CHALLENGES FACED BY MATHEMATICS TEACHERS IN TEACHING SECONDARY SCHOOL LEARNERS WITH VISUAL IMPAIRMENT IN THE KHOMAS REGION

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APPROVAL PAGE

This research has been examined and approved as meeting the required standards for partial fulfilment of the degree of Master of Education requirements.

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LIST OF ABBREVIATIONS AND ACRONYMS

ETSIP:	Education Training Sector Improvement Progress
IE:	Inclusive Education
LSN:	Learners with Special Needs
LVI:	Learners with Visual Impairment
MEAC:	Ministry of Education, Arts and Culture
MOE:	Ministry of Education
MiET:	Media in Education Trust
NCTM:	National Council of Teachers of Mathematics in Namibia
NEID:	National Institute of Educational Development
SVI:	School of the Visually Impaired
SPSS:	Statistical Package for Social Science
USA:	United States of America

ABSTRACT

In recognising the importance that Mathematics as a subject play in fulfilling the Namibian Vision 2030, the Ministry of Education, Arts and Culture (2010) made Mathematics a compulsory subject in schools in the year 2012 for all learners at the Senior Secondary School level, including learners with visual impairment (LVI). Hence, this study's primary purpose was to investigate the challenges faced by Mathematics teachers in the Khomas region when teaching learners with visual impairment in a Special Secondary School in Namibia. This study employed Bruner's theory of constructivism as a theoretical foundation. Furthermore, the study adopted a qualitative approach with a case study research design, in which one secondary school was selected as a research site. The study sample consisted of six participants: two Mathematics teachers from Grades 8-10 and four Grade 8-10 learners with visual impairment. The participants were purposively selected using a homogeneous sampling strategy to describe the visually impaired learners' subgroup for this study. An observation schedule and a semi-structured interview guide were used as data collection instruments. The study revealed that Mathematics teachers at special schools have the knowledge, experience, and skills to teach Mathematics to visually impaired learners. However, changes in the teaching environment can affect the teaching and learning process. If the curriculum's implementation is not well planned, it can be difficult for teachers at special schools to teach effectively and efficiently as they have to go beyond ordinary teaching in the lesson's creativity. Hence, the study recommends effective teaching and learning at special schools and for learners with visual impairment. Furthermore, there should be teaching and learning materials accompanied by assistive devices.

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DECLARATION

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CHAPTER 1: INTRODUCTION AND BACKGROUND OF THE STUDY

1.1 Introduction

This Chapter discusses the study's background concerning the challenges faced by Mathematics teachers in teaching secondary school Learners with Visual Impairment (LVI) in the Khomas region, Namibia. It presents the problem statement and outlines the research questions, the study's purpose, and the study's significance. The limitations and delimitations of the study are also deliberated. Finally, critical terms used in the study are defined. Complete Loss of vision is defined as visual acuity of less than 3/60 (WHO, 2014). In this study, we will refer to LVI with complete loss of vision, to which, it refers to the complete loss of vision and where a learner would require the use of technological and assistive devices as well as pedagogical support in order to benefit from the teaching and learning process (Sheyapo, 2017).

1.2 Background of the Study

The Bantu education system in the colonial era incorporated in South Africa and Namibia segregated the natives from elites, and the idea was to differentiate these two as subordinate and master (Amukugo, 2017). Teaching and learning were more radical, less accommodating, and autocratic; therefore, there was no equitable education. However, just before independence, the Namibian education sector introduced a few special schools for the differently-able and segregated classrooms according to their conditions (Reshad, 2021). Although the colonial policies emphasized special needs education, isolation of special needs and mainstream learners was undesirable.

The early 1990s saw a massive transformation in the education sector, implementing primary education for all Namibians, including special needs learners. The introduction of the National Policy on Disability (1997) further cemented the above cause, as it aimed to award the same rights to education enjoyed by those without special needs to all children and youths with special needs (Mokaleng & Mowes, 2020). On the same footing, Chitiyo, Hughes, Haihambo, Taukeni, Montgomery and Chitiyo (2016) highlighted that the National Disability Policy emphasized providing education to all children, regardless of their differences. That meant all learners, regardless of their physical condition, could get the same teaching experience as other learners. For instance, classroom etiquette and learning are applied to every learner equally (regardless of their differences).

However, to further develop the education system of Namibia into a comprehensive education for all strategy which aligns with the global efforts of improved education, the Education Sector Policy on Inclusive Education was drafted in 2012 (Republic of Namibia, 2013). The policy gave all children the right to quality education regarding accessibility, inclusivity, equitability, efficiency and good quality, regardless of their circumstances (Republic of Namibia, 2018). Inclusive education would ensure a holistic approach to education for all children and youths without room for segregation. From 2013 onwards, the education sector has been riding on the IE mantra with many other contemporary policies and strategies supporting the exact cause.

Furthermore, Mathematics became a crucial subject in Namibian schools and was made compulsory in 2012 for all learners at the senior secondary school level, including LVI

(Ministry of Education Arts and Culture, 2013). The move to make Mathematics a compulsory subject was meant to aid Namibia's development of Science, Technology, and Commerce. Prior to that (before 2012), Mathematics was a compulsory subject for Grades 1 up to 10 learners in Namibia. The Namibian curriculum grouped Grade 11 and 12 subjects into four different fields of study as follows: Natural Science and Mathematics (Mathematics, Biology and Physical Science), Commerce (Accounting, Economics, and Business Studies), Technical (Design and Technology, Physical Science and Mathematics) and Social Sciences (History, Development Studies, and Geography). However, Natural Science, Mathematics, and technical fields had Mathematics as a compulsory subject. Learners from the other fields (Commerce and Social Sciences) had a choice to either take Mathematics or any other subject of their choice as an additional subject to their field of study (Ministry of Education, 2010). The above meant that Mathematics was a key player in the Namibian education system and a crucial subject for tertiary entry level on most programmes.

The Ministry of Education (MoE) (2010) noted that Mathematics is a language, thinking and communicating, which every person needs. In this regard, numerical skills are required in creating logical models for understanding, coupled with the ability to think in terms of relations of quantity, size, shape, space, and computations. As mentioned earlier, in January 2012, Mathematics was made compulsory for all learners from Grades 1 – 12 nationwide and thus has become part of all the fields of study in the National Curriculum for Basic Education (MoE, 2013).

Namibia educates learners with special needs (LSN) and various service provisions, including special schools, integration/mainstreaming, partial-inclusion, and full-inclusion (Chitiyo et al., 2016). Zimba, Mostert, Hengari, Haihambo, Mowes, Muetudhana and Mwoombola (2011) reported that inclusive education in Namibia relies on well-trained and motivated teachers, adequate teaching and learning materials and a flexible curriculum with the active participation of parents and the community at large. However, with teaching Mathematics to LVI, although some schools provide apparatus for these learners to be taught, challenges are still faced. Mathematics at the school level includes the frequent use of visual aids, drawing, and intangible representations and without apparatus such as Braille, there is no quality, equitable and efficient learning for LVI.

The irony is that there are few special schools for LVI and other conditions such that most learners are incorporated in mainstream education, a flow that comes with the IE policy (Mokaleng & Mowes, 2020). Learners are therefore forced to learn using the same methodologies (in some cases slightly different), to the disadvantage of the differently abled. In light of the above, UNESCO (2016) emphasised that LVI and other physical or mental conditions still experience barriers to accessing quality education. Therefore, IE has not yet fully guaranteed equitable and fair education for the disadvantaged in Namibia.

It is a fact that all learners, including LVI, can learn mathematical content and be successful in Mathematics if their needs are addressed (Tenti, 2006). However, in a recent study on assessing the challenges of IE in Namibia, the outstanding factors hindering inclusive education were a lack of teacher expertise with LSN and a lack of material for

LSN (McKinney, 2018). Therefore, this study explored the challenges faced by secondary school teachers when teaching Mathematics to LVI in the Khomas region, Namibia.

The selected school is in the Khomas region, specifically Windhoek. It is a relatively particular school with few learners such that the number of learners per class ranges from 8-12 learners with an average of 1 learner with complete loss of vision (LVI) per class group. Furthermore, the other learners in the class had different levels of visual impairment from partial to sighed learners, which comprised the majority and thus would look at them as partially inclusive. However, the school qualifies as a Special School regarding the availability of resources, special needs, the Braille subject offered at the school, and the ratio of teacher to learner in a class. The school has a few Braille machines/apparatus, but at the time of the study, none were working. In terms of learning, learners are mixed, and after the main class ends, LVI attend afternoon classes where the content taught before is transmitted for Braille illustrations to these learners.

1.3 Statement of the Problem

Education of people with disabilities is crucial because many do not have access to quality education. Hence, IE is attributed to incorporating people with disabilities in order for them to enjoy economic independence and eradicate poverty among them (Mphwina, 2022). In other words, IE fosters equity among learners in class, fairness and social justice for the marginalised/minority. The researcher has been a Mathematics teacher at an inclusive school that accommodated LVI from 2014 to 2019. However, in 2018, at this particular selected school, the Head of the Department for Mathematics and Science office

did not permit LVI to take Mathematics as a subject. This decision deviated from the government's effort towards Inclusive Education which has the mandate to stop segregation or deliberate exclusion of learners on academic performance, race, gender, health condition, disability, culture, religion and lifestyle (Republic of Namibia, 2013). Perhaps the decision was necessitated by the fact that there were inadequate resources and expertise for LVI to continue Mathematics in higher grades. Friend and Bursuck (2016) asserted that although inclusive education has yielded positive results in various aspects, inadequate infrastructure, lack of teaching and assistive aids, and inadequate knowledge of teachers were common in mainstream schools that offered services for people with disabilities.

Instead, LVI at the selected school were advised to take Computer Studies or History as supplementary subjects to replace Mathematics. The restriction of LVI to take up Mathematics further precipitated an infringement of their rights to equitable and quality education and an effort to ensure social justice in the education sector (Amukugo, 2017). Hence, because these learners did Mathematics from Grades 1-10 from the feeding schools, the researcher wanted to find out how teachers managed to teach them Mathematics at those feeding schools and their challenges. Therefore, due to the observed absence of skills needed to teach Mathematics in the year 2018 to LVI, this study explored the challenges faced by both Mathematics teachers and LVI in Mathematics.

1.4 Research Questions

In alignment with the purpose of this study, the following research questions were addressed:

1. What strategies are mathematics teachers using in teaching LVI at a selected school in the Khomas region?
2. What challenges do Mathematics teachers face in teaching LVI from grades 8 to 10 at a selected school in Khomas Region?
3. To what extent do LVI achieve the equity, social justice and fairness in learning specified for grades 8 to 10 in Mathematics?
4. What mitigation strategies ensure equity and social justice in teaching Mathematics to LVI at a selected school in Khomas Region?

1.5 Purpose of the Study

This study's primary purpose was to investigate the challenges that secondary school Mathematics teachers face in the Khomas region teaching learners with visual impairment. Specifically, an observation was done to know how Mathematics teachers were teaching learners with visual impairment in secondary schools. The study established the suitability of Mathematics resources for these learners and further identified relevant mathematics teaching strategies teachers could utilize when teaching LVI. In addition, the study focused on the challenges related to Mathematics teaching and learning processes of LVI.

1.6 Significance of the Study

The study results highlighted how teaching Mathematics is facilitated in mainstream schools for LVI, which could be applied in inclusive schools in Namibia. It may be ground for improving IE employing opening special schools for LVI and other conditions to ensure quality, equity, fairness, and social justice for all. The study's findings may significantly impact the teachers' continuous professional development, as the study gives insight into mitigating strategies to improve the teaching of LVI. Study results could also equip Mathematics teachers with skills to evaluate their teaching methods and assessment tasks. To the policymakers, the study can be helpful in the improvement of IE policies and future strategies to strengthen IE in Namibia.

Furthermore, policymakers could use the results and consider the importance of evaluating current practices at the national level. Parents could be informed from the study about the challenges faced by Mathematics teachers and their children (LVI), which can provide them with a decision-making base regarding access to quality, equitable and fair education for their children. Lastly, it is hoped that these findings could add to the existing literature and create knowledge gaps that call for future studies by other researchers.

1.7 Limitations of the Study

The study was only conducted at an unnamed mainstream school that accommodates LVI in Windhoek due to confidentiality, although this gave a general (non-specific) outlook of the case study. One school was chosen as a case study and one for a pilot study due to work commitment and financial constraints. The sample size was small, and the low numbers of LVI and other physical conditions in the school necessitated this. Time was

limited to cover all regions within Namibia that accommodated schools with LVI. The study findings were limited to the experiences of the secondary school Mathematics teachers and learners from the participating school only. Furthermore, the observation checklist (research instrument) had limitations as it changed the observed situation and the research bias (Brooks & Brooks, 1999). In this case, teachers that were observed might have changed their standard behaviour patterns to impress the researcher, and in an effort to eliminate these weaknesses, the observation was repeated for two or three consecutive lessons.

