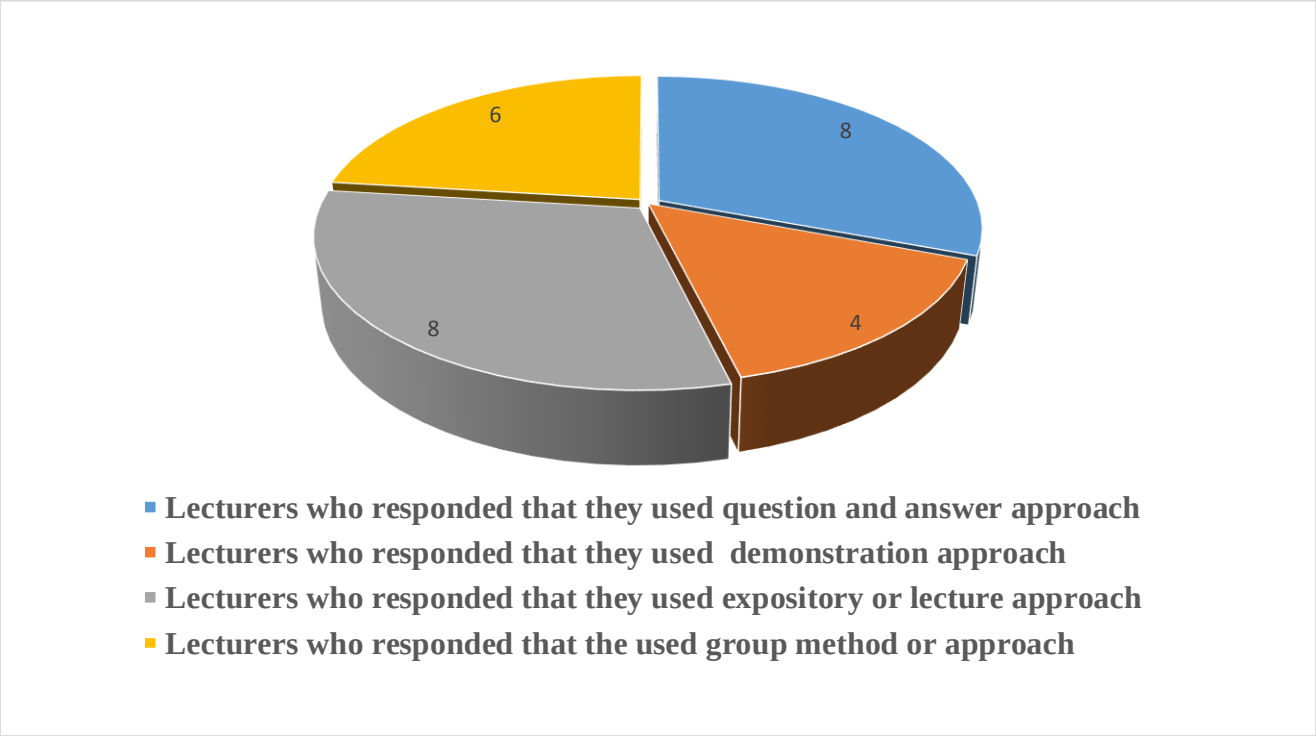
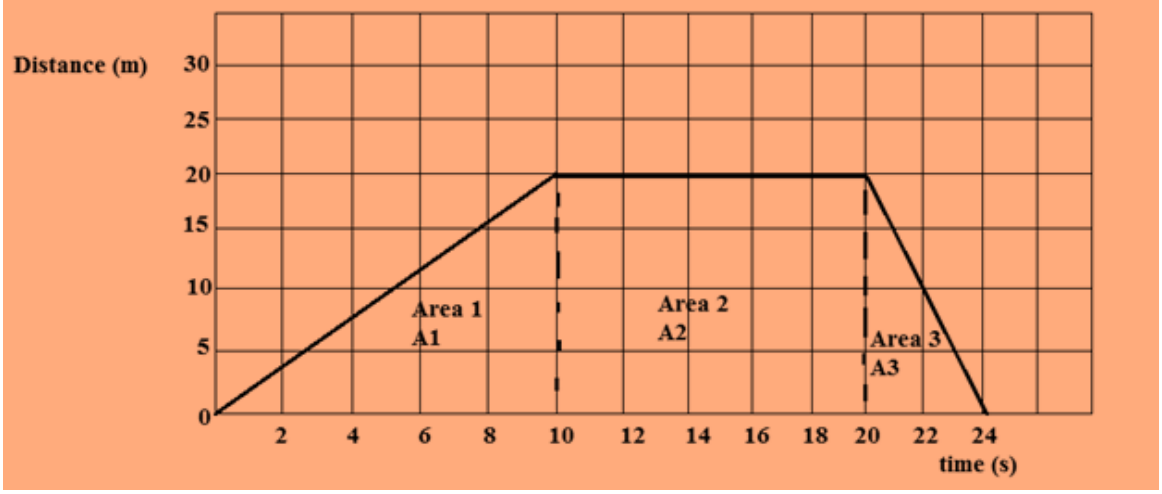



Figure 4.4 indicated that all the eight lecturers used question and answer as well as expository teaching approaches. Six lecturers confirmed to use group discussion method, four confirmed using demonstration approaches. Their responses were reflected in the following statements. For example, one lecturer from college 'A' stated that 'I use group discussion in my teaching.' Another lecturer from college [A] mentioned that 'I use group discussion in most of my mathematics lessons.'

The responses from the lecturers and students with visual impairment were confirmed during a lesson observation made at college of education [B] on the topic 'distance-time graphs.' This lesson was presented to 35 students of which 3 were students with visual impairment. It was noted that the lecturer used more than two instructional approaches and these were exposition, question and answer, demonstrations and group discussion. The lecturer introduced the topic by

referring to a car ascending a hill. He later explained that the total distance covered by a car can be calculated using the area around the graph. The lecturer further took a graph which was drawn on a piece of Manila paper and demonstrates how total distance can be calculated using the area of a rectangle as well as the area of a right-angled triangle. Figure 4.5 showed the graph used by the lecturer to explain how the distance covered by a car could be calculated.

**Figure 4.5: Calculating the total distance under a graph**




The lecturer explained that the total distance covered by the car could be calculated by summing up the values of area 1, area 2 and area 3. He explained that area 1 could be calculated using the formula of triangle such as; area = half base X height; $A = \frac{1}{2}bh$

The lecturer further stated that the area of a rectangle could be calculated by using the formula; Area = length X breadth (A= LB). As the lecturer was explaining this, he was also pointing at the areas 1, 2 and 3. The lecturer explained that $A_1$ and $A_2$ could be calculated using the same formula $A = \frac{1}{2}bh$. Unfortunately the students with visual impairment were not able to see the areas 1, 2 and 3 which the lecturer was pointing at. Furthermore the lecturer combined exposition with demonstration and demonstrated how to calculate area 1. Using question and answer, the following information for area 1 ($A_{1)}$ was obtained from the students;

Base = 10

Height = 20

Area = x (unknown)

The following calculations were done by the lecturer using data which was obtained by the members of the class.

$$\text{A1} = \frac{1}{2}\text{bh} = \frac{1}{2} X\ 10\ X\ 20 = 100m$$

After a demonstration, the lecturer divided the class into seven groups comprising five members each and 3 groups had a student with visual impairment each. When group discussion was effected in the lesson, the three students with visual impairment did not contributed their ideas to the discussion due to intimidation for being disabled thus they remained passive or not actively involved. It was also observed that during group discussion, the three students with visual impairment were shy and did not participate in the discussion. During the implementation of group discussion approach, discussions were dominated by the sighted students as a result the students with visual impairment were left out without clearly understanding the concepts. Besides, the students with visual impairment were not able to see what was written on the Manila paper and as such they were learning the concepts in abstract.

During the lesson observation, it was noted that when using the expository method, students did not receive relevant skills because they needed to be shown through touch of what was talked about. Furthermore the lecturer did not go round to see or monitor how the students with visual impairment were learning mathematics.

The students were given 15 minutes in which to discuss. During the discussion the students with visual impairment were noticed to be passive while the sighted students dominated the discussions. It was further observed that when expository method was used, there was less lecturer-learner interaction with students with visual impairment which led to them not to easily comprehend what was being taught during the lesson. The time for reporting what was discussed in groups came and five students represented their colleagues in their respective groups and none of them was a student with visual impairment. All the groups got the correct answers and the following answers were given by all the groups;

Area 2 = L x B

= 20m x 10m

= <u>200m</u>

Area 3 = $\frac{1}{2}$bh = $\frac{1}{2}$X 4m X 20m = 80m

Total distance = Area 1 + Area 2 + Area 3

= 100m + 200m + 80m

= <u>380m</u>

The lecturer confirmed the answers given to be correct and further appreciated the groups for their concerted efforts. He later allowed the group representatives to go sit down. Furthermore the lecturer distributed the text books to each of the seven groups and asked them to write exercise 4 which was on page 189 of the text book. One of the students with visual impairment inquired from the lecturer if the student could be provided with any text book which had an embossed exercise but she was told to consult the sighted friends.

The students started writing their class exercise and those with visual impairment had problems of copying the questions which were in small print. The lecturer went through to check those who completed the first question. Surprisingly, no student with visual impairment completed any of the three questions and the lecturer concluded his lesson by emphasizing that those who had not completed the exercise must do it as homework and books were to be submitted to the tutorial room the following morning.

When the students with visual impairment were asked through the interviews about the other approaches used during teaching and learning of mathematics at college level, they cited expository approach and their responses were shown in the following statements. One student with visual impairment from college of education [A] stated that *'expository method was not useful to us students with visual impairment.'* Another student said that "*I stated that, 'when expository method was used it encouraged day-dreaming and I did not participate in learning*.' A student respondent said that '*when expository method was used, most of the time I remained a passenger or listener without getting involved in the lesson*.' Another student participant from college of education [B] stated that '*expository method did not give us time to interact with others and in the process some students with visual impairment were lost.*'

When the lecturers were asked about their use of expository method during mathematics lessons at colleges of education, their responses were as follows. For instance one lecturer explained that

'*although I used expository method to teach mathematics, the concepts were not grasped quickly because I did not have simplified materials to cater for the students with visual impairment*.' Another lecturer respondent went on to say that, '*some of us lecturers use expository but fail to explain everything clearly for the students visual impairment to grasp concepts easily*.' One Head of department stated that '*when expository method was used, the students had difficulties to get what was being taught and as such, they had to struggle to grasp the mathematical concepts*.'

Concerning the research findings from the lessons observed, it was evident that, the students with visual impairment did not benefit much from lessons where the expository method was used. The study also found that the expository method was lecturer-centered as it did not make these students with visual impairment participate during the lessons and as a result there was less excitement, motivation or interest in the lesson on the part of these students. The students with visual impairment easily forgot what was taught to them when the expository method was used. When the expository method was used, the students with visual impairment only got the general idea about the lesson and not the detailed information. The expository method did not help the students with visual impairment develop self-confidence because the method made them depend heavily on lecturers to provide them with all the academic knowledge, mathematical concepts and skills for their academic success. In this case the students with visual impairment could not learn mathematics well and their academic performance in mathematics was hindered.

Basing on these findings concerning the instructional approaches used during mathematics lessons for the visually impaired students, the study revealed that the lecturers relied heavily on expository, demonstration, question and answer as well as group discussion method, the instructional approaches used indirectly demanded the use of the sense of sight, lecturers had no skill to handle the visually impaired students efficiently, In this case, the research established that instructional approaches used during the learning of mathematics to learners with visual impairment were not beneficial.

### 4.3 **Established Best Practices in Teaching Mathematics to the Students with Visual Impairment in Colleges of Education.**

With regards to the best practices in teaching mathematics to the ten students with visual impairment, data was collected from students with visual impairment, heads of department

(mathematics) heads of section and lecturers handling students with visual impairment. The researcher used the interviews and focused group discussion to probe the responses on the best practices in teaching mathematics to the students with visual impairment. Furthermore, the researcher used the four themes namely; the instructional materials, the instructional approaches, the academic performance and the lecturers' attitudes towards learners with visual impairment to ascertain the best practices in teaching mathematics to the students with visual impairment at colleges of education.

### 4.3.1. **Instructional Materials**

In order to ascertain the best practices concerning instructional materials which could be used to teach mathematics to the students with visual impairment, a question was posed to the students with visual impairment and a variety of responses was given. For example, a student with visual impairment from college of education [A] suggested that '*adaptive instructional materials could be of great help to me during mathematics lessons.'* Another student from college of education [B] said that '*the use of teaching and learning materials which involve touch could help us learn mathematics more effectively.'* A student with visual impairment from college of education [A] maintained that '*instructional materials with 'touch' must be used to cover up our loss of sight in mathematics lessons.'*

Additionally, one student with visual impairment from college of education [A] said that "*for me to learn mathematics well there is need for the lecturers to use instructional materials which involve touch."* Another student with visual impairment from college of education 'A' said that *"using the sense of touch combined with the sense of hearing can be very helpful for me to learn mathematics but the instructional materials miss out this component."*

When the heads of department, heads of section and lecturers handling students with visual impairment were asked during a focused group discussion about the best instructional materials which could allow the students with visual impairment to learn mathematics at colleges of education with less difficulties, their suggestions and responses were shown in the following statements.

A lecturer from college of education [A] stated that "*there is need to use instructional materials that can suit the students with visual impairment."* Another lecturer from college of education

'A' said that "*I propose that it is important to use instructional materials which involve the use of other senses apart from sight so that these students can learn mathematics well.'* The head of section from college of education [A] suggested that *'there was need for the government to change the mathematics curriculum with adaptive instructional materials for the students with visual impairment at college level.'* Another lecturer participant from college of education [A] suggested that "making Braille as a medium of instruction for students with visual impairment can allow students use touch to learn mathematics"

A lecturer from college of education [B] also suggested that *"using pre-recorded lessons as instructional materials can be a beneficial thing to them."* One Head of department from college of education [B] suggested that *'the instructional materials used during mathematics are not enough to make the students with visual impairment learn mathematics well but it could be good for the lecturers to provide these students with tape recorded lessons a day before the actual lesson."* One lecturer from college of education [B] suggested that '*the use of Brailed instructional materials in all the mathematics lessons and using large prints could be a possible solution."* Another lecturer from college of education [B] said that *'the best instructional materials for the students with visual impairment are those which involve the use of 'touch'.*

Basing on the empirical evidence of the study on best instructional materials in teaching mathematics to students with visual impairment at colleges of education, the study revealed that, there was need for the lecturers to use adaptive instruction materials, teaching and learning materials which involve the sense of touch combined with the sense of hearing, making braille as a medium of instruction and using prerecorded lessons. In this case the best method of using instructional materials was established.

### 4.3.2 **Instructional Approaches**

In order to probe from the respondents about the best practices in terms of instructional approaches which could be used to teach mathematics to the students with visual impairment, the question was posed to the students in an interview and their responses reflected in the following statements. For instance, one student from college of education [A] indicated that '*the approaches to be used in mathematics lessons should involve the use of other remaining senses.'* Another student from college of education [A] suggested that '*using demonstration approach*

*alone in teaching mathematics is only fair to those students with sight, instead the approaches which involve other senses must be used.'*

A student with visual impairment from college of education [A] proposed that *"lecturers should avoid using approaches which stressed the use of the sense of sight.'* A student with visual impairment from college of education [B] proposed that *'lecturers should by all means avoid using terms such as "look at this" while they are pointing to something on the board or chart or number line, to prevent them from asking their peers what the lecturer was talking about."* Another student from college of education 'B' added that "*learning mathematics has become difficult because the instructional approaches used by our lecturers do not involve the use of other senses apart from the sense of touch."*

A student with visual impairment from college of education [B] said that *'approaches which rely on lecturers' explanation are not good for students with visual impairment and there is need to use methods which involve the use of other senses.'* Another student from college [B] said that '*I don't enjoy teaching which involves putting us in groups with those who are able to see because we are disadvantaged and it is better to use individual teaching especially to us who are blind.'* Furthermore, another student from college of education [B] mentioned that *'I wouldn't like to learn from a lecturer who likes explaining the concepts but I would rather learn from someone who can give us time to analyze our tasks and allow us to think critically on our own.'*