1.8 Delimitation of the Study

Delimitations are the boundaries the researchers would like to place their study (Eftekhar, nd). The study was limited to teachers of LVI undertaking Mathematics at a particular mainstream school in the Khomas region because classes accommodate LVI learners and teachers with experience with such a situation. Observations were done in two mainstream schools that offer services for LVI, one of which was for the pilot study and the other for the main study.

1.9 Definition of Terms

Learners with Special Needs (LSN): Learners who, because of disability, disease, medical condition, the physical or mental state, requires special treatment to facilitate his/her learning process and participation in social activities

Learners with Visual Impairment (LVI): LVI in this study refer to learners in high school who are directly affected by the loss of vision either moderately or severely, including those that can legally or educationally be classified as blind (Knouwds,2010; Josua, 2013).

The Braille Alphabet: The alphabet that people/persons with visual impairment use to take notes.

Nemeth Codes: Codes that show the mathematical notations in the Braille alphabet.

Special School: Schools that specialise in including children with a particular impairment in this study LVI. Resource centres also support 'non-specialised' inclusive schools to educate children with specific impairments in their community school, thus also known as centres of excellence in a particular area of education.

CHAPTER 2: THEORETICAL FRAMEWORK AND LITERATURE REVIEW

2.1 Introduction

This chapter reviews the literature under the headings: inclusive education, inclusive education in Namibia, teacher's attitude towards teaching Mathematics to learners with visual impairment (LVI), challenges faced by teachers teaching Mathematics to LVI, challenges faced by LVI in learning Mathematics, strategies used by Mathematics teachers in teaching LVI and ways to learning objectives by LVI and mitigating the challenges and the ensure equity, social justice and fairness in teaching Mathematics to LVI at a selected school. Due to limited literature in Namibia on the problem of interest, literature was drawn from studies done in other countries.

2.2 Theoretical Framework

This study is informed by Bruner's constructivist learning theory (1960), a general framework for instruction based on the study of cognition. Bruner's theory focuses on instruction, whereby the teacher encourages learners to discover principles themselves. The teacher and learner should engage in an active dialogue (i.e., Socratic learning); hence, in this study, learners with visual impairment should be engaged in active dialogue. The ideas outlined by Bruner (1960) originated from a conference that focused on Science and Mathematics learning. Bruner (1960) opposed Piaget's notion of readiness by arguing that schools waste time trying to match the complexity of subject material to a child's cognitive stage of development; as a result, teachers hold learners back at some point with specific topics and subjects such as Mathematics deemed challenging to understand taught when the learner reaches the appropriate stage of cognitive maturity. Mathematics as a

technical subject can be daunting for most students, let alone those with visual impairment, unless there are appropriate teaching aids and apparatus such as Braille.

Research further suggests that differentiation helps learners perform better in Mathematics at both basic and advanced levels (Kilpatrick, Martin & Schifter, 2003). However, mainstream schools that incorporate LVI fail to differentiate due to inadequate resources, lack of teacher experience in dealing with LVI and so forth; thus, active dialogue between LVI and teacher can be distorted at some point. Furthermore, Mathematics emerges as a critical school subject that determines success in life. Therefore, the National Council of Teachers of Mathematics (NCTM) (2000) posits that understanding and making sense of Mathematics is crucial to climbing the social ladder. In light of the above, NCTM (2000) highlights that in terms of Mathematics education, their ambition was to provide all students with equal opportunities to succeed in life and this context, including LVI, which has been evident in Namibia's tertiary institutions that require Mathematics as a prerequisite to enrol for many courses and job vacancies that ask for a pass in Mathematics for one to be employed. It could seem unfair for LVI to expect them to succeed in Mathematics if teachers are not trained to handle their needs and resources such as Braille are not readily available. Hence, one of the disadvantages of inclusive education in Namibia.

Bruner (1960) adopts a different view citing that a child of any age is capable of understanding complex information by stating, "We begin with the hypothesis that any subject can be taught effectively in some intellectually honest form to any child at any

stage of development" (p. 2). Bruner (1960) further explains how this hypothesis form of teaching was possible through the concept of the spiral curriculum. The spiral curriculum involved information structured so that complex ideas were taught at a simplified level first, then re-visited at complex levels later. Therefore, subjects such as Mathematics could be taught at levels of gradually increasing difficulty, hence the spiral analogy. Ideally, this way of teaching should lead to LVI being able to solve problems by themselves.

Bruner's constructivist theory (1960) further suggests that it is helpful to follow a progression; of enactive (action-based), iconic (image-based) and symbolic (language-based) representations when faced with new material. The suggestion above can be helpful when dealing with LVI. In the same vein, Ostad (2000) emphasised that meaningful Mathematics learning involves three types of experiences which are; concrete, semi-concrete and abstract. A substantial learning experience helps learners relate to manipulative objects and computational processes. Therefore, learners focus on manipulated objects and symbolic processes that accompany, correlate and describe the manipulation. Semi-concrete experiences are visual for children who can see, which include drawings, pictures and diagrams. Thus, Bruner's constructivist theory is helpful in this study of the challenges faced in teaching Mathematics to LVI. Since Mathematics is a complex subject, factors that make it better understood by learners are imperative to adopt.

According to Barbe, Swassing and Milone (1979), teachers can use three learning modalities: visual, auditory and kinaesthetic learning methods to teach LVI. Learners with

visual impairment are tactile and kinaesthetic learning helps them use their sense of touch to learn the content (Sahin & Yörek, 2009). The Braille is an excellent example of a touch device that helps them predict or depict content. Therefore, the differences in learning and related teaching play a crucial role in ensuring equity in Mathematics lessons (Dunn, Honigsfeld, Doolan, Bostrom, Russo, Schiering, Suh & Tenedero, 2009). Hence, teachers of Mathematics must master the suitable methodologies and tools to use for LVI and utilise different strategies for the learners to obtain quality education like their counterparts.

Moreover, in a Laboratory Tutorial Series on cognitive functions of the brain: perception, attention and memory, Zhang (2019) reported a significant concern with how children recognised, coded, stored and retrieved information to carry out cognitive tasks. According to information processing theorists, cognition involves using a small number of basic cognitive processes in a structured way (Berk, 2004); hence this study acknowledges that the teachers' role is vital. According to Rugamba (2018), the teachers' duty in the teaching of Mathematics to LVI is to:

1. Identify precisely what key elements a learner with visual impairment needs to recognise to master a learning objective.
2. Understand how these elements and existing knowledge can best relate to each other to generate meaning.
3. Know in what form these elements can most effectively be stored in the memory.
4. Understand how these elements are usefully selected and retrieved to help solve new problems (p. 16).

Based on the above, however, Namibian LVI are not fully included and lack proper teaching due to teachers' inexperience and lack of skill, lack of adequate unique resources and less involvement of parents in their children's education (Uusiku, 2020). The selected school (as a case study) does not have one teacher experienced with teaching methodologies of LVI, and at the time of data collection, all the devices used for such learners, such as the Braille, were out of order. Mathematics for LVI can be a challenge if the teachers and the education sector do not play a significant part in guiding learners and ensuring adequate resources for learning.

2.3 The Concept of Inclusive Education

Inclusive education combines learners with disabilities and learning difficulties and those without learning difficulties within the same space, class, or roof (Singh, 2016). Hence, it is noticeable in Namibian mainstream schools that LVI, for instance, is mixed with other learners in a class. However, in this case, there is no fairness or equity in education for the disadvantaged (Amukugo, 2017, Uusiku, 2020). In support of this, Hausiku (2017) highlighted that learners with disabilities are at the receiving end as their needs are not fully satisfied by teachers not trained for them and inadequate resources available in Namibian schools for learners with disabilities. One can conclude that inclusive education, as 'inclusive' as it sounds, is not exclusive inclusivity because those that should enjoy the benefits of it are still marginalised in teaching and learning.

IE discovered that learners with disabilities and those challenged academically were excluded, segregated or isolated in learning because of their conditions (Mercinah & Nirmala, 2014). Many children with that condition would stay home or give up on school because of the alienation and treatment given by schools. A study conducted by the World Bank in 2002 indicated that 30-40% of approximately 115 million children worldwide not in school had disabilities (Peters, 2003). Globally, children with disabilities were likelier to be out of the school system or leave school before completing primary or secondary education (UNESCO, 2009). Education at that time was not an absolute right, and it was easy to marginalise certain groups. As inclusive education came into existence around the mid-2000s, it encouraged those left out to enrol and stay in schools.

As reiterated by UNICEF (2007), inclusive education thrives on incorporating education for all discourse by offering individually tailored support within a class or group. However, Kirschner (2015) argues that there is a daunting task in including every student within a class because learners have different capabilities, styles, and learning patterns and different assimilation to content. In this case, the teacher is burdened with making the class completely inclusive. Further research also indicates that among the small number of learners with disabilities who attend school, there was an exclusion from other classroom activities leading to failure and drop out despite countries adopting international policies and initiatives for inclusive education (UNESCO, 2015; UNICEF, 2016; Florian, 2008; UN, 2006a). Thus, inclusive education requires strategy, policy change, and funding to accommodate all learners. Therefore, a vast gap must be filled in the implementation and execution of IE.

Furthermore, a study on inclusive education as a multi-faceted concept by Mitchell (2015) highlights that the class environment becomes less conducive for the teacher and other learners due to the confusion created because different learners assimilated content. Imagine a case where a learner with visual impairment is placed in the mainstream class, and the teacher does not have any specialised skills to deal with the LVI. This situation not only puts the learner at a disadvantage, but the teacher and other learners have to bear the divided attention that comes with the learning and teaching process. Consequently, IE has been attributed to failure to include all students in the learning process, contrary to what the phrase 'inclusive' entail (Mariga, McConkey & Myezwa, 2014). Perhaps what makes IE a part failure is the mixture of both learners with disability and able-bodied ones in the mainstream classroom, with a non-specialised teacher in the field of special education (for people with disability). On the other hand, separating both parties in the learning process can be seen as segregation, although it can enhance some form of quality education and ensure social justice.

A study by Vojvodina by Galovic, Brojcin and Glumbic (2014) explored teachers' attitudes towards IE. The study found that if teachers have a negative attitude towards inclusive education, they may not make enough effort to engage in relevant professional development to promote the success of inclusion. Other studies were conducted in Zimbabwe and Malawi (respectively) on the attitude of teachers towards inclusive education. Among them is a study by Magumise and Sefotho (2018) that examined parents' and teachers' perceptions of inclusive education which revealed mixed results

categorised into positive, mixed and negative perceptions. Furthermore, Chavuta, Itimu-Phiri, Chiwaya, Sikero and Alindiamao (2008), in a baseline report on Montfort Special Needs Education College and Leonard Cheshire Disability International Inclusive Education reported the presence of negative teachers' attitudes towards inclusive education. The paradox of IE, as shown above, puts teachers in an awkward position and dramatically affects their execution of duties. IE does not increase the exclusive attention of all learners of Mathematics regardless of their various conditions, and then there is a problem with it.

2.4 Inclusive Education in Namibia

Being a signatory to the *UN Convention on the Rights of Persons with Disabilities (UNCRPD)* and the *UN Convention on the Rights of the Child (CRC)*, Namibia is committed to monitoring and implementing these conventions. Although Namibia has made progress towards achieving "Education for All" goals as set out by the UNCRPD and is implementing the *Sector Policy on Inclusive Education* ("the Sector Policy"), progress in implementing the inclusive education principles has been slow. As a result, children with disabilities still experience challenges in accessing better education and remaining in school in Namibia (UNICEF, 2016). LVI are not an exception as their conditions need attention from specialised teachers and adequate resources. Mathematics being a crucial subject that elevates students to higher prospects, care should be given to all Namibian learners equally by schools, their teachers and other learners. A study on assessing the provision of inclusive education in the Omusati region by Haitembu (2014) identified that the effective implementation of inclusive education in Namibia is affected

by teachers' attitudes towards inclusive education. A negative attitude can affect teachers' professional development towards inclusive education. As a result, teachers find it challenging to handle inclusive classrooms, and hence most teachers are not equipped with the necessary skills to accommodate learners with disability.

The Namibia Curriculum Framework for Inclusive Education (2014) emphasised the need to teach LVI to use Braille and other assistive devices such as mathematical signs, symbols, alternative notations and abbreviations that help them understand questions in the mathematics external examinations. It is agreed that understanding mathematical symbols will boost learners' confidence in the subject. However, in a study on challenges of inclusive education of LVI to school management in the Oshana region of Namibia, Josua (2013) reports that few books in Braille and other materials such as magnifying devices, talking computers and calculators. A lack of resources can hinder LVI; for instance, a calculator is an essential tool in Mathematics; hence in an inclusive class, learners are expected to be at par with their classmates.

In a study investigating the support rendered to teachers of LVI in an inclusive secondary school in the Oshana region of Namibia, Shivute (2018) report that in the Namibian education system, teachers face many challenges in teaching LVI which calls the input of all the education stakeholders to assist such teachers. Thus, Namibian teachers need to be exposed to issues of inclusive education approaches and styles, teaching material and use of available support services through workshops, seminars and short courses. Teachers must also acquire the necessary skills and knowledge in inclusive education, as teachers

were not provided with adequate inclusive skills at teacher-education institutions. Unfortunately, the reality is that most teachers are unqualified to teach LVI in an inclusive school. Mathematics, a practical subject, requires training for teachers of LVI to deliver knowledge accordingly.