On the other hand lecturers were asked during a focused group discussion about the best practices in terms instructional approaches which could be used in teaching mathematics at colleges of education. For instance, a lecturer from college of education [A] suggested that *"the use multisensory learning methods could be a solution that can overcome dependency on sighted learners during mathematics lessons."* Another lecturer from college of education [A] mentioned that 'the lecturer based approaches such as exposition and demonstration are not helpful to the students with visual impairment instead there is need to involve the students in constructing their learning.' The head of section from college of education [A] stated that '*using multisensory approaches in teaching mathematics to the student with visual impairment could be the only solution to effective learning of mathematics among the students with visual impairment.'*

Another lecturer from college of education [B] unveiled that *'demonstration is not a good method to be used when teaching mathematics to the students with visual impairment because the students are not able to see. Instead the approaches to be used in learning of mathematics should involve the other senses other than the sense of sight.'* Another lecturer respondent from college of education [B] suggested that *"it could be better if some of the teaching approaches are to be modified according to the needs of the students to allow them experience their own learning."*

Another lecturer from college of education [B] said that *'these students cannot learn mathematics well because we heavily depend on the methods which stress the use of the sense of sight and as such they depend on the sighted peers who might not be there every time they may need them.'* A lecturer from college of education [B] stated that *'using multisensory teaching approaches can allow the students to learn mathematics effectively rather than relying on the methods which demand for the use of the sense of sight.'*

The findings of this study established the best practices for the instructional approaches to be used to the visually impaired students in learning mathematics such as, lecturers should avoid using approaches which stressed the use of the sense of sight, teaching approaches to be modified according to the needs of the visually impaired students, lecturers to use recorded lessons, Brailed material to be used when using demonstration method. In this case, the best instructional approaches were established.

### 4.3.3. **Academic Performance of Learners with Visual Impairment**

When the researcher asked ten students with visual impairment during an interview about whether they performed well or poorly in mathematics, the findings indicated that all the students with visual impairment gave common responses and agreed that they performed poorly in mathematics during classroom activities as well during public examinations. However, the students were asked about how best their performance could be improved and their responses were in the following statements.

For example one student with visual impairment from college of education [A] indicated that *'I have not scored above 40% in all the mathematics tests I have written so far but I can still improve if given individual attention.'* Another student from college of education [A] said that *'I*

*don't perform well in mathematics but the chances of improving are there if the lecturers are able to monitor my progress in classroom activities especially during the learning process.'* One student from college of education [A] added that *'I perform poorly in mathematics during both class exercises and tests. Nevertheless the chances of improving are there if I am treated as a person who can learn mathematics.'* A student with visual impairment from college of education [A] indicated that '*passing mathematics cannot be a dream if I am allowed to use the sense 'touch' in my learning.'*

Another student from college of education [B] narrated that *'I cannot remember the time I passed a test in mathematics but if the instructional materials and approaches are modified according to my needs I should be able to do well.'* A student from college of education [B] stated that *'It doesn't mean that I can fail to pass a mathematics test if all the materials I am using in mathematics are in Braille.'* Another student from college of education [B] indicated that *"my course work marks in mathematics can be good if I'm given instructions in Braille form.'* One student from college of education [B] added that *'I don't think the blind students and those without proper sight can fail mathematics if they are motivated and their needs are taken care of.'* Additionally, a student with visual impairment from college of education [B] maintained that *'I personally cannot fail mathematics if the instructional approaches used in class are not based on the use of the sense of sight.'*

When the lecturers were asked to tell the best practices concerning the academic performance of students with visual impairment, the lecturers had these to say. For example, a lecturer from college of education [A] said that *'the performance of students with visual impairment cannot be compared to their sighted peers but there is room for improvement if the instructional approaches and materials used during mathematics lessons involve the use of other remaining senses.'*

A lecturer from college of education [A] said that *'students with visual impairment in our classes cannot continue performing poorly in mathematics if instructional materials used are tactile in nature.'* One head of section from college of education [A] said that '*these students cannot continue performing poorly unless we totally neglect and ignore them in mathematics lessons.*' Another head of department from college of education [B] confirmed that *'generally students with visual impairment perform poorly in mathematics because as lecturers we don't meet their*

*individual needs.'* One lecturer handling students with hearing impairment from college of education [B] added that *'these students perform poorly in mathematics mainly due to their loss of sight.'* Another lecturer from college of education [B] explained that *'if the performance for those with sight can perform poorly, equally the performance of the students with visual impairment in mathematics is not well.'* On the other hand, another lecturer from college of education [B] indicated that '*these students can perform well if we develop positive attitude towards them, encourage and motivate them fully*.'

Basing on these findings of the academic performance of the visually impaired students, all the students with visual impairment performed poorly in mathematics during classroom activities as well as during public examinations. The research findings indicated that if given individual attention, monitored their progress in classroom activities, allowed to use 'touch' in their learning, if the instructional materials and approaches are modified according to the students' needs, the performance of the students with visual impairment in mathematics could improve. In this case the best practices for better academic performance of students with visual impairment were established

### 4.3.4. **The Lecturers' Attitudes**

In order to probe from the respondents about their experience on the attitudes the lecturers had on the students with visual impairment, the researcher used, interviews, focused group discussion and ended with the observation of classroom activities.

During an interview with students at college of education [A], a question was posed about the best practices on the lecturers' attitudes towards the students with visual impairment and some of their responses concerning the lecturers' attitudes towards the students with visual impairment were in the following statement;

A student from college of education [A] confirmed that *'If lecturers have love for the students with visual impairment they can perform very well in mathematics*. Another student from college of education [A] stated that *'I have not received any love from our mathematics lecturer but other students and I with visual impairment need to be loved and be treated equally like our sighted peers.'*

When the students from college of education [B] were interviewed, their responses were in the following statements. For example, one student said that *'I don't like the way we are treated by our lecturers'*.

On the other hand, when lecturers handling students with visual impairment were asked about the best practices in terms of lecturers' attitudes towards the way students with visual impairment learn mathematics, they responded to this question with different views. For example a lecturer from college of education [A] suggested that *'these students cannot learn mathematics well because we heavily depend on the methods which stress the use of sense of sight and as such they depend on the sighted peers who might not be there every time they may need them.'* The head of department from college of education [A] further suggested that *'lecturers should go round the groups and see what the students with visual impairment are doing.*'

A lecturer from college of education [B] also suggested that 'the students with visual impairment can learn mathematics if we are to build self-esteem, independence and autonomous in them.' In addition, another lecturer from college of education [B] suggested that *"there is need for us to provide independent learning skills in students with visual impairment as opposed to letting them depend on us and their sighted peers.'* One head of department from college of education [B] added that *these students can learn mathematics very well if we are to encourage and motivate them in and outside the classrooms.* On the other hand lecturers were asked during a focused group discussion about the best practices in terms instructional approaches which could be used in teaching mathematics at colleges of education. For instance, a lecturer from college of education [A] suggested that *"the use multisensory learning methods could be a solution that can overcome dependency on sighted learners during mathematics lessons."* Another lecturer from college of education [A] mentioned that 'the lecturer based approaches such as exposition and demonstration are not helpful to the students with visual impairment instead there is need to involve the students in constructing their learning.' The head of section from college of education [A] stated that '*using multisensory approaches in teaching mathematics to the student with visual impairment could be the only solution to effective learning of mathematics among the students with visual impairment.'*

Another lecturer from college of education [B] revealed that *'demonstration is not a good method to be used when teaching mathematics to the students with visual impairment because*

*the students are not able to see. Instead the approaches to be used in learning of mathematics should involve the other senses apart from the sense of sight.'* Another lecturer respondent from college of education [B] suggested that *"it could be better if some of the teaching approaches are to be modified according to the needs of the students to allow them experience learning on their own."*

Another lecturer from college of education [B] said that *'these students cannot learn mathematics well because we heavily depend on the methods which stress the use of the sense of sight and as such they depend on the sighted peers who might not be available every time they may need them.'* A lecturer from college of education [B] stated that *'using multisensory teaching approaches can allow the students to learn mathematics effectively rather than relying on the methods which demand for the use of the sense of sight.'*

The findings of this study established the lecturers' attitude towards students with visual impairment in learning mathematics such as; showing love and care, building students' self-esteem, providing independent learning methods, teaching approaches to be modified.

## 4.4 **Summary**

This chapter presented the findings of the study aimed at establishing the academic performance of students with visual impairment in Mathematics at colleges of education. The chapter highlighted that the students with visual impairment performed poorly in mathematics at the two selected colleges of education due to the fact that the instructional approaches used during mathematics lessons stressed the use of the sense of sight and these approaches were exposition and demonstration methods which did not favour the visually impaired students. Instruction approaches used in teaching mathematics did not involve the use of other senses like touch but the approaches were full of explanations which were not good enough but had put the students learning at risk. The instructional materials and approaches used in teaching mathematics were not modified according to the students' needs and this plummeted the performance of the students with visual impairment in mathematics. The chapter also highlighted that the lecturers' attitudes towards students with visual impairment were not good especially that the students' rights were infringed upon by the lecturers and the lecturers did not show enough love for the visually impaired students. Furthermore it had been highlighted that the lecturers did not help

students in mathematics lessons and the students' individual needs were neglected leading to poor students' performance. This chapter also highlighted that students were not given individual attention, their progress in classroom activities were not monitored and they were not allowed to use 'touch' in their learning.

# CHAPTER FIVE

# DISCUSSION OF THE FINDINGS

## 5.1. Overview

This chapter discusses the findings of the study according to different categories of themes which were in line with the objectives which were set in this study. The objectives of the study were to: establish the academic performance of students with visual impairment in Mathematics at colleges of education, to investigate instructional approaches used to teach Mathematics to students with visual impairments and to establish best practices for students with visual impairment in terms of their academic performance in Mathematics. The discussion of the study findings was confined to the questions which appeared in the interview guide, a semi-structured focus group discussion as well as those in the observation checklist. The discussion of the findings were compared to other studies carried out in different parts of the world, the theoretical and conceptual framework. The chapter ends with a summary.

### 5.1.1 Instructional Materials

The current research findings concerning the instructional materials used during mathematics lessons in colleges of education were that, there was need for the lecturers to use adaptive instruction materials, teaching and learning materials which involve the sense of touch combined with the sense of hearing, making braille as a medium of instruction and using prerecorded lessons. In this case the best method of using instructional materials was established. This was shown in some of the participant's response. For example, a student with visual impairment said that '*the teaching materials used during our mathematics lessons were too small and as such we fail to grasp the concepts taught, hence we get poor academic performance.*'

The findings of the current study corresponded with the findings of Akakandelwa and Munsanje (2012) who conducted a research on 'the provision of learning and teaching materials for pupils with visual impairment: Results from a National Survey in Zambia.' The previous researchers discovered that most children with visual impairment appeared to perform poorly in their studies and are required to drop mathematics subjects due to lack of teaching and learning materials.

Nevertheless, the current study showed that despite using instructional materials which did not foster learning, the students with visual impairment never dropped mathematics.

The findings of the current study were in conflict with the theoretical framework model by Allan (2008) which highlighted that the key accommodations in the instructional materials for the students with visual impairment that are absolutely essential in learning mathematics are access to embossed textbooks and instructional materials as well as in the appropriate media such as recorded media. However, the study findings discovered that lecturers did not use embossed instructional materials and pre-recorded lessons but rather used instructional materials which were tiny and in small print.

In this vein, it is the researcher's opinion that if the instructional materials are not adapted in nature, learning of mathematics by the students with visual impairment would be affected and this in turn would affect the academic performance of the students with visual impairment.

### 5.1.2 **Instructional Approaches**

The findings of the current study concerning the instructional approaches used during mathematics lessons showed that the lecturers relied heavily on expository, demonstration, question and answer as well as group discussion method, the instructional approaches used indirectly demanded the use of the sense of sight, and lecturers did not have the skill to handle the visually impaired students efficiently. This was reflected in the responses from the participants. For example, one student from college of education [B] said that ' *some of our lecturers like using methods which demands the use of the sense of sight and this makes me to perform poorly because I can't see anything*.'

The findings of the current study correlated with the findings of Kiarie (2004) who carried out a research on education of students with visual impairments in Kenya. The findings of the previous study indicated that obstacles also exist in the area of adaptations of instructional approaches for students with visual impairments and some subjects such as biological sciences and mathematics, studied in the secondary schools have had instructional approaches used stressing the use of the sense of sight and this made it extremely hard for students with visual impairments to access the general education curriculum. The study findings showed that lecturers used approaches which stressed the use of sight and exposition as well as demonstration method did not favour the

visually impaired students because the instructional approaches did not involve the use of other senses apart from touch, (approaches used not multisensory). In this case the study revealed that the instructional approaches used by lecturers contributed to poor performance of students with visual impairment when learning mathematics.

It is the researcher's view that if the instructional approaches used in teaching mathematics involved the use of other senses other than the sense of sight and hearing students with visual impairment could learn mathematics very well and their academic performance could improve.

### 5.1.3 **The Academic Performance of the Students with Visual Impairment.**

The current study findings concerning the academic performance of student with visual impairment in mathematics during classroom activities as well during public examinations showed that some students got below 40% did not perform well in class activities, marks were not good, they failed despite attending lessons and due to lack of sight, their performance was poor. Students with visual impairment were generally neglected and ignored. These were reflected in some of the responses from the participants. For example one student with visual impairment from college of education [A] indicated that *'I have not scored above 40% in all the mathematics tests I have written so far.'* Another student from college of education [A] said that *'I don't perform well in mathematics.'*

The findings of the current study were similar to the findings of Megan (2012) who carried out a research in Michigan in the United States of America on "students with visual impairments and math: 'impact of practice on achievement and attitude". The previous study revealed that the achievement in mathematics among blind and severely visually impaired persons is, and has always been extraordinarily low" compared to students with sight. The previous study further highlighted that students could only improve if the individual needs of the learners in a classroom are taken care of. In similar manner, the current study discovered that students with visual impairment performed poorly because the lecturers did not take care of individual needs of the students.

The findings of the current study were in line with the conceptual framework which stressed that if the individual needs of the students are not taken care of the performance of the students with

visual impairment in mathematics could be low. The study discovered that the lecturers did not care about the absence of the sense of sight in the students with visual impairment and the remedies that could have compensated on the loss of the sense of sight.

In this vein, it is the researcher's view that students performed poorly in mathematics due their loss of the sense of sight and lecturers did not take care of the students' individual needs. If interventions to compensate on the loss of sense of sight were put in place, students with visual impairment would have performed better in mathematics.

### 5.1.4 **The Lecturers' Attitudes**

The findings of this study concerning the academic performance and the lecturers' attitude towards the visually impaired students in learning mathematics indicated that the relationship and attitudes of lecturers towards students with visual impairment was not good, student rights were infringed upon by the lecturers and lecturers had no love for the visually impaired students, lecturers did not help students in mathematics lessons. For example, this was found in the participants' responses in the following statements.

The findings of the current study concerning the lecturers' attitudes towards the students with visual impairment were in consistence with the findings of Athanasius etal, (2009) who conducted a research on 'students with visual impairments in higher education institutes in Thessaloniki, Macedonia. The previous study indicated that students with visual impairments faced several structural and attitudinal barriers from teachers when entering higher education and this could result of academic failure or withdrawal from a course or school. On a contrary base, the students with visual impairment in the colleges of education under the study continued learning mathematics despite being ignored and labelled as time wasting students.

Additionally, the findings of the current study were in line with Allan (2008) model which stressed that if students receive low cooperation and attention from the teachers, their learning is totally distorted. Furthermore, the findings of the current study showed that students with visual impairment received little or no attention in classrooms as compared to their sighted counterparts who were actively involved in learning and this in turn made them to encounter reduced academic performance in mathematics.