In a study on teachers' experiences with strategies for teaching LVI in the Oshana Education region, Tobias (2017) reported that the fact that learners with visual impairment have different challenges; most of them rely on using their 'hands' (especially fingers) to read tactile and model materials in order to obtain and convey non-textual information. On the contrary, most Mathematics teachers use pictures or photographs and various colour-coded materials in their classroom instructions (Russ, Sherin & Sherin, 2011). The best approach between the above could close the gap that IE leaves behind in most cases where teachers do not know how to deal with the minority in class (LVI, for instance). Tobias (2017) further suggests that teachers in special and inclusive classrooms should plan and adapt to the relevant material beforehand for LVI who do not have the necessary visual skills required for the task. Charts, models, maps and graphs are considered to have a more excellent educational value if they can be read using the sense of touch, especially for Mathematics.

According to a study on using tactile strategies with LVI and severe disabilities by Downing and Chen (2003), cited in Tobias (2017), teachers dealing with LVI should resort to alternative teaching strategies incorporating tactile representations of pictures, graphs, diagrams and other images in Braille. It allows LVI to feel the embossed lines and surfaces

while obtaining the same information that other learners acquire by looking at pictures and other visual images.

2.5 Towards Equity in Inclusive Education

Equity is essential when addressing learners' needs by creating a fair environment in the mathematics classroom where all learners can reach their potential (Bartell & Meyer, 2008). Equity requires a high-quality curriculum, materials and resources, and practical teaching to narrow the gap among students with different needs while learners learn Mathematics in a productive environment (Allexsaht-Snider & Hart, 2001). In Namibian schools that incorporate LVI in mainstream classrooms, equitable learning has always been complex compared to where such learners are in special classes. Hence, most schools do not provide a packaged and well-structured package to ensure equity among learners.

The Constitution of the Republic of Namibia, Article 20 (1990), Towards Education for All (1993), Presidential Commission on Education, Culture and Training (1999), National Policy on Disabilities (1997), National Disability Council Act (2004), to mention a few are Namibian documents and policies that signify a pledge to establish an inclusive society through the inclusive education (IE) system. *The National Policy on Disabilities* (1997) states the following:

"The provision of education shall be based on the fundamental principles of inclusive education, which demands that all children be taught together, whenever possible, regardless of individual differences or difficulties. In light of the above, "this inclusion

entails developing the capacity of the regular school system to meet the diverse educational needs of all children" (Ministry of Lands, Resettlement and Rehabilitation, 1997, p. 10).

The above views clearly illustrate the position taken by the Namibian government towards the inclusion of learners with disabilities in the mainstream education setting. School managers are thus expected to work towards ensuring that all learners, irrespective of their diverse needs, benefit from the education given to them. According to Anderson (2006) in Human (2010), many teachers understand equality based on the notion that 'everyone gets the same thing', which can result in denial or disregard of diversity to promote uniformity. Thus, a more mature understanding of fairness would be the idea that everyone gets what he or she needs.

2.6 Teachers' Attitude Towards Teaching Mathematics to LVI

Van der Sandt (2007) explored Mathematics teachers' behaviour in the United States of America (USA) and noted relative teachers' attitudes towards teaching Mathematics, which has a powerful impact on the subject's teaching. Similarly, in a study on Mathematics, Hannula (2002) revealed that teachers' attitudes towards Mathematics subjects could influence classroom actions critical to learning and performance. Furthermore, research on the challenges experienced by LVI in Klerksdorp primary schools, Dr Kenneth Kaunda District in South Africa by Morelle (2016) note that the attitude of Mathematics teachers towards LVI is a noticeably significant role in shaping the learners.

It is essential to identify the source of the attitude shown by LVI mathematics teachers, as it cannot come from an isolated place. Hence, positive sources yield a positive attitude and vice versa. Thus, Gablinske (2014) added that teachers who show acceptance, clarification of learner's feelings and praise had been associated with a more positive attitude towards higher achievement by the learner. However, for the teacher to show acceptance, they need to be confident and better equipped for the venture, and if not, positive emotions cannot be triggered. Likewise, LVI mathematics teachers should be well-equipped to manage these learners to impact the learning and teaching process positively.

According to a study on teaching Science to LVI in the USA by Sahin and Yorek (2009), cited in Tobias (2017), Science and Mathematics teachers of LVI have to cope with learners who have a less informative and exciting background against which to develop an interest in Mathematics concepts than their sighted counterparts. Total lack of sight may cause delays in areas involving an understanding of relationships in numbers, size and shapes as well as a partial concept which is comparative in Mathematics as a subject, hence a challenge for the teachers. Furthermore, Maguvhe (2015) acknowledges that LVI are limited and inexperienced in visual patterns and shapes used for fully-sighted learners, especially in graphics, visual materials and objects that surround them in their ordinary life.

Therefore, the burden LVI carry is handed over to the teachers that do not have enough teaching methodologies at their disposal; due to many other factors, such as lack of training, lack of policies supporting inclusivity at the school and lack of resources to cater for LVI. The study also revealed through the opinions of the blind technician that, Mathematics and Science teachers need to attend regular staff development workshops covering selected challenging topics in Mathematics and Science accommodative of LVI (Maguvhe, 2015). Therefore, the education sector must invest in teachers' continuous professional development in dealing with LVI.

2.7 Challenges Faced by Teachers in Teaching Mathematics to LVI

2.7.1 Curriculum Choices

In research investigating the principals' knowledge and perception regarding inclusive education in the Zambezi Region of Namibia, Mayumbelo (2006) states that the curriculum used in schools does not cater to the needs of learners with special needs. To cement this observation, in a study on the social inclusion of LVI in a mainstream secondary school in Namibia, Human (2010) confirmed that such learners struggled with subject choices and had difficulties with school subjects that are practical such as Science and Biology. LVI struggles to cope with their disability, especially when there is little teacher guidance for complex mathematical methods. Mowes (2002), as cited in Kasanda and Mostert (2006), mentioned curriculum modification of lessons as one of the obstacles to inclusive education in Namibia. They stated that any curriculum that is not learner-

based and learner-paced would hinder learning and active participation of LVI. Moreover, some educators are unaware of the action to accommodate LVI during the acquisition of science process skills and assessment (Sahin & Yorek, 2009). Based on the above claim, teachers seem to discourage LVI from taking or considering Science-related subjects as curriculum choices.

However, the Directorate of National Examinations and Assessment (DNEA) in Namibia have implemented measures regarding running examinations for candidates with visual impairment (Ministry of Education, 2010). The measures are as follows:

- Additional time allowance of up to 25% for most candidates with visual impairment; in severe cases, those with Braille papers may require 100%.
- Candidates may get supervised rest breaks.
- Candidates that cannot use Braille can apply through the Examination Centre to use a reader (p. 2).

In light of the above, the Namibian government's effort to inclusive education especially targeting LVI, is commendable, considering the report by the Namibia Statistics Agency (NSA) (2016) that the highest proportion of disabled persons without formal education are visually impaired. The DNEA can also provide examination papers in Braille, enlarged text in A3 size and modified enlarged texts (Ministry of Education, 2010). Needy learners are exempted from paying examination fees through the Ministry of Finance: Treasury (Ministry of Education, 2008). Furthermore, in terms of curriculum adaptation and

delivery, Fraser and Maguvhe (2008) listed alternative approaches that can be applied to teaching LVI across the board. Here are some of the approaches:

- Setting substitute tasks of similar scope and demand.
- Replacing unfriendly tasks such as drawing graphs in Mathematics with tasks of different kinds such as calculations.
- Allowing a learner to take on a task at a different date.
- Giving learners concession (extra time) to complete tasks (p. 85).

Therefore, curriculum adaptation and delivery by teachers of LVI must be supported by the relevant authorities such as the school administration, the ministry responsible, and policies to ensure that all steps to inclusivity in the curriculum are met. In support of the above, in 2010, the Ministry of Education (MoE) in Namibia commissioned the development of alternative curricula for learners with various disabilities for all subjects taught in Namibian schools (Josua, 2013). These curricula were utilised alongside regular curriculum for teachers to make necessary adaptations for learners with various special needs, including LVI. The merging of these curricula was a way of inclusivity despite their capabilities/abilities and the level of disability/inability. Considering the above, Massanga and Mkandawire (2007), in their study on inclusive quality education in Eastern and Western Sub-Saharan Africa, identified three components of curriculum (i.e., content, methodology and resources) that were modified to cater for inclusive education. Therefore, inclusive education should be all-encompassing to avoid challenges LVI faces in learning subjects such as Mathematics, considering the right curriculum suitable for both learners with full, partial and compromised visions.

2.7.2 Lack of Training on Teaching Strategies for LVI

Professional development of teachers is essential to maintain a higher standard of learning. How both general and special education teachers are trained could influence the success of special and inclusive education (Royster, Reglin & Losike-Sodimo, 2014). Research carried out in Zambia on challenges in teaching LVI in Zambia by Penda, Ndhlovu and Kasonde (2015) discovered that there were no appropriate experienced teachers for such learners. A study conducted by Sight Saver International (2010) attributed the low academic performance of LVI in schools to using teaching methods which only suit learners with sight. Penda, Ndhlovu and Kasonde (2015) further state that teachers had difficulties using traditional teaching methods, such as the question-and-answer method that required a clear picture and quick feedback.

However, due to the gap of literature in Namibia, a study on inclusive education and challenges of students with disabilities in institutions of higher education in Namibia by Haihambo (2010) describe the challenges of students with disabilities in higher education institutions in Namibia from the students' perspective and reports lack sensitivity and skills by lecturers as challenges faced by students with disabilities in Namibian institutions of higher education by Sheeyapo (2017). Thus, school teachers have similar challenges because of the lack of training in working with LVI.

2.7.3 Resources for Teaching Mathematics to LVI

The success of the teaching and learning process in Mathematics depends mainly on the availability and effective use of teaching materials. Babu (2005) recognises the need to use the right equipment and improvise necessary learning aids using locally available materials. If Mathematics teachers hope to impart change and improve their performance, there must be adequate and appropriate resources for LVI regarding structures and teaching or learning resources. Sahin and Yorek (2009) point out that most African schools did not provide LVI with adequate resources that made learning easy. In addition, a study on challenges experienced by LVI in South African township primary schools by Morelle and Tabane (2019) acknowledges that the South African education system still struggles to cater for disabled persons, especially LVI. The slow progress may be attributed to late inclusive education efforts in the South African education system, which relied more on differentiating special and mainstream schools.

Furthermore, in Tanzania, the implementation of IE in schools has become complicated, with few resources accorded to teachers of learners with a disability, despite being one of the leading advocates and forerunners of IE in Africa (Mwakyeja, 2013). Tanzania's situation is a litmus test for inclusive education, considering its position in the continent concerning education and inclusivity. On the same footing, in a study on challenges in teaching LVI in inclusive classrooms in Ghana, teachers emphasised the availability of primary assistive devices to teach LVI and the absence of crucial and sophisticated apparatus (Sikanku, 2018). Mathematics for LVI requires specialised, sophisticated resources/apparatus in order for them to understand numbers and symbols easily. Failure

to which their future is compromised, considering that Mathematics in Namibia is crucial for tertiary and employment undertakings

According to a study by Maguvhe (2015), lack of necessary innovation where resources for teaching mathematics and Science are limited. For this purpose, the European Union (2015) suggests using the following resources:

- A Thermo form is used for embossing drawing machine that prints on a special sheet using heat.
- Different geometry kits with tools specially adapted for LVI.
- The GEOMAG game (containing magnetic segments that can be put together employing metal balls, helpful in building up geometric shapes).
- The Geoboard Kit (a wooden or plastic piece of which metal rivets or bolts are inserted at a certain distance, and students use elastic strips to form basic geometric shapes).
- Special plastic sheets on which students draw desired shapes using the compasses or Braille stylus; however, the student must be permanently assisted by teachers. The plastic foil is placed on a silicone mat or soft rubber where learners plot the lines that will be raised out.
- A Braille printer.
- A 3D printer that can output handy geometric shapes is excellent for Mathematics (p. 13).

The figures below show examples of resources that can be used to teach mathematics to LVI, Source for all the figures below: (European Union, 2015)

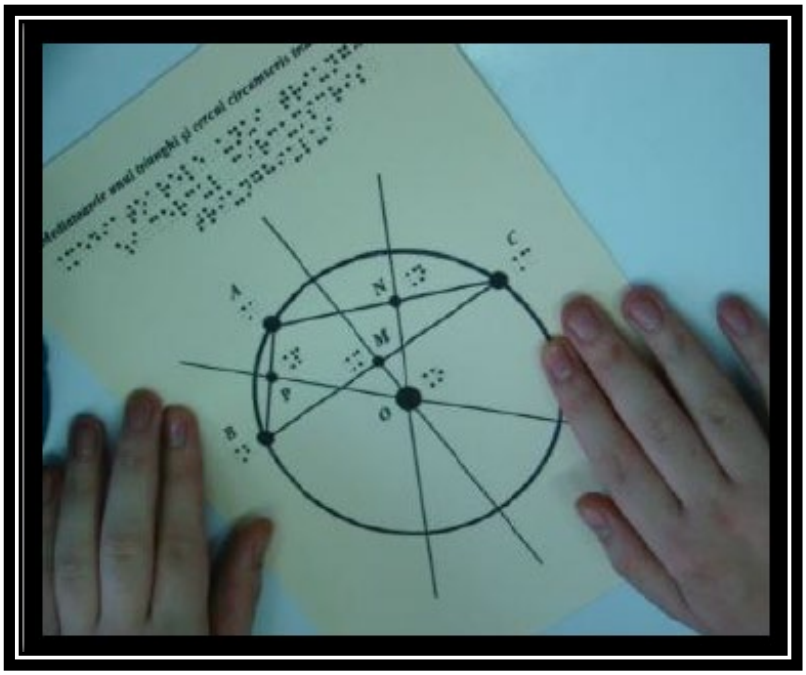

Figure 1: Geometry of Swell-Paper

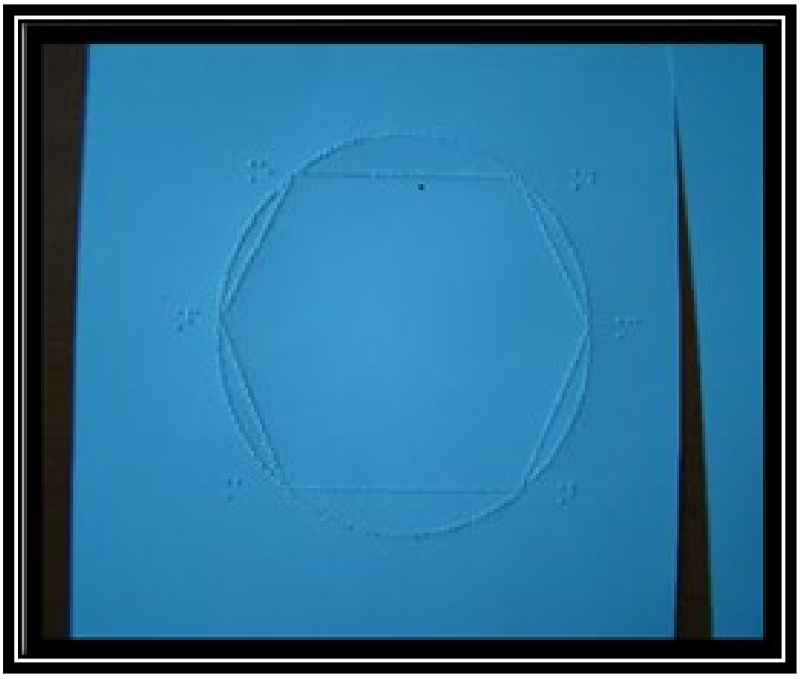

Figure 2: Drawing on Brail Paper

Figure 3: Plastic Sheets

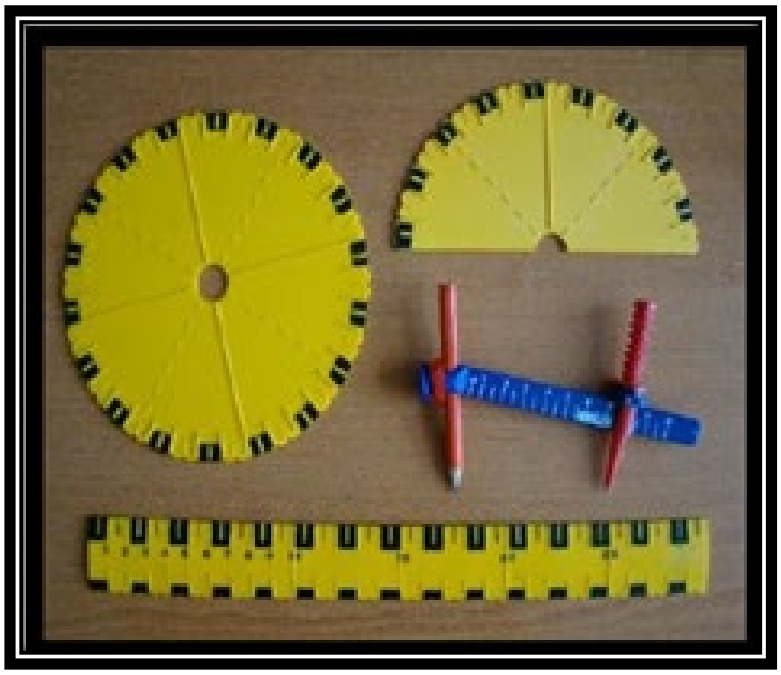

Figure 4: Geometry Kit Tools for the Blind

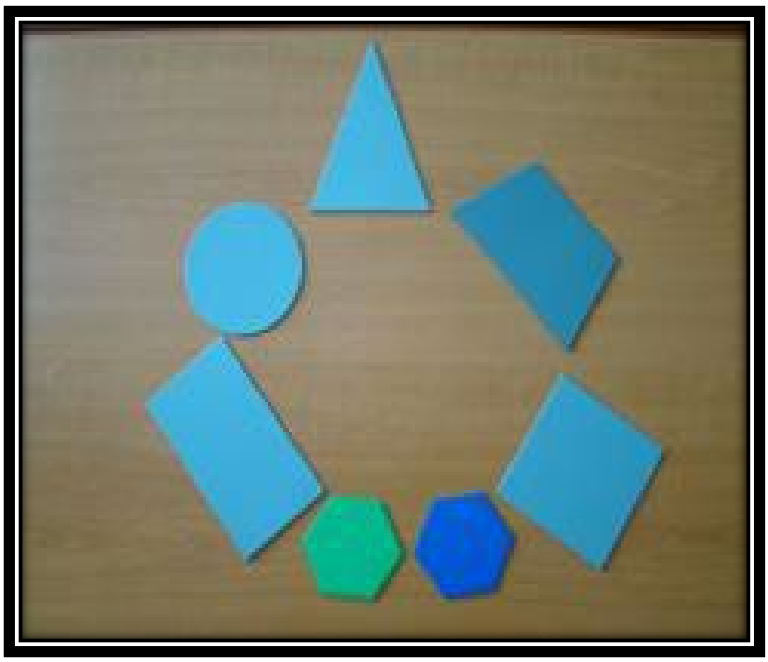

Figure 5: Geometry Kit Shapes for the Blind

Figure 6: GEOMAG Kit

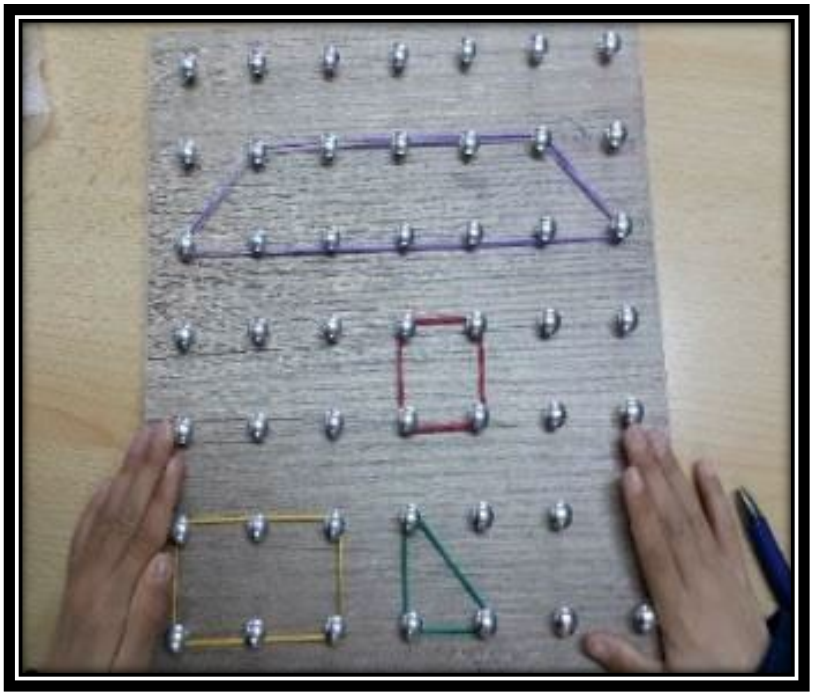

Figure 7: GEOMAG Board

Figure 8: Calculator with Speech Function

Furthermore, Peters (2003) identifies the lack of material needed for adoption to the curriculum and instruction on children with disabilities. According to Josua (2013), there were few books in Braille in Namibia, specifically the brailed Mathematics textbooks for secondary school learners and magnifying devices, Braille machines, Zytex2 swell paper, talking computers and calculators. A study on the experiences of LVI with regards to disability and social exclusion in Oshana regions in Namibia by Tobias (2017) identified a shortage of Braillewriters (Braillers) and Braille papers (Braillons) in inclusive and special schools. This challenge prevented both teachers and LVI from completing their planned lessons and learning activities on time so that Mathematics teachers who give homework and class activities daily to LVI are left behind.

A study on tactile and model representation uses by Tobias (2019) alluded that there was limited stock for talking calculators, magnifying devices, Zytex2 swell paper, Braillers and Braillons. Hence, how can learners with visual impairment perform in Mathematics without the necessary essential equipment? Moreover, to what extent will these learners meet the learning objectives stipulated in the syllabus, as the required resources to teach the subject are scarce?

The National Institute of Educational Development (NIED) (2014) acknowledged their awareness of the shortage of equipment for special needs children in Namibian schools and recommended that necessary tools be provided to cater for effective and individual teaching and learning needs. Regrettably, special and inclusive schools in Namibia had the challenge of receiving Brailed materials (Brailed textbooks, examination question papers and practical sheets for class work activities) on time or not at all (Ambili, 2018).

Therefore, lack of resources puts LVI doing Mathematics at a disadvantage as they are left behind, and there is no way to follow during the lesson, as the subject is practical, with various exercises during lessons. Thus, Mathematics teachers need to find ways of bringing these learners to par with their peers as required by the inclusive education paradigm, although, with a lack of resources, it is a big challenge.

2.8 Challenges Faced by LVI in Learning Mathematics

Learners with visual impairment have their fair share in learning Mathematics. Below are the identified challenges faced by LVI in learning Mathematics.

2.8.1 Lack of Support from Teachers, Schools and the Government

To include LVI in the access to education, the Department of Educational Psychology and Inclusive Education at the University of Namibia (UNAM) in 2010 requested the Senate approve stand-alone inclusive education qualifications (Tobias, 2017). Although consented efforts were made to sensitise teachers on the issue of including learners with special educational needs (including LVI) in regular schools, many teachers still have mixed feelings and attitudes towards the inclusion of Learners with special needs (LSN) in their classrooms. The challenge of lack of preparedness to handle special needs classrooms was attributed to the fact that most teachers are inadequately equipped with pre-service or in-service training to manage students with diverse educational needs (Chiner & Cardona, 2013; Josua, 2013; Mangope & Mukhopadhyay, 2015). In addition, numerous teachers had not received training in inclusive and special education during their pre-service teacher qualification (Holdheide & Reschly, 2008; Mostert, 2002; Philpott,

Furey & Penney, 2010). Therefore, it can be deduced from this finding that inclusive education came in prematurely because training of teachers for special needs learners was never a priority.

Additionally, Mostert (2002) conducted a study on teachers' perceptions about the inclusion of LSN in Namibia's traditional schools, and it was found that when LSN were included in regular classrooms, most - if not all, teachers could not give adequate support to such learners. Mostert (2002) attributes the challenges to a lack of teachers' training in special education (inclusive education). Other than that, the study findings by Media in Education Trust (MiET) Africa (2013) indicate that the Faculty of Education graduates from UNAM appointed in special and inclusive schools have often reported difficulties in executing duties. The teachers (participants) attribute the challenge, such as lack of practical teaching skills, since such component(s) were/were not included in their pre-service teacher education field of study.

Contrary to the above, many teachers did not practice what they were taught in college (MiET Africa, 2013). In support, a study by Josua (2013) on challenges facing the management of one secondary school in the Oshana region in Namibia reports concerns about including learners with visual impairment, which revealed that the school was managing inclusive education as an extra duty. Besides, Josua (2013) highlighted that the Ministry of Education (MoE) did not adequately support schools in providing staff training and learning materials for LVI. Furthermore, Zimba et al. (2002) and Haihambo (2010) highlighted that the government did not know much to curb the challenges faced

by Mathematics teachers when teaching learners with visual impairment at the secondary school level in Namibia.