In this regard, it is the researcher's assessment that if the lecturers develop negative attitudes towards the students with visual impairment, students' academic performance could be negatively affected.

### 5.2 **Instructional Approaches in Teaching Mathematics**

The study revealed that the instructional approaches used during mathematics heavily relied on expository, demonstration, question and answer as well as group discussion method which demanded the use of the sense of sight for the students to grasp the concepts. The approaches posed challenges on students with visual impairment and they hindered academic performance of the students with visual impairment. These findings were reflected in some of the responses from the participants. For instance one lecturer from college of education [B] explained that, *"students with visual impairment perform poorly in mathematics because the instructional approaches used during the learning process were dependent on the use of sight which is absent in the students with visual impairment.* Another lecturer handling students with visual impairment stated that, *"I usually use expository method to teach these students because I know that everyone has got ears.*

The findings of this research were not in line with the findings of Malasig and Dake, (2015) who conducted a research on review of literature: mathematics instruction for students with visual impairments' in New Jersey in the United States of America. The researchers revealed that students with visual impairment have the potential in mathematics achievement at par with their non-disabled peers if educated appropriately for their needs especially if the instructional approaches to be used involved the other remaining senses. The researchers further disclosed that instructional practices or strategies have been key to good academic performance by students with visual impairment in mathematics. However, the current study discovered that the instructional approaches used in learning mathematics involved the use of the sense of sight which was absent in students with visual impairment.

The findings of the current study correlated with the findings of Kerri and Johnson (2017) who conducted a study on educating Students with Visual Impairments in the General Education Setting. The previous study indicated that students with visual impairments require specific interventions and modification of the methods used because children with visual impairments

can learn, but the access of their visual senses is impaired, as such, they require different ways to interact with information, relying on touch, taste, and hearing to gather information.

The findings of the current study were contrary to the theoretical framework on the academic performance of the students with visual impairment in mathematics in selected colleges of education which highlighted that students with visual impairment could learn mathematics well if the instructional approaches used involve the other senses. The research findings showed that the students with visual impairment were not exposed to instructional approaches which relied on using other senses apart from the sense of sight and hearing.

The research findings also contradicted with the theoretical framework guided by Path-smoothing model designed by Alan (2008). The model stresses the essential methodology make a smooth path for the learner to learn Mathematics. The findings of the current study showed that the methodology or instructional approaches used in learning mathematics did not make a smooth path for the students with visual impairment in learning mathematics especially that the approaches used indirectly demanded for the use of the sense of sight which was absent in the students with visual impairment. Furthermore, the study also found that the expository method was lecturer-centered as it did not make these students with visual impairment participate during the lessons as a result; there was less excitement, motivation or interest in the lesson on the part of these students. The students with visual impairment easily forgot what was taught to them when expository method was used. When expository method was used, the students with visual impairment only got the general idea about the lesson and not the detailed information. Expository method did not help the students with visual impairment develop self-confidence because the method made them depend heavily on lecturers to provide them with all the academic knowledge, mathematical concepts and skills for their academic success.

It is the researcher's view that the students with visual impairment did not learn mathematics effectively due to the instructional approaches used which indirectly stressed the use of the sense of sight and hearing. If the methods used in learning of mathematics had to involve other remaining senses, students with visual impairment would have learnt mathematics effectively and their academic performance would have being outstanding.

### 5.2.3 **The Instructional approaches used in learning mathematics**

The study findings concerning the instructional approaches used in mathematics to the students with visual impairment revealed that the lecturers relied heavily on expository, demonstration, question and answer as well as group discussion method. The study also showed that the instructional approaches used indirectly demanded the use of the sense of sight and the lecturers had no skill to handle the visually impaired students efficiently. These findings were reflected in the following participants' responses. For instance, one student from college of education [A] indicated that '*the approaches used in mathematics lessons involved the use of the sense of sight and this prevented us from learning because we don't have the sight.'* Another student from college of education [A] said that '*using demonstration approach alone in teaching mathematics is a mockery because the approach favours those students with sight.*

The findings of the current study correlated with Kiarie (2004) who carried out a research on education of students with visual impairments in Kenya. The findings of the previous study indicated that obstacles also exist in the area of adaptations of instructional approaches for students with visual impairments and some subjects such as biological sciences and mathematics, studied in the secondary schools have had instructional approaches used stressing the use of the sense of sight and this made it extremely hard for students with visual impairment to access the general education curriculum. The findings of the current study also discovered that learning of mathematics became challenging to the students with visual impairment because the instructional approaches used relied comprehensively on the use of two senses namely the sense of sight and the sense of hearing despite the sense of sight being absent in the students under the study.

The findings of the study indicated that there was less participation on the part of these students with visual impairment when approaches like group discussion and question and answer were used because different abilities made group work difficult for them as the discussions were dominated by few individuals who were intelligent or were bullies. Furthermore, group discussions were characterized by lack of monitoring by the lecturers and students with visual impairment remained dormant during the discussions.

The current study findings contradicted with the conceptual framework which stressed that lecturers teaching students with visual impairment should focus on using different instruction

approaches such as tactile method and other methods in which other senses are used such as hearing, taste and smell, in order to reduce some challenges the visually impaired students encounter in mathematics. The conceptual framework further highlights that approaches should include the correct use of vocabulary and interpretation and use of symbols, images and diagrams with tactile features. The current findings showed that the use of touch was totally ignored and the use of teacher centered approaches applied frequently during mathematics lessons. This finding is also supported by Zebehazy (2014) who stated that lecturers teaching the students with visual impairment should engage their students by providing tactile, visual and auditory information because they convey their mood through touch expressions, tone of voice, giving directions and touching or holding their hands.

In this regard, it is the researcher's view that if the instructional approaches involved the use of touch and Braille as medium of instruction, students with visual impairment could learn mathematics effectively and their academic performance could improve.

### 5.3. **Best Practices in Teaching Mathematics among the Students with Visual Impairment**

The best practices that were suggested to be used when teaching mathematics to the students with visual impairment were discussed under the following themes: instructional materials, instructional approaches, academic performance and the lecturers' attitudes towards the students with visual impairment.

#### 5.3.1. **Instructional Materials**

The study findings on the best practices concerning the instructional materials in teaching mathematics to students with visual impairment at colleges of education revealed that, there was need for the lecturers to use adaptive instruction materials, teaching and learning materials which involve touch, sense of touch combined with sense of hearing, making braille as a medium of instruction and using prerecorded lessons. These findings were recorded in the following responses from the participants. For example, a student with visual impairment from college of education [A] suggested that '*adaptive instructional materials could be of great help to me during mathematics lessons.'* Another student from college of education [B] said that '*the use of*

*teaching and learning materials which involve touch could help us learn mathematics effectively.'*

The findings of the current study on instructional materials used when teaching mathematics to the students with visual impairment at colleges of education were in line with Brawand and Nicole (2016) who conducted a research on effective methods for delivering mathematics instruction to students with visual impairment in Kutztown Canada. The previous researchers disclosed that some challenges that students with visual impairment encounter when learning mathematics could be overcome when the content is taught in an appropriate manner, such as by using adaptive materials. The researchers also pointed out that the use of adaptive materials such as the abacus, the Nemeth Code for braille mathematics and the tactile graphics, or "graphics intended to be read principally by touch rather than vision.

The findings of the current study on instructional materials used in teaching and learning mathematics to the students with visual impairment were contrary to theoretical framework of the Path-smoothing model designed by Alan (2008) which stressed that the appropriate instructional materials students with visual impairment requires a combination of the abacus, braille codes, tactile materials, and concrete materials to teach mathematics skills to students with visual impairment. However, the current study discovered that the instructional materials used in teaching mathematics did not involve the use of touch and neither did the lecturers bring concrete objects during mathematics lessons.

It is the researcher's view that if the lecturers had used adaptive instructional materials, teaching and learning materials which involved touch, sense of touch combined with sense of hearing, making braille as a medium of instruction and using prerecorded lessons, students with visual impairment would have learnt mathematics efficiently and academic performance could improve.