2.8.2 Complex Mathematical Methodologies for LVI

LVI may learn mathematical concepts slower than fully-sighted learners. The Royal National Institute of Blind People [RNIB] (2011), a UK-based organisation, explained how LVI used the Braille alphabet for note-keeping in Mathematics lessons. However, using Braille in complex mathematical applications challenges many LVI. Bearing in mind the above, Bitter (2013) asserts that Mathematics becomes unpopular to LVI because of complex mathematical formulas that are difficult to comprehend with Braille. Furthermore, reading and writing Mathematics with the Braille alphabet is more problematic than reading and writing a text using Braille. However, Braille is easy to use with simple mathematical formulas. In light of the above, Karshmer and Bledsoe (2002) mention that because of the Braille alphabet, which is linear, there are no problems in writing simple equations or expressions in Mathematics. For example, if a learner wanted to write $f(x) = ax^2 + b$, the characters that correspond to f (x) = a * (x^2) + b are used.

However, it could be significantly problematic if more complicated equations or expressions are written in Braille. For example, if the expression is $f(x) = \frac{3-x^3}{x^2+4}$, the learners need to use the characters, such as: f (x) = [3 - (x^3)] / [(x^2 + 4)]. Therefore, it gets more complicated when the equations are more complex. The other problem is the character set of the alphabet. The letters can represent different notations, and their capital position or other conditions could affect the writing of mathematical expressions. To

eliminate these problems, the Nemeth codes were invented for mathematical writing. However, according to Rosenblum and Amato (2004), most learners and teachers do not know the Nemeth codes.

One drawback of one of the mathematical methodologies LVI uses is that Namibia does not have Braille equipment technicians in case of faults, so broken equipment is sent to South Africa for attention (Fransman, 2017). In such cases, interruption of classes and losing out on lessons are inevitable. Furthermore, Fransman (2017) further states that teaching LVI is expensive because of the equipment needed, and currently, Braille textbooks for learners are insufficient. Hence, the challenges faced by LVI in learning Mathematics in Namibia cannot be underestimated.

2.9 Strategies Used by Mathematics Teachers in Teaching LVI

As instructors for LVI, mathematics teachers have to adjust and improve their teaching. However, such strategies need to be emphasized, as discussed below.

2.9.1 Use of Graphics in Mathematics (Tactile and Print)

Zebehazy and Wilton (2014) in Tobias (2017) conducted a study in Canada and the United States of America on the views and practices of teachers of LVI through a survey focusing on graphics (tactile and print) used by LVI. Zebehazy and Wilton (2014) revealed that 70% of teachers of LVI who responded to the survey valued the importance of using tactile media and print. The study further indicates that the teachers of LVI figured that graphics (tactile or print) were effective in teaching concepts, while these learners better understood

graphics when written descriptions were paired with tactile, compared to giving them (LVI) written descriptions alone. In light of the above, while there is an indication of the significance of using tactile and printing materials in general, the study by Zebehazy and Wilton (2014) also reports that teachers pay less attention to teaching LVI how to make their tactile graphics. Graphics (tactile and print) boost learners' confidence and creativity in the subject; as a result, they have a better understanding of challenging topics such as graphs of function and geometry.

2.9.2 Diverse Teaching Strategies and Methodologies

A study on "A good teaching strategy" by Whitburn (2014) in Tobias (2017) suggests that detailed verbal descriptions of complex mathematical problems enabled LVI to follow material independently, which could be used by teachers as a teaching method for LVI. However, a study by Shute, Graf and Hansen (2006) argues that as the intricacy of visual content intensifies, so does the challenge of presenting it to LVI; thus, when transforming content from one format, for example, pictorial to another, such as auditory; it is vital to provide representations that convey the same meaning. To ensure that no student is unfairly advantaged or disadvantaged because of the format of the assessment task. Consequently, while detailed descriptions of visual content may be adequate for straightforward graphs and diagrams, they may not be best for complicated mathematical elements (Shute, Graf & Hansen, 2006). See Figure 1, which shows a simple linear graph from Recording for the Blind and Dyslexic [RFB&D] (2004) in Shute et al. (2006). The text equivalent of this graph is as follows:

This figure shows a straight line drawn on two-axis systems with a horizontal axis labelled X and a vertical axis labelled Y. All four quadrants are shown. The line begins in the third quadrant and moves upwards to the right; it crosses the negative X-axis, passes through the second quadrant, crosses the positive Y-axis and ends in the first quadrant. Three points are shown, two on the line and one in the fourth quadrant.

The point on the line in the first quadrant is labelled X, Y; the point on the line in the third quadrant is labelled X-sub-one, Y-sub-one. The point in the fourth quadrant is labelled X, Y-sub-one. In addition, two dashed line segments are shown, one that drops vertically from the point X, Y and connects it to the point X, Y-sub-one and one that moves horizontally to the right from the point X-sub-one, Y-sub-one and connects it to the point X, Y-sub-one. This forms a right triangle with the solid line as a hypotenuse, the horizontal dashed line as the base, and the vertical dashed line as a side (p. 5).

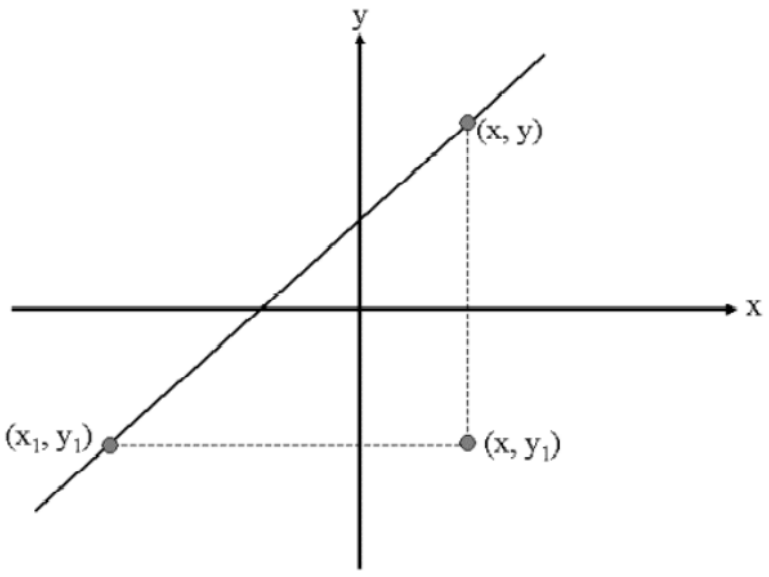

Figure 9: Example of a Simple Linear Graph

A tactile graphic may thus supplement an audio or Braille description of the visual graphic. Nevertheless, it can still be challenging to coordinate mentally and physically what one feels on the tactile graphic with the text description, which is either heard via audio or received via Braille. Thus, teachers must be very descriptive and detailed for LVI to be on par with others.

Therefore, diverse, flexible and supportive teaching strategies are required to ensure that LVI can achieve their full potential when learning Mathematics (Matthews, 2009). If the government of Namibia can invest in supporting teachers and learners in a quest for inclusive education, teaching Mathematics for LVI can be made simple.

Miheso (2002) observes that within the school curriculum, the teaching of Mathematics is uniquely challenging since it is organised, sequential and progressive. However, Belson (2012) observes that reading and writing in the standard text is entirely different from reading and writing Mathematics, and mathematics is considered a language on its own. There are many intricacies, strategies and philosophies in teaching Mathematics to a visual-impaired learner. According to Belson (2012), some of the general approaches to teaching Mathematics to such learners include:

Tactile Representations: Are used to represent text with raised characters per the traditional 6-dot Braille.

Audio Aids: Audio aids encompass a variety of tools that include direct reading to a learner's audio computer-based devices and language structure, among others.

Tonal Representations: Sinification of graphs can be used to represent and describe simple graphs for the visually impaired. With this, one can represent graphs by music tones.

Haptic Devices: Haptic devices are systems that can develop highly resolved two or three-dimensional space to give the user a physical feeling of the shape.

Integrated Approaches: The integrated approach is simply the idea of using each approach by selecting them appropriately for their strengths and weaknesses (p. 28).

It could be possible that Mathematics teachers are faced with challenges in teaching LVI. However, Klingenberg, Holkesvik and Augestad (2019) attribute these challenges to the inability of the teacher to sort learners into homogenous ability groups according to Mathematics as well as a high teacher-learner ratio and lack of resources that could hinder the teacher's effort to provide significant individual attention to each learner. Furthermore, the challenges can be attributed to how teachers balance the teaching speed for learners with low vision and those with total visual loss (Klingenberg et al., 2019). Whereas these challenges are looked at from the perspective of teaching Mathematics to all categories of learning for LVI, this study strives to identify challenges faced by Mathematics teachers during the instruction of mathematical concepts to LVI at a secondary school in Khomas region, Namibia.

It is a fact that there is confusion with Braille notation, and considering that most Mathematics teachers do not know Braille Mathematics notation (Karshmer & Bledsoe, 2002) contributes to challenges experienced by LVI when engaging with the mathematics curriculum. Cahill et al. (1996) identified graphical-spatial mathematical topics, including tables and graphs, as particularly challenging for those with severe vision impairments because Braille is not always adequate for Mathematics notation.

Effective teachers prepare Mathematics lessons and set challenges appropriately for learners to construct their knowledge by connecting with the learners' interests and experiences (Anthony &Walshaw, 2009). Learners with visual impairment are tactile or can use graphical or pictorial symbols without difficulty and use their senses to assimilate knowledge (Cox & Dykes, 2001), hence the need for appropriate teaching methods that match their learning methods (Anthony &Walshaw, 2009). These learners also need differentiated education according to their readiness levels (Levy, 2008). Hence, using beneficial teaching techniques and materials ensures LVI's academic improvement and achievement in Mathematics (Quek & Mcneill, 2006).

2.10 Mitigation Strategies to Ensure Equity and Social Justice in Teaching Mathematics to LVI

2.10.1 Ensuring equity in Mathematics Education

A study on including LVI in a Namibian mainstream secondary school by Knouwds (2010) states that LVI cannot be assessed like the learners without visual impairment. Therefore, tests should be modified to make them accessible to LVI. All these

modifications should be considered, keeping the individual needs of learners in mind. For instance, tests can be orally read to learners, who can answer back orally or write down answers using Braille. Enlarged print and natural objects or models for pictures can be provided, and pictures can also be coloured to make them easier to see.

Furthermore, LVI should be allowed extra time to complete the tests since Braille learners need twice as much time as other learners. McCall (2000) wrote that introducing national performance criteria for children who cannot adequately access the national curriculum has been helpful for teachers in the UK. Furthermore, McCall (2000) reported that the above criteria give teachers a framework to assess progress in language, literacy, mathematics, and personal and social development. These national performance criteria also support the development of cohesive practice. Therefore, such adaptations must prevent the assessment from becoming an extrinsic barrier to learning for LVI. Therefore, the equity principle is a complex issue that requires collaboration and understanding the challenges all stakeholders face, thus recommending further research.

2.10.2 Special and Inclusive Education Training for Teachers – Training and Development

In Malawi, inclusive education is implemented primarily with resource centres where students with special needs are taught in the general education classroom but receive additional support in resource centres outside of the general education classroom (Banks & Zuurmond, 2015). In addition to resource centres, special schools are also available,

especially for students with sensory disabilities (Banks & Zuurmond, 2015). However, African governments could require all general education teachers to take compulsory special and inclusive education classes as part of their pre-service teacher preparation (Kamchedzera, 2008). Training teachers in compulsory special and inclusive education programmes could also help advance the inclusive education policy many African nations have embraced. Malawi and Namibia, for example, are pioneers in this regard, as they now require all general education teachers to take at least one special and inclusive education course as part of their pre-service training (Chitiyo et al., 2015).

Furthermore, while taking one course may not be adequate to prepare highly-qualified teachers for students with exceptional needs, adequately preparing general education teachers in terms of inclusive education is necessary to improve educational outcomes for children with special needs (Blanton, Fugach & Florian, 2011). Thus, encouraging general education teachers to take special and inclusive education classes in specific subjects may be a viable approach to boost the education systems' abilities to provide special and inclusive education for the many children who need such services in Africa.

In Namibia, the responsibility for pre-service and in-service teacher training courses lies with the National Institute for Educational Development (NIED) under the Ministry of Education (MoE) (Namibian Ministry of Basic Education and Culture, 1993). The execution of teaching, that is; training of teachers for primary, junior secondary and senior secondary phases; was the duty of colleges of education before 2011. As indicated earlier, before 2011, the Ministry of Education managed four education colleges, offering a three-

year Basic Education Teacher Diploma (BETD) until April 2010. After that, the government decided to merge the colleges into the Faculty of Education of the University of Namibia (MiET Africa, 2013), which only catered for secondary teacher education phases and postgraduate qualifications with specialisations before the merger.

At present, NIED, UNAM, Education Training Sector Improvement Progress (ETSIP) and the National Professional Standard for Teachers in Namibia all focus on professional growth as well as pre-and in-service training for teachers in special and regular schools both in the primary and secondary phases (Government of the Republic of Namibia, 2006; 2011; 2014). Efforts are aimed at improving the education system in Namibia through the inclusivity of learners with special needs, such as those with visual impairments.

2.10.3 Resource Mobilisation for Supporting LVI

Learners with visual impairment struggle to deal with illustrative aids such that teachers need extra apparatus, equipment, and aids to enhance the learning process. Mobilising resources for the effective education of special needs learners should be a priority by schools and governments as a whole. Ludikova and Finkova (2012) highlighted that the effective learning process for LVI is motivated by investment in technical resources, such as optics, and acoustics, backed by pedagogy suitable for learners to comprehend the lessons. On the other hand, as costly as it may be, it is recommended that LVI receive visual aids to guide them in the learning process (Finkova, Ruzickova, &Stejskalova, 2011).

For instance, 3D maps can assist the LVI in visualizing content due to the maps' effect. Schools supported with resources for LVI have the chance to succeed in effective teaching.

Laboratory equipment and computers have been attributed as some of the best resources that can assist LVI. The Namibian government has made strides in using ICT in education to ensure comprehensive IE through the Vision 2030 framework (Simataa, 2016). Thus, resource mobilisation for learners with special needs should be on the national education budget. In light of this, Maurya (2016) asserts that the lack of resources for learning and teaching LVI in schools should be addressed with urgency if inclusive education is to benefit all. Therefore, it is safe to mention that equity and social justice in education are possible, provided resources for learners are available.

2.11 Summary

This chapter reviewed and deliberated the theoretical framework of the study. Furthermore, the study presented literature about inclusive education, inclusive education in Namibia, teacher's attitude towards teaching Mathematics to LVI, challenges faced by teachers teaching Mathematics to LVI, challenges faced by LVI in learning Mathematics, strategies used by Mathematics teachers in teaching LVI and ways to learn objectives by LVI and mitigating challenges faced by teachers in teaching Mathematics to LVI.

CHAPTER 3: RESEARCH METHODOLOGY

3.1 Introduction

This Chapter introduces the methodology used to carry out the study. The methodology will aid in collecting and analysing data from teachers and selected LVI at the chosen school and will be fully discussed in Chapter 4 of the study. Concepts forming the structure of the methodology include the research design, population, sample and sampling procedures, research instruments, pilot study, data collection procedures, data analysis and research ethics.

3.2 Research Approach

The study employed a qualitative research approach. Denzin and Lincoln (2005) describe qualitative research as a multifaceted method involving an interpretative, naturalistic approach to the subject matter. The comprehensive nature of qualitative research enables researchers to develop a holistic picture of the phenomenon in question.

Qualitative research was considered suitable for this study as the main purpose was to investigate the challenges faced by Mathematics teachers in Khomas region to teach learners with visual impairment in a special secondary school in Namibia. The research aim was for the researcher to observe how Mathematics teachers were teaching LVI. The study was established to identify the suitability of Mathematics resources for these LVI. It further identified relevant Mathematics teaching strategies teachers may utilise when

teaching LVI in their classrooms. In addition, the study focused on the challenges related to the mathematics teaching process for the LVI.

3.3 Research Design

The study adopted a case study research design. According to Yin (2003), a case study design should be considered when: (a) the focus of the study is to answer "how" and "why" questions; the study focuses on how Mathematics teachers teach LVI; (b) one cannot manipulate the behaviour of those involved in the study, therefore, in this study, the behaviour of teachers and LVI was not influenced by the researcher (c) you want to cover circumstantial conditions because you believe they are relevant to the phenomenon under study in this study the context of challenges in Mathematics to LVI. A case study was chosen for this study since the study focused on the case of challenges faced by Mathematics teachers, but the case could not be considered without the background, which is the teaching of Mathematics to LVI, and most specifically, the methods used by teachers of LVI. Hence, the researcher would not have an accurate picture of the challenges faced by Mathematics teachers of the LVI without considering the setting within which it occurred.

3.4 Population

A population refers to a large group of individuals with the same characteristics from which a researcher draws a sample, usually stated theoretically (Creswell, 2014; Neuman, 2014; Best & Kahn, 2014). The population of this study comprised all Mathematics teachers and LVI at a secondary school in Khomas region, and the total number of learners

at the school was 140, of which the total number of secondary school learners (8-10) consisted of 35 learners only. The total number of teachers at the school was 21, of which the number of Mathematics teachers was 6(six).

3.5 Sample and Sampling Procedures

The study sample consisted of six participants: two Mathematics teachers from Grades 8-10 and four LVI from the secondary school. A small sample was chosen considering the size of the school (140 learners and 6 Mathematics teachers). Furthermore, Bless, Higson-Smith and Sithole (2013) highlighted that representation of the whole population was not an issue in a qualitative study, with data quality being a priority. The teachers were both selected, and the LVI were selected using the non-probability purposive sampling strategy/technique, which intends to describe the subgroup for this study, the LVI. Purposive sampling selects participants based on a particular purpose and specific knowledge about the phenomenon under study (Bless et al., 2013). Participants are selected due to some defining quality that makes them holders of the data needed for the research (Human, 2010). In this case, teachers of Mathematics and LVI were chosen because they provided individual accounts of their experiences or had defining qualities specific to the study.

The guidelines for the selection of learners were used:

- LVI at the special schools in the Khomas Region, in Namibia.
- LVI having Mathematics at the secondary school level
- LVI, who used the Braille machine during lessons.

The guidelines for the selection of teachers were used:

- The special school teacher teaches Mathematics in the Khomas Region in Namibia.
- All the Mathematics teachers are currently teaching LVI at the secondary school level.
- Teachers who had LVI used the Braille machine during the mathematics lesson.

3.6 Research Instruments

An observation schedule and a semi-structured interview guide were used as data collection instruments. Using these instruments facilitated the researcher to capture information that was beneficial in developing an accurate and reliable report (Creswell, 2008).

3.6. 1 Observation

Observation is collecting data by observing participants in their natural settings (Newby, 2010). The observations were for teachers teaching LVI and the LVI themselves during the mathematics lesson, of which 15 lessons for each teacher were on different topics. Teachers were with Algebra grade 9, Numbers and operation grade 8, and geometry grade 10 at the time of lesson observation. According to Norskov and Rask (2011), as a participant in research, the observer assumed the role of an observer by interacting with participants without being a natural part of the setting. Observation sheets and field notes were used to record information. Observation enabled the researcher to answer questions 2 and 3 of the study: What Mathematics teachers use strategies in teaching LVI at a selected school in the Khomas region? To what extent do learners with visual impairment achieve the learning objectives specified for Grade 8-10 Mathematics? The observations

lasted two weeks for different topics requiring visual aid and drawings. It was observed that teachers tried to engage the LVI in their lessons, but, at times, lack of material challenges hindered the lesson objectives from achieving all specified lesson objectives.

3.6. 2 Interview

Smith and Osborn (2007) affirm that semi-structured interviews create an opportunity to probe for more clarity. Semi-structured interviews were used and conducted in participants' natural settings, and interviews empowered the researcher to intermingle with participants and investigate for more transparency on the responses. All participants were interviewed individually and permitted the researcher to audio-record their responses and later transcribe them verbatim. The semi-structured interview guides were used to collect data on the challenges faced by teachers and learners for the study.

3.7 Data Collection Procedures

Before the data collection process and upon approval from UREC, the researcher waited to receive the ethical clearance certificate and permission letter. The researcher used these documents to request permission from the Executive Director of the Ministry of Education, Arts and Culture, which was granted. Furthermore, through a formal letter, the researcher used this letter to request permission from the Director of Education in the Khomas Region for the respective regions. Secondly, the researcher inquired for permission from the school principal at the selected school. Thus, the researcher scheduled appointments with Mathematics teachers, learners and their parents.

Furthermore, informed consent was provided to inform participants about the purpose of the research by allowing them to decide whether they wanted to be part-takers in the research or not. An informed consent form was given to the teachers that agreed to participate in the study. Since the research had minors, the researcher sought permission from the parents; hence, the parents signed the consent form. The rights of participants were specified in the informed consent form, those that were willing to participate signed the forms, and those that did not feel free to participate were not coerced. Even for those that agreed, it was their right to withdraw whenever they felt uncomfortable. Finally, observations were conducted on Mathematics classroom lessons, and interviews with teachers and LVI were conducted.

3.8 Pilot Study

The researcher conducted a pilot study on a selected school offering special education to LVI in the Oshana Region, which had similar basic features to those of the targeted school in the main study. This school was not incorporated into the primary data collection. The pilot study sample consisted of seven (7) participants, including one Mathematics teacher (in charge of Grades 7-9) and six LVI.

Before interviews were carried out during the pilot study, the purpose of the study was explained to all the participants, and verbal informed consent was obtained to record the pilot interviews. Various interview questions were asked to all participants thus, one for LVI and the other for the mathematics teachers, while instrument two observed the mathematics lessons of how the teachers presented the lesson to the LVI. After the

interviews, participants were asked to identify questions they had difficulty understanding. They were also asked to comment or suggest how best the questions could have been asked to yield the necessary information and inform adjustment by the researcher.

The researcher transcribed some recorded responses and checked for unexpected answers that could have occurred because of a possible misunderstanding of interview questions. The pilot study results indicated that the research instruments stimulated most of the anticipated responses, and it also indicated that it would be essential to refine some questions in the interview guides. The following are the results of the pilot study.

The pilot study results revealed that the instruments were reliable and valid since the respondents understood most of the questions. The pilot study indicated that some questions in the instruments should be revised, while others were removed as it was redundant. Also, some probing questions were added to enable a clear understanding of some of the questions. Some questions were separated to make it easier for the researcher to use the instruments and more focused on one issue. The following paragraph indicates how the pilot study changed the instruments.

- *Instrument 1, Interview guide for blind learners (focus group)*: The pilot study revealed that *question 1.6*, which field do you want to study in university, ‟ was altered to what do you want to become? *In question 3.1, the word 'lessons' was altered to 'subjects', and 3.4 and 3.5* were merged into one question. *Question 3.2*

asked about the learning process but did not specify which subject; hence, the researcher edited it by specifying the subject's name, while question 4 was about the equity principle and was well understood.

- *Instrument 2, Interview guide for teachers (focus group)*: *Questions 4.7 and 7.4* were asked simultaneously as they required similar answers. *Question 8.5 and 8.6* was formulated as they answered the research question.

- *Instrument 3, Observation schedule*: The observation schedule was slightly changed as the researcher added a section of "any other observation" relevant to the study since the information in the item was found applicable.

Regarding the management of tools, the teachers and the blind learners observed some challenges during the pilot study. Securing appointments with learners was challenging because they had classes and wanted to rest during the break. Another major challenge was experienced regarding the school secondary blind learners who did not have Mathematics as a subject; thus, the researcher asked them questions based on the experience. As a result, the researcher used the observation schedule on the grade seven class that had a blind learner doing Mathematics and interviewed the learner as well.

The instruments were improved according to the comments of the participants and the analysis of the participants' replies. The research instruments were changed and refined to permit the researcher to gather sufficient information.

The research questions were adjusted, and one was added, which specified mitigation strategies to improve teaching Mathematics for LVI at the selected school.

3.9 Data Analysis

This study has made use of the Microsoft Excel application as a tool to analyse the data collected. SPSS software was minimised due to the limited amount of data collected and the nature of the study.

Data analysis aimed to translate the data collected to answer the research questions into information (Human, 2010). Qualitative data was attained from transcripts from semi-structured interviews and notes from the observation schedule. Data analysis is an ongoing process in qualitative research (Merriam, 1998). This section outlines how the data collected was accessible and scrutinised for interpretation, where Microsoft excel was used to interpret some of the interview responses.

The researcher conducted lesson observations simultaneously with the interviews; for lesson observation during class hours and break time for the interview for two weeks starting the day, the researcher entered the research site. The researcher recorded interviews and transcribed them verbatim. The transcribed data were re-read several times. The observation notes were taken during observed classroom activities. The data collected were grouped in subheadings such as challenges faced by LVI in Mathematics, curriculum choices and teacher's training. The data collected through observation was examined using interpretations that relied on the researcher's comprehension.

Data obtained through interviews were presented and analysed employing thematic narrations. Thematic analysis is used to analyse qualitative data applied to texts, such as interview transcripts and observation checklists (Sekaran & Bougie, 2013). Data were examined to identify common themes, such as topics, ideas and patterns of meaning, that came up repeatedly or as a trend. Here, data were grouped according to themes. These themes followed the research questions of the study as well as other common patterns identified. From the themes, narrations were done in report form, and in some cases, direct quotes and still pictures were used to support some responses. The narrations, graphs and pie charts were used to present the findings.

3.9 Research Ethics

According to Creswell (2014) in Kandjinga (2018, p. 53), "data collection should be ethical and should respect the site". Therefore, researchers should gain access to organisations by seeking permission from those in charge (Creswell, 2014; Cohen et al., 2007; Resnik, 2010). The researcher obtained ethical clearance from the University of Namibia Research Ethics Committee and a permission letter from the university before commencing with data collection (See Appendix A and B). Upon granted permission, the researcher requested permission from the Executive Director and the respective Regional Directors of the Ministry of Basic Education, Arts and Culture (See Appendix C and D) as required by the University to collect research data. The researcher observed ethics by explaining the purpose of the study to all participants before giving the participants consent forms to sign and give verbal consent.

Since the research had minors, the researcher sought permission from the parents of LVI participants; hence, parents signed the consent form (See Appendix D). As for the teachers, they signed consent forms in their capacity.

Participation in the study was voluntary, and participants were free to withdraw from the study at any time. The researcher observed strict confidentiality and anonymity throughout the study. Real names of participants were not used; instead, codes were assigned to each respondent, for example, (L.1) for learners and (T.1) for teachers. The hard copies were stored in lockable cabinets accessible by the researcher only, while voice-recorded interviews were stored in a laptop file with a password accessible to the researcher only. Data gathered was securely stored until the examination and publication process was completed.

3.10 Summary

In this chapter, the research design and methodology were discussed. The methods used, for example, data collection, selection of participants, interview with participants, observation, data analysis and ethical considerations, were highlighted and fully explained. The chapter outlines the procedure followed during the research process and sheds some light on the pilot study conducted to determine the validity and reliability of the research instruments. Data analysis will be discussed in Chapter 4.

CHAPTER 4: PRESENTATION, INTERPRETATION OF RESULTS AND DISCUSSIONS OF RESULTS

4.1 Introduction

Data analysis aims to convert the information gathered to answer the research question (Human, (2010). This chapter provides a discussion of the analysis of the study. The information was gathered from interviews and observations from a special secondary school in the Khomas region in Namibia. The chapter further presents the results from the interviews and observations. It also presents an analysis of findings intended to describe the challenges faced by Mathematics teachers in teaching secondary school LVI in the Khomas region.

4.2 Overview of Data Collection and Analysis

The primary participants in this study were secondary school Mathematics teachers of LVI and their learners (LVI) at one special secondary school in the Khomas region. This study used semi-structured interviews and observations as data collection methods. The semi-structured interviews were conducted with all four LVI from different class groups (Grade 8-10) and two Mathematics teachers in the selected special school. The data collected were grouped into the main themes and related classifications, which were organised according to the research questions of this study. In this chapter, some participants' comments are quoted verbatim to illustrate the themes and their respective classifications.

4.3 Data Analysis

Qualitative data analysis is the non-numeric assessment of observation made through participant observation, content analysis, in-depth interviews and other qualitative research techniques (Babbie, 2007). Data in this study were analysed employing content analysis, which, according to Kumar (2005), provides the basis for identifying the main themes that emerge from the responses. In this chapter, findings originating from the collected data obtained through individual semi-structured interviews and classroom observation are presented in tables and graphs obtained from excel based on some common opinions and differences among the participants.

Furthermore, learners as participants were denoted as learner number one (L1) up to learner number four (L4). LVI mathematics teachers were also interviewed as teachers' number one (T1) and two (T2).

4.3.1 Description of the Profiles of the Participants and Biographical Information

The profiles of participants are presented in this section because it is necessary to inform the readers and help them make sense of the information provided under the themes. This section starts with the teacher's profile, denoted by T1 and T2, followed by the learner's profile, which L1-L4 denotes.

Table 1: Description of the Participants of the Study from Teachers (T)

Participants	**T1**	**T2**
Gender	**Male**	**Male**
Age	**34**	**41**
Institution of Higher Education	Windhoek College of Education and the University of Namibia	Windhoek College of Education
Teaching experience with Visually Impaired Learners	Eight years	16 years
Did you learn the Braille alphabet?	Yes	Yes
Why did you choose to teach here?	I knew nothing about the school but was at an inclusive school for teaching practice. I was interested in learners with the visually impaired at the school as I got an opportunity to teach them. Hence, upon appointment at this school, I had some background.	During my studies at the College, I did my teaching practice at the school and upon completion, I applied Moreover, I have been teaching here.
Number of LVI taught at Secondary phase	Two in grade 10	Two, one is in grade 8 and The other is in grade 9.

Regarding their biographical information, as in *Table 1*, findings indicate that teachers T1 and T2 were male. Thus, there was a gender imbalance among the teachers chosen as participants in the study. Participants were all adults of ages 34 and 41, respectively.

Furthermore, the findings above indicate that both T1 and T2 were trained educators and possessed basic teacher qualifications with experience of 8 years and 16 years, respectively. Furthermore, both teachers knew using Braille, although they did not acquire the skill in their tertiary education (skill acquired on the job).

Based on other descriptions of participants, both had taught LVI at some point. Since the school has mainstream classes (no separation of learners according to condition), both teachers encountered teaching one or two LVI in their classes, with the remaining learners being learners with low vision that uses enlarged paper and do not need Braille.

Overall, the study's findings indicate that the selected school was more inclusive than a special school since the school had few LVI. The findings show that inclusive education in Namibian schools guides the teaching and learning process. Thus, LVI and their teachers interacted actively in mainstream classes, not special ones.

Table 2: Description of the Participants of the Study from Learners (L)

Participant	**L1**	**L2**	**L3**	**L4**
How long have you been blind?	Nine years	Since birth but not blind. I can see a pintsize in one eye.	Since 2014 when I was 11 years old, thus, it has been six years now.	Seven years now since 2011
Grade	Grade 10	Grade 9	Grade 8	Grade 10
Age	17	14	13	16
Gender	Male	Male	Male	Female
Home Language	Oshiwambo	Oshiwambo	Oshiwambo	Shambyu
How long have you been doing Mathematics?	Ever since grade 1	Since my Pre-grade	Since grade 1	Since grade 1
Educational background	I started my grade 1 to 4 in Otavi and came to repeat my grade 4 at the special school upon getting blind.	I was at Eluwa school for my pre-grade to grade 1 and came to this special school in grade 2.	I did my pre-grade in Windhoek and grade 1 in the north. My eyesight started getting weak, and I was hospitalised	I started my grade 1 to 2 at Vungu-Vungu primary school, and in grade 3, I came to the special school

			and did the hospital school the year. I was placed in a special school in 2013 and got blind in 2014.	
When did you learn the Braille alphabet?	In 2011, for nine years now	Ever since grade 1	2013 when I was in grade 3	In my grade 3 year
Why did you choose to do Mathematics?	Because it is compulsory, and one cannot do anything without Mathematics.	Because it is compulsory	Because I love doing calculations.	Because it is easy. You do not have to read much; you have to master your formulas
What do you want to become?	I want to become a Judge or an Athletic coach.	Psychologist/ Politician	I want to be a Businessman	I initially wanted to become a doctor or something in Mathematics and Science, but because of my condition, I want to become a Lawyer.

It was observed that most learners come from a diverse background, as presented in *Table 2,* with two (L2 and L4) from schools in the rural area, whereas the remaining two come from urban areas. However, the latter does not necessarily mean that these learners had access to education in the areas of birth. The Windhoek Special School is the only one in the Khomas Region providing an opportunity for visually impaired learners to be included in the educational setting of the country.

Most of the learners at this school come from regions with limited or no special schools to cater for visually impaired learners, particularly those considered completely blind. This study was focused on LVI with complete blindness condition and who are in secondary school.

Regarding the biographical information of participants (LVI), the table above shows that all learners started doing Mathematics in school from Grade 1 and specified that they attended Mathematics classes because they were compulsory. Furthermore, all learners came to enrol in this school they perceived as special because it accommodated LVI, although it is a mainstream school. Furthermore, L2 and L4 joined the school when their visual impairment intensified, leaving other schools they were attending before. Asked about their aspirations, all learners had different dreams, with L1 dreaming of becoming a Judge or Athletic coach, L2 Psychologist or Politician, L3 Businessman and L4 Doctor or Lawyer.

Findings, therefore, depict that learning Mathematics for these learners was noble as most of the careers they intend to pursue required basic Mathematics to qualify for tertiary education and to understand numbers in executing their duties. The findings also depict that Mathematics is compulsory in Namibia under the IE vision.

4.4 Results from Interviews

This section presents the findings from interviews. The researcher read through the transcripts several times to gain a deep understanding of the responses. Several codes were allocated to the transcripts. As the transcripts were read thoroughly, emerging themes were identified and recorded. Themes were clustered following repeated aspects and meanings from individual narratives. Furthermore, themes from the transcripts were compared and combined into major themes. Related aspects representing a lower order of major themes were considered sub-themes.

4.4.1 Challenges Faced by Teachers Teaching Mathematics to LVI

Teaching methods play a crucially important role in learner success. Teachers' methods were shaped according to several variables, such as individual learners' needs, requirements of the mathematics topics (the use of technology, material, and many others) and the support system in place. Learners and teachers in this section described the effects of different teaching methods on their learning and teaching. They also shared their challenges in Mathematics and most approach teachers use to ensure that LVI understand the subject.

Learning Perspective on Challenges Faced by Mathematics Teachers Teaching LVI

Regarding challenges faced by the LVI in the Mathematics learning process, participants responded differently, and their approaches depended on the degree of visual impairment experiences. Although most learners did not point out the specific challenges, some hesitated and briefly stated what they did in the classrooms.

It was observed that teaching aid materials required for this particular learner are the braille which, during the data collection period, was not functional and required technicians from South Africa flown into the country. There is no local technical capacity to manufacture, repair or conduct routine maintenance on the Braille machines.

In teaching Mathematics to the LVI, teachers use Zy-fuse papers to draw, and in some instances, during assessments, the learners are only required to identify the y and x-axis, rather than requiring them to draw, for example. The latter happens mainly with questions that consist of the Cartesian graphs or any other diagrams that did not form part of their curriculum due to difficulties in teaching the LVI.

The LVI struggled with mathematics, as indicated by all four respondents. As per the data collected, it can be concluded that the need for special drawing instruments for drawings and calculations makes Mathematics difficult to learn. Noting that the LVI under study is those with vision loss, they are usually mixed with those with lesser vision impairment who can follow on the teacher's board.

The learners' perception of teaching Mathematics is that 75% of the respondents consider it a tougher subject to learn compared to the rest, as depicted in *Figure 4.1*.

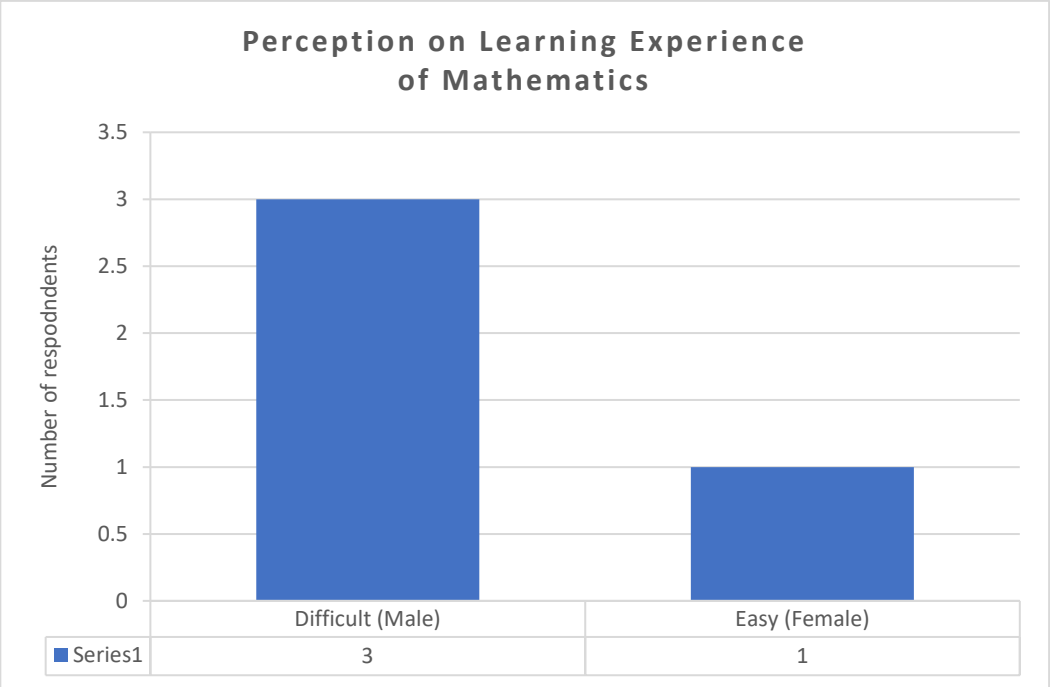

Figure 10: Perception of Learning Experience of Mathematics

Of the four respondents, three are male, and one is female. It has been noted that the respondents who perceive Mathematics to be difficult to learn are Males, whereas the sole female respondent considers it easy.