### 5.3.2. **Instructional Approaches**

The finding of the current study on the best practices in terms of instructional approaches which could be used to teach mathematics to the students with visual impairment indicated that lecturers should avoid using approaches which stressed the use of the sense of sight, teaching approaches to be modified according to the needs of the visually impaired students, lecturers to

use recorded lessons and Brailed material to be used when using demonstration method. The study findings were reflected in the following responses from the respondents. For instance, one student from college of education [A] indicated that '*the approaches to be used in mathematics lessons should involve the use of other remaining senses.'* Another student from college of education [A] suggested that '*using demonstration approach alone in teaching mathematics is only fair to those students with sight, instead the approaches which involves other senses must be used.'*

The findings of the current study on instructional approaches correlated with the findings of Penda et al, (2015) who conducted a research on the challenges in teaching learners with visual impairment in Zambia. The findings of the previous researchers indicated that using traditional teaching methods impeded the way learners with visual impairment acquired academic skills. The current study findings discovered that instructional approaches such as expository method yielded forgetfulness and passiveness among students with visual impairment as they learnt mathematics.

It is the researcher's point of view that if the lecturers had avoided using approaches which stressed the use of the sense of sight, teaching approaches to be modified according to the needs of the visually impaired students, lecturers to use recorded lessons, Brailed material to be used when using demonstration method, students with visual impairment would have learnt mathematics very well and their academic performance could have improved.

### 5.3.3**. Academic Performance of Learners with Visual Impairment**

Concerning the academic performance of students with visual impairment in mathematics, the study findings indicated that all the students with visual impairment performed poorly in mathematics during classroom activities as well during public examinations. These findings were reflected in the following statements. For example one student with visual impairment from college of education [A] indicated that *'I have not scored above 40% in all the mathematics tests I have written so far but I can still improve if I am given individual attention.'* Another student from college of education [A] said that *'I don't perform well in mathematics but the chances of improving are there if the lecturers are able to monitor my progress in classroom activities especially during the learning process.'*

The findings of the current study on the academic performance of students with visual impairment in mathematics correlated with the findings of Megan (2012) who carried out a research in Michigan in the United States of America on "students with visual impairments and math: 'impact of practice on achievement and attitude". The researcher reveals that the achievement in mathematics among blind and severely visually impaired persons is, and always has been extraordinarily low" compared to students with sight. The previous study further highlighted that there are many reasons for low academic performance including the visual nature of math, delayed development of concepts needed to understand math and lack of necessary knowledge among teachers of students with visual impairments. However, students with visual impairment have the capacity to learn mathematics if all the necessary logistics are put in place. The current study also discovered that the students with visual impairment performed poorly in mathematics due to the use of inappropriate instruction materials and approaches as well as negative attitudes of the lecturers towards the students with visual impairment.

It is the researcher's view that if the students with visual impairment were given individual attention, monitored their progress in classroom activities, allowed to use 'touch' in their learning, if the instructional materials and approaches are modified according to the students' needs, the performance of the students with visual impairment in mathematics could improve.

### 5.3.4. **The Lecturers' Attitudes**

The findings of this study on the best practices concerning the lecturers' attitude towards students with visual impairment in learning mathematics showed that showing love and care, building students' self-esteem, providing independent learning methods, modifying instructional approaches to be of great help in improving the academic performance of the students with visual impairment in mathematics. These findings are shown in the following responses. For instance, a student from college of education [A] confirmed that *'If lecturers have love for the students with visual impairment we can perform very well in mathematics*. Another student from college of education [A] stated that *'I have not received any love from our mathematics lecturer but other students and I with visual impairment need to be loved and be treated equally like our sighted peers.'*

The findings of the current study were in line with the findings of Chengeti, (2015) who conducted a research in Kalulushi and Kitwe, Zambia and his research was on the perception of students and teachers on learning mathematics by students with visual impairment in secondary schools. The previous research findings revealed that traditionally, the general attitude for the visually impaired people in many societies had negative connotations. In a classroom situation, the researcher disclosed that there is a social stigma on students with visual impairment an attribute which impedes their academic, social and economic welfare. The current study findings unveiled that students with visual impairment and the blind have been made to suffer more by being brought in a regular program where lecturers feel that they are just a sheer wastage of time and mostly visually impaired student were treated like abnormal students in these colleges and as people who could not learn mathematics. .

The findings of the current study correlated with Alan's (2008) Path-smoothing model which stressed that it is believed that the teacher plays a vital role in academic performance of the learners with visual impairment and even those without impairment. The model further highlighted that if teachers have negative attitudes towards learners with visual impairment and consider them as people who cannot perform well in mathematics would affect their performance. Nevertheless, the findings of the current study discovered that the students with visual impairment received little or no attention in classrooms as compared to their sighted counterparts who were actively involved in learning and for this reason, the students with visual impairment encountered reduced academic performance in mathematics. The study further showed that the lecturers rated learners with visual impairment low in cooperation, academic competences and having greater problems of behavior than their sighted counterparts and these attitudes deprive the learners' right to education and hindered the self-esteem of the students with visual impairment. In this regard, it is believed that these attitudes negatively affected the academic performance of learners with visual impairment.

In similar vein, it is the researcher's view that if the lecturers' attitude towards students with visual impairment in learning mathematics showed love and care, built students' self-esteem, provided independent learning methods, teaching approaches to be modified, the academic performance of the students with visual impairment could improve.

## 5.4 **Summary**

This chapter discussed the findings of the study according to different categories of themes which were in line with the objectives which were set in this study. The current findings concerning the academic performance of students with visual impairment in mathematics during classroom activities as well during public examinations indicated that the students performed poorly in class activities despite attending lessons and this was due to lack of sight and that the students were neglected and ignored. The findings of the current study concerning the instructional approaches used during mathematics lessons showed that the lecturers relied heavily on expository, demonstration, question and answer as well as group discussion method, the instructional approaches used indirectly demanded the use of the sense of sight. It was discussed from the research findings that lecturers had no skill to handle the visually impaired students efficiently. The chapter also highlighted that the instructional materials used during mathematics lessons in colleges of education were not adaptive instructional materials and did not involve the use of the sense of touch combined with the sense of hearing. Furthermore, it was discussed that Braille was not used as the medium of instruction and the use of prerecorded lessons was totally omitted. This chapter also highlighted that the lecturers' attitude towards the visually impaired students in learning mathematics was not good and the students' rights were infringed upon by the lecturers. It had been discussed that lecturers expressed no love for the visually impaired students and lecturers did not help students in mathematics lessons and this eventually impeded the academic performance of students with visual impairment in mathematics at colleges of education.

# CHAPTER SIX

# CONCLUSION AND RECOMMENDATIONS

## 6.1. Overview

This chapter presents the conclusion and recommendations of the study. The chapter concludes the research findings on the academic performance of students with visual impairment in mathematics at selected colleges of education. The chapter also outlines the recommendations for the current study and recommendations on areas for further studies. The conclusions on the recommendations will be according to the research findings and objectives.

## 6.2 Conclusion

It was evident from the findings that learners with visual impairment performed poorly in mathematics at two selected colleges of education. The current findings concerning the academic performance of students with visual impairment in mathematics during classroom activities as well during public examinations indicated that the students performed poorly in class activities despite attending lessons and this was due to lack of sight and that the students were neglected and ignored. The study also revealed that the instructional approaches used during mathematics lessons relied heavily on expository, demonstration, question and answer as well as group discussion method which indirectly demanded the use of the sense of sight. It was discovered from the study that lecturers had no skill to handle the visually impaired students efficiently and this affected the academic performance of the students with visual impairment. This study also unveiled that the instructional materials used during mathematics lessons in colleges of education were not adaptive and did not involve the use of the sense of touch combined with the sense of hearing. Furthermore, the study discovered that Braille was not used as the medium of instruction and the use of prerecorded lessons was totally absent in mathematics lessons. This study also discovered that the lecturers' attitude towards the visually impaired students in learning mathematics was rather negative and the students' rights were infringed upon by the lecturers. The lecturers showed little or no love for the visually impaired students and lecturers did not help students in mathematics lessons. This eventually impeded the academic performance of students with visual impairment in mathematics at colleges of education.

## 6.3. **Recommendations**

In view of the findings and conclusions, the study made the following recommendations;

### Lecturers

1. Lecturers should use adaptive instruction teaching and learning materials which involved touch, sense of touch combined with sense of hearing.
2. Braille should be made as a medium of instruction in all lessons where students with visual impairment are present.
3. Lecturers should use prerecorded lessons to allow students with visual impairment go through what is to be learnt a day before the content is taught.
4. Lecturers should modify the instructional approaches according to the individual needs of the visually impaired students.
5. Lecturers should show love and care to students with visual impairment and build students' self-esteem.

### Colleges of Education

6. Colleges to recommend and train lecturers in special education so that they can acquire relevant knowledge and skills to handle students with special education needs.

### Further Research

The study on the academic performance of students with visual impairment in mathematics would be necessary to establish the performance of these students at colleges of education. Since the study was conducted in two selected colleges of education in Zambia, it is important to carry out a similar study in all the colleges of education in Zambia.

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## APPENDICES

## APPENDIX A: STUDENTS' SEMI STRUCTURED INTERVIEW GUIDE FOR STUDENTS WITH VISUAL IMPAIRMENT

## SUBJECT: THE ACADEMIC PERFORMANCE OF STUDENTS WITH VISUAL IMPAIRMENT IN MATHEMATICS AT M.S AND M.C

Dear Respondent,

This interview is designed to collect information from students experience in terms of academic performance of in mathematics at colleges of education. This study intends to establish the academic performance of students with visual impairment in Mathematics at colleges of Education, to investigate instructional approaches used to teach Mathematics to students with visual impairments and to establish best practices for students with visual impairments in terms of their academic performance in Mathematics. You are purposely selected to answer the questions in this discussion or interview. Please, note that the research being conducted is strictly for academic purpose and as such, its findings or information provided will be treated with confidentiality. May you please supply answers as truthfully and sincerely as possible?

1. **The Academic Performance**

   **Instructional Materials**

   i. Are you given Brailled teaching and learning materials when learning mathematics? If so how do you learn? If not what challenges do you face?
   ii. During mathematics lectures, are you given materials which are in large prints? If not, how do you manage to study?
   iii. If teaching materials are not labeled in Braille, what difficulties do have while learning mathematics at colleges of education?
   iv. What difficulties do you face when the lecturer is just explaining mathematical concepts without providing the teaching/learning materials to you?
   v. What types of difficulties do you face to learn what is being demonstrated in mathematics?

**Instructional Approaches**

i. When you are not given extra time to complete your tasks during mathematics, does it affect your academic performance? If so how?
ii. If you are not given instructions in written form using Braille, does it affect your performance in mathematics? If so how?
iii. Do you use the sense of touch to fill the embossed or raised numbers

**Academic Performance**

i. When Lecturers are teaching mathematics, are you able to learn?
ii. Which methods help you learn mathematics better? Is it when lecturers do demonstrations accompanied by writings on the board, put you in groups or when they explain mathematical concepts?
iii. Since you are unable to observe lecturer demonstration during mathematics lectures, how do you learn the concepts being taught?
iv. Do you use other senses to learn mathematics apart from the sense of sight? If so which ones?
v. Are they the ones who are not committed?

**Lecturers' Attitude**

i. Do lecturers concentrate on using modified materials?
ii. Do lecturers use same syllabus they use when teaching the sighted ones?
iii. Do lecturers show positive attitude when teaching?

**Instructional Materials**

i. Do you learn better when you are able to touch the teaching materials?
ii. Are you given tape recorded materials a day before a lesson?
iii. When learning mathematics, are you given extra time to complete your tasks?
iv. Are you given instructions in written form using Braille?

**Instructional Approaches**

i. When lecturers are teaching mathematics are you able to learn
ii. Which method help you learn mathematics learn better
iii. Is it when lecturers do demonstration accompanied by writings on the board
iv. Do lecturers put you in groups when learning mathematics

**Academic Performance**

i. Do you perform well in mathematics? If not what challenges hinders yours performance?
ii. Are you able to complete favorably in mathematics with your sighted peers?
iii. What types of difficulties do you face to learn what is being demonstrated in mathematics?
iv. If teaching materials are not labeled in braille what difficulties do you have while learning mathematics at colleges of education?

**Lecturers' Attitude**

i. Do lecturers use collect approaches when handling students with visual impairment
ii. Are the teaching and learning instructions modified?
iii. What are the best instructional approaches to use when teaching the visually impaired students?

**1. Best Practices**

**Instructional Materials**

i. What are some of the tools you are using at this college to learn mathematics?
ii. Is the lecturer of mathematics conversant in using the tools? If yes how?
iii. Are the braille materials enough to curter for all the visually impaired students?
iv. Are the lecturers using adaptive teaching and learning materials?

**Instructional Approaches**

i. What could be the best way to learn mathematics since you are not able to see?
ii. Which learning/teaching materials can be of help to you when learning mathematics?
iii. Is the use of other senses beneficial to you when learning mathematics? If so how?

iv. Are the instructional approaches modified when given to you?

v. Which of the senses do you prefer to uses when learning mathematics at college level?

**Academic Performance**

i. Is the extra time beneficial to you in learning if so how?

ii. Which of the senses do you prefer to use when learning mathematics?

iii. Do you use other senses to learn mathematics apart from the sense of sight? If so which ones?

iv. What types of difficulties do you face to learn in an inclusive setup?

v. Do lecturers modify questions when assessing you?

**Lecturer's Attitude**

i. When lectures are teaching mathematics are you able to learn?

ii. Since you are an able to observe lecture demonstration during mathematic lectures how do you learn the concepts being taught?

iii. Have you noticed some challenges from lecturers who teach mathematics?

## APPENDIX B:

**Observation Checklist for Lecturers/Students**

**ACADEMIC PERFORMANCE OBSERVATION CHECK LIST FOR LECTURERS/ STUDENTS FOR THE CASE STUDY**

**INSTRUCTION: THE RESEARCHER WILL BE TICKING TO SHOW PRESENCE OR ABSENCE OF THE EXPECTED CHARACTERS IN THE CLASSROOM SITUATION RESPONSES, WHERE POSSIBLE THE RESEARCHER WILL WRITE COMMENTS FOR EACH OBSERVED CHARACTER.**

Dear Respondents,

This observation is designed to collect information from lecturers'/students experience in terms of academic performance of students with visual impairment in mathematics at colleges of education. This study intends to establish the academic performance of students with visual impairment in Mathematics at colleges of Education, to investigate instructional approaches used to teach Mathematics to students with visual impairments and to establish best practices for students with visual impairments in terms of their academic performance in Mathematics.

You are purposely selected to answer the questions in this discussion. Please, note that the research being conducted is strictly for academic purpose and as such, its findings or information provided will be treated with confidentiality. May you please supply answers as truthfully and sincerely as possible?

**SUBJECT:** AN **INVESTIGATION OF ACADEMIC PERFORMANCE OF STUDENTS WITH VISUAL IMPAIRMENT IN MATHEMATICS AT COLLEGES OF EDUCATION.**

1. **Academic Performance of Students with Visual Impairment**

   **Academic Performance**

(i) Students with visual impairment do not perform well academically in classrooms when doing exercises in mathematics. Yes ☐ NO ☐

(ii) Students with visual impairment perform poorly in mathematics as compared to their sighted peers Yes ☐ NO ☐

(iii) Learning methods affecting academic performance Yes ☐ NO ☐

(iv) Non-adaptive learning materials affecting academic performance Yes ☐ NO ☐

**Instructional Approaches**

**A. Students with Visual Impairment Learn Using**

(v) Explanation Yes ☐ No ☐

(vi) Demonstration Yes ☐ No ☐

(vii) Discussion method Yes ☐ No ☐

(viii) Students engaged in group discussion Yes ☐ No ☐

(ix) Lecturer using best adaptive methods Yes ☐ No ☐

**B. Lecturers Attitude**

(i)Touch Yes ☐ No ☐

(ii) Smell Yes ☐ No ☐

(iii)Taste Yes ☐ No ☐

**C. Instructional Materials**

Students with visual impairment learn well using

(i) Brailed material Yes ☐ No ☐

(ii) Students with visual impairment learn in isolation Yes ☐ No ☐

(iii) Large prints Yes ☐ No ☐

(iv) Real objects Yes ☐ No ☐

**Best Practices**

**Instructional Materials**

A. Students with visual impairment learn mathematics using

(i) raised teaching/learning materials Yes ☐ No ☐

(ii) raised diagrams Yes ☐ No ☐

(iii) real objects Yes ☐ No ☐

(iv) materials which are in large prints Yes ☐ No ☐

(v) Multisensory learning strategies Yes ☐ No ☐

**Instructional Approaches**

(i) Lecturer acquainted with the skills to handle students with visual impairment