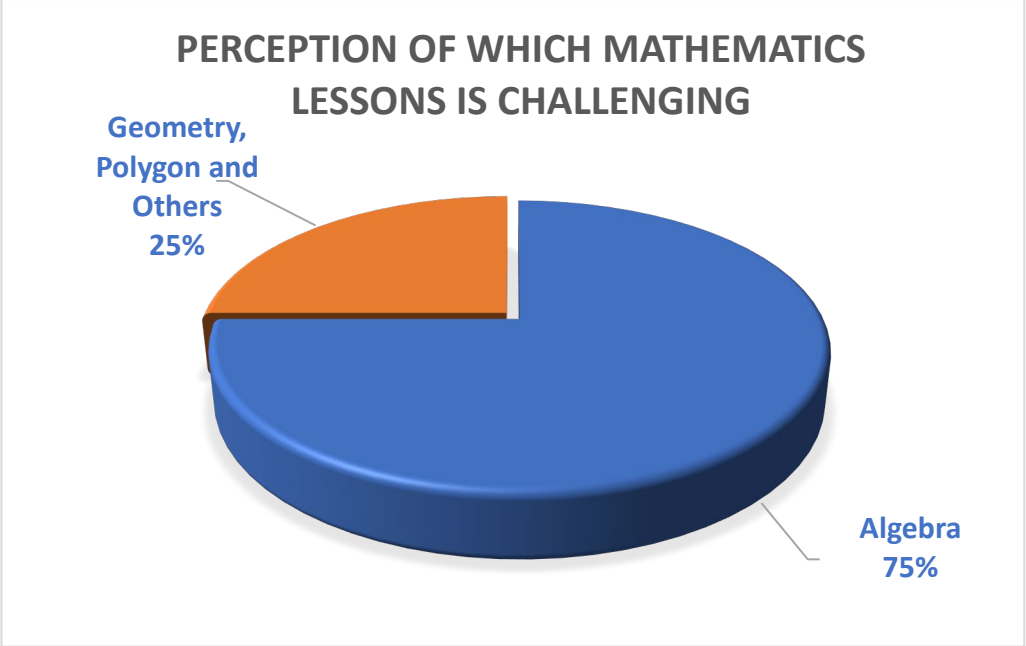

Figure 11: Perception of which Mathematics Lessons are Challenging

The school has no Braille books for Mathematics, and the talking calculator is not always functional. LVI's struggle was mainly with the Algebra lesson in the mathematics class. Thus Geometry, all the LVI respondents confirmed that in some cases, the drawings are excluded during examination or test assessments. In classroom homework given, the LVI struggled since they are not equipped with a Braille machine at home; this sentiment has been shared by L3, who indicated that:

The biggest challenge is when we get homework because we do not have Braille machines at home since they are expensive to buy. As a result, we are left behind as Mathematics is a practical subject.

Teachers have also supported that teaching Mathematics is a Learner-centred approach; however, with LVI, you cannot expect them to carry out exercises from home. L3, in this case, also agrees on the challenge faced when doing homework by indicating that:

I use my friends to read for me, and we do not have Braille machines in the hostel for homework, so it is tough to do homework.

Financial challenges highlighted by learners and teachers, for instance, in response to some of the challenges faced with Mathematics as a subject, L4 indicated that:

The lack of calculators makes it difficult to solve mathematical problems, and we have to share the calculators. No Braille notes to follow when the teacher is teaching, and the required stationery for LVI is expensive; for instance, the talking calculator is N$ 7 000.

Learners and teachers are not resourced adequately in teaching Mathematics, as reliance on government support is high. Although one of the learners has indicated that she buys her materials, this may not be true with the rest of the respondents.

Teaching Perspective on Challenges Faced by Mathematics Teachers Teaching LVI

Regarding challenges teachers face when teaching Mathematics to LVI, participants responded differently, and their approaches depended on their teaching experiences with LVI. Although teachers did not mention specific challenges, they hesitated and briefly stated what they did in their classrooms.

Both respondents (Teachers) felt positive towards the teaching process for the LVI; however, the latter can only be achieved with adequate resources. The school uses the same textbook, titled: with the sighted learners.
Based on the school curriculum and prescription, this is because Braille books are expensive and require many papers. A comprehensive mathematics book costs about N$ 1.2 million to purchase at the current market price.

On the other hand, both teachers agreed that teaching LVI is not so difficult, provided that there is adequate teaching and learning material, as T1 and T2 highlighted it:

T1: Teaching Mathematics to a visually impaired learner is not difficult. You should bring in learning aids for the learner that can make sense depending on his/her condition.

T2: It is a difficult task because we do not have all the materials. There are no textbooks for Braille to teach LVI at the school, and there are no appropriate teaching materials to make them understand Mathematical concepts; hence you have to create some by yourself for learners to understand.

The school relies on the government to acquire teaching aids and resources, which are often inadequate. Both teachers have confirmed that the braille machine, brailed notes, software on the computer and Zy-fuse paper for drawings are used in teaching the LVI on Mathematics.

The braille machine, also known as braille printer/embosser, is defined by Technopedia (2022) as a device that can generate printed material using the braille writing system for learners with loss of vision or visually impaired users.

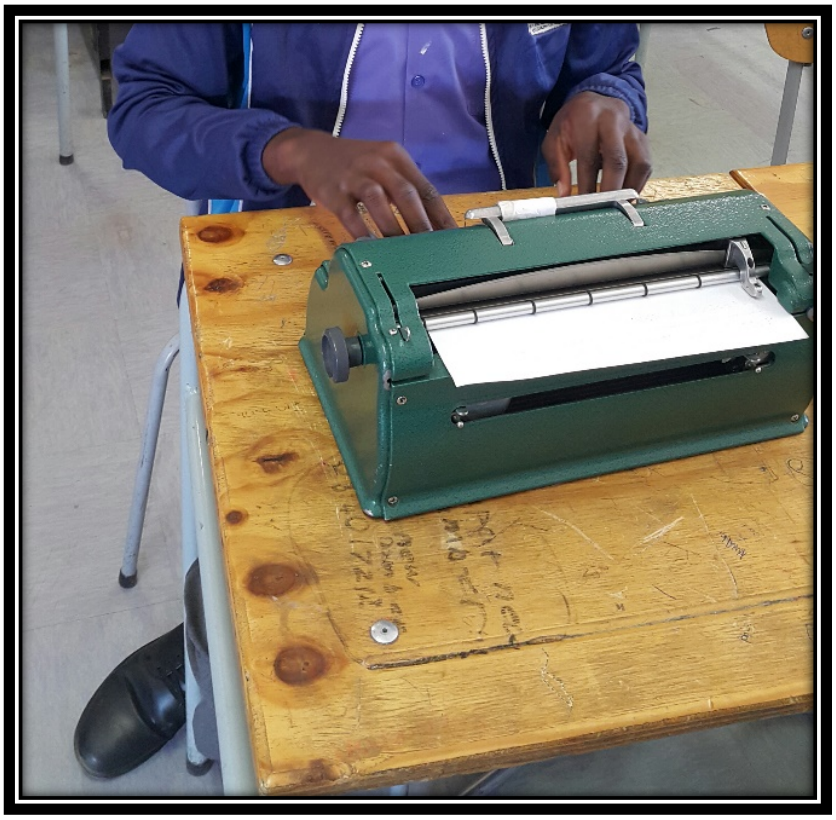

Figure 12: Learner uses the Braille Machine at the Special School

The machine in *figure 4.3* presses dots onto a piece of a special paper, which then allows the person using the braille system to use their fingers to read the content (Technopedia, 2022). The Zytex2 swell paper or Zy-fuse paper Swell Paper is a specialist paper onto which images can be printed and made into tactile diagrams (Enabled. In, 2022).

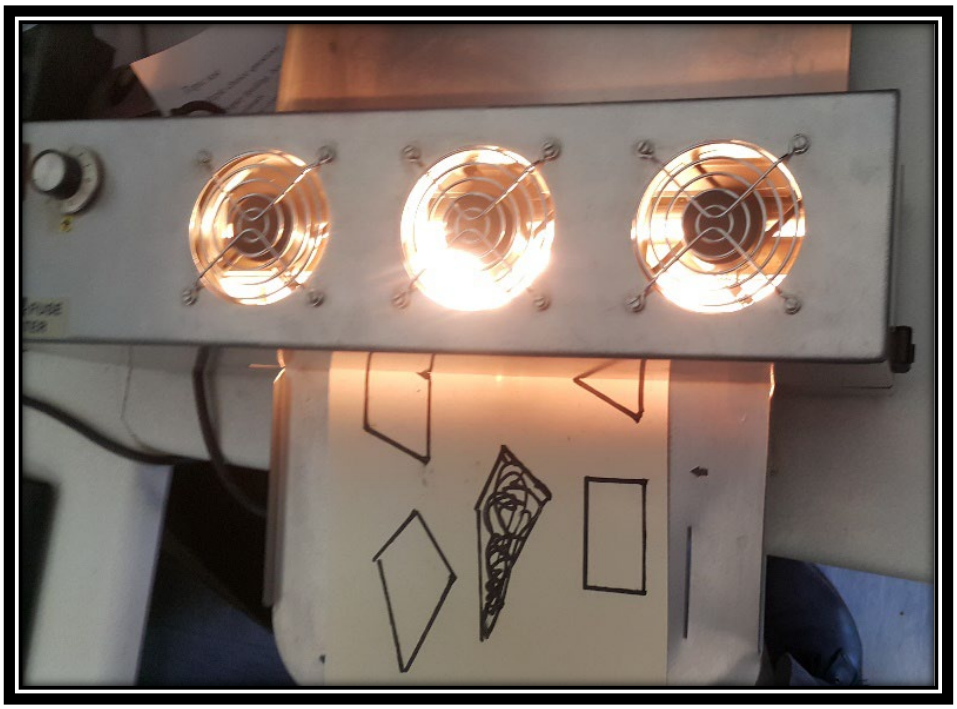

Figure 13: Zy-fuse Machine at the Special School

In conclusion, participants (learners) complained about the challenges related to teaching methods used by their Mathematics teachers. They emphasised that their teachers did not have enough information to provide inclusive education for LVI, and therefore, the teachers could not use effective methods since there were few teaching materials. Lastly, they compared classroom lessons in terms of Mathematics lessons and other subject lessons.

4.4.2 Equity Principle in the Mathematics Lessons

Participants indicated that they could not get enough out of the classroom teaching methods as the way they learnt Mathematics differed from the sighted learners, and teachers had limited knowledge on how to deal with both groups combined.

Participants (learners) added that they could not use the materials effectively in Mathematics because the teachers sometimes forget about them. Therefore, participants concluded they could not benefit from their high school Mathematics lessons because they were dealing with more problems than their well-sighted counterparts. Only the learners' views on equity in Mathematics education were presented in this part.

Learners' Views on Equity in Mathematics Lesson

Comparing themselves in terms of performance to the sighted learners, all respondents have indicated their strength over the sighted except for L3, who feels that he has to spend more time asking questions. The respective responses were as follows:

L1: There is no difference except the eyesight.

L2: We are good at mental calculations, and sighted learners are good at drawings.

L3: When the teachers explain, I must listen, and I have to ask if I do not understand, so it is tough.

L4: I think I am better than the sighted learners.

All respondents believe that teachers treat them all equally and feel excluded only in terms of comparisons to other learners with the sighted learners, as stated by L4 that she feels there is not much equity in the mathematics class in her response:

Because we do not receive notes while the sighted learners have notes and tests written, we are left behind.

Regarding the attitude around learning Mathematics, all respondents responded positively and indicated that the sighted learners are described as friendly. Furthermore, the respondents (learners) indicated they are given extra time during assessments. Hence can be proven with at least the following comments from the respondents:

L1: *Extra time during the exam; we have been marked the same way as the sighted learners.*

L2: *Extra time is given, but we should be given more calculations to make the assessment fair.*

L3: *Extra time is given, and the assessment is fair when the teachers' DE Braille our answers and mark from it.*

L4: *Extra time, and we are marked fair.*

4.4.3 Teachers' Training and Professional Development

The participants agreed that the teachers' training and professional development were important for learners learning. However, teaching methods in the teachers' training should have been tailored to their needs. They explained that because the learners had a disability, they should have had different teaching methods to accommodate LVI. In this chapter, the teaching methods of the participants were detailed according to participant experiences.

Teacher's view on Teacher Training and Professional Development

No formal qualifications are provided to the teachers; all of them supplemented the use of their qualifications without specialised training in using braille, not teaching LVIs. It is imperative to note that the teacher's interest in teaching Mathematics to LVI is at the centre of their interest's response from one of the mathematics teachers (T1) based on if they received training in special education:

No training is given to the teachers besides the qualification one already has; we follow the mainstream. We (teachers and LVI) are not accommodated, and at the mathematics congress, I decided to blindfold everyone and presented a lesson to them to make them aware of the crisis we faced as teachers of LVI. I hope the organisers will incorporate presenters for special education in Mathematics.

However, job training in the use of the Braille machine is conducted but is not adequately equipping the teachers in teaching LVI mathematics as agreed by T1 and T2:

T1: Yes, we receive training because we deal with LVI.

T2: Yes, we receive training; it is the first thing I was taught when I entered school.

The teachers use posters and prepare teaching materials before the lessons, as respondents (T1 and T2) indicated.

Learners' views on teacher training and professional development

The LVI is given several various forms of preparedness for the class. The teacher avails extra time for lessons; they also explain descriptively, and in some instances, they provide valuable handmade materials. In response to the latter, L4 also agreed and responded as:

Yes, we have been given materials such as drawings, and the teacher uses strings on a poster