(ii) Lecturer taking care of individual pupil's needs **Yes** ☐ **No** ☐

(iii) Lecturer gives instructions in written form using Braille. **Yes** ☐ **No** ☐

(iv) Lecturer give extra time to students with visual impairment to complete tasks during mathematics **Yes** ☐ **No** ☐

(v) Student using the remaining senses to acquire mathematical skills **Yes** ☐ **No** ☐

**Academic Performance**

(i) Students with visual impairment given extra time when learning mathematics at colleges Of education. **Yes** ☐ **No** ☐

(ii) Lecturer gives instructions in written form using Braille. **Yes** ☐ **No** ☐

(iii) Students with visual impairment learn mathematics in groups. **Yes** ☐ **No** ☐

**Lecturer's Attitude**

(i) Lecturer using adaptive teaching/learning materials **Yes** ☐ **No** ☐

(ii) Lecturer encouraging students to use other senses to learn mathematics **Yes** **No** ☐

(iii) The teaching giving extra time to students with visual impairment during mathematics.

**Yes** ☐ **No** ☐

## APPENDIX C:

## FOCUSED GROUP DISCUSSION FOR LECTURERS HANDLING STUDENTS WITH VISUAL IMPAIRMENT AT COLLEGES OF EDUCATION

## ACADEMIC PERFORMANCE GROUP DISCUSSION FOR THE CASE STUDY

**SUBJECT:** AN **INVESTIGATION OF ACADEMIC PERFORMANCE OF STUDENTS WITH VISUAL IMPAIRMENT IN MATHEMATICS AT COLLEGES OF EDUCATION**

Dear Respondents,

This discussion is designed to collect information from lecturers' experience in terms of academic performance of students with visual impairment in mathematics at colleges of education. This study intends to establish the academic performance of students with visual impairment in Mathematics at colleges of Education, to investigate instructional approaches used to teach Mathematics to students with visual impairments and to establish best practices for students with visual impairments in terms of their academic performance in Mathematics.

You are purposely selected to answer the questions in this discussion. Please, note that the research being conducted is strictly for academic purpose and as such, its findings or information provided will be treated with confidentiality. May you please supply answers as truthfully and sincerely as possible?

**The Academic Performance**

**Instructional Materials**

i. Do students with visual impairment perform well in mathematics? If not what challenges do they face?
ii. Are they able to compete favorably in mathematics with their sighted peers?
iii. Are students given Brailed teaching and learning materials when learning mathematics? If so how do they learn? If not what challenges do they face?

iv. During mathematics lectures are the students with visual impairment given materials which are of large prints? If so how do they manage to study?

v. If teaching materials are not labeled in Braille, what difficulties do students with visual impairment have while learning mathematics at colleges of education?

**Instructional Approaches**

i. What difficulties do students with visual impairment face when the lecturer is just explaining the concepts without providing the teaching/learning aids?

ii. What types of difficulties do students with visual impairment face to learn what is being demonstrated in mathematics?

iii. When the students with visual impairment are not given extra time to complete their tasks during mathematics, does it affect their academic performance? If so how?

iv. If students with visual impairment are not given instructions in written form using Braille, does it affect their performance in mathematics? If so how?

**Academic Performance**

i. When you are teaching mathematics, are students with visual impairment able to learn?

ii. Which methods help the students with visual impairment learn mathematics better? Is it when lecturers do demonstrations accompanied by writings on the board, put students in groups or when you explain mathematical concepts to the students?

iii. Since students with visual impairment are unable to observe lecturer demonstration during mathematics lectures, how do they learn the concepts being taught?

iv. Do students with visual impairment use other senses to learn mathematics apart from the sense of sight? If so which ones?

**Lecturers' Attitude**

i. Do students with visual impairment learn mathematics better when they are able to touch the teaching materials?

ii. Are the students with visual impairment given tape recorded materials a day before a lesson?

iii. When learning mathematics, are students with visual impairment given extra time to complete their tasks?

iv. During mathematics lessons, are students with visual impairment given instructions in written form using Braille?

**Best Practices for Students with Visual Impairment in terms of their Academic Performances**

**Instructional Materials**

i. What could be the best way for the students with visual impairment to learn mathematics
ii. Since they are not able to see?
iii. (b) Which learning/teaching materials can be of help to the students with visual impairment
iv. When learning mathematics?

**Instructional Approaches**

i. Is the use of other senses beneficial to the students with visual impairment when learning
ii. Mathematics? If so how?
iii. Which of the senses do they prefer to uses when learning mathematics at college level?
iv. Is the extra time beneficial to the students with visual impairment when learning
v. Mathematics? If so how?

**Academic Performance**

i. When you are teaching mathematics are the students with visual impairment able to learn?
ii. Which methods help them learn better
iii. Are students with visual impairment able to learn mathematics?

**Lecturer's Attitude**

i. Do you give attention to individual learners?

ii. Do you give tape recorded materials to students?

iii. During mathematics lessons are the learners given instructions in braille?

**THANK YOU FOR YOUR PARTICIPATION**

## APPENDIX D


### Research Ethics Consent Form

**Name of Participant:** _____

**Title of Research:** To explore learners with the condition of down-syndrome and its impact on their academic performance at one school and hospital unit in Kitwe

Contact Details of Main Researcher: 0978829566

Members of research team (if applicable): NIL

1. I agree to take part in the above research. I have read the Participant Information Sheet which is attached to this form. I understand what my role will be in this research, and all my questions have been answered to my satisfaction.
2. I understand that I am free to withdraw from the research at any time, for any reason and without prejudice.
3. I have been Sign formed that the confidentiality of the information I provide will be safeguarded.
4. I am free to ask any questions at any time before and during the study.
5. I have been provided with a copy of this form and the Participant Information Sheet.

Data Protection: I agree to the University processing personal data which I have supplied. I agree to the processing of such data for any purposes connected with the Research Project as outlined to me.

Name of participant

(print)……

Signed…… Date…….....

If you wish to withdraw from the research, please complete the form below and return to the main investigator named above.

Title of Project: _____

**I WISH TO WITHDRAW FROM THIS STUDY**

Name: ……..... Signed ……

Date:……

Appendix E Introductory Letter

KWAME NKRUMAH UNIVERSITY

DIRECTORATE OF RESEARCH AND POSTGRADUATE STUDIES

P.O.BOX 80404, KABWE, ZAMBIA

Website: www. nkrumah.edu.zm

PHONE:0977897325/0967507131

TEL/FAX: 021 5-223223.

**March 10, 2020**

**TO WHOM IT MAY CONCERN**

**Introduction Letter: Chidongo Phenny (Student No. 120180007)**

This serves to introduce the above named as bona fide student of Kwame Nkrumah University in Kabwe. She is a Postgraduate Student in the School of Education and pursuing **Master's Degree in Special Education.** Ms.Chidongo is working on the topic **"Learners With The Condition Of Down Syndrome And Its Impact On Their Academic Performance"** in her research, which is partial fulfillment of the Master of Education Special Education Degree requirements for graduation. As part of her research, she will need to collect information regarding her subject of interest from **institutions such as yours,** as well as from the general members of the public. She has chosen to visit your institution for this purpose. The data she will gather will strictly and purely be used for academic purposes only, i.e. to enable her write a research paper that will culminate in a Master's dissertation which will be submitted to the University upon completion.

Any favourable assistance rendered to her will be highly appreciated.

Thank you in advance.

Yours sincerely,

Dr. Hachintu Joseph (Phd)

**Director: Research & Postgraduate Studies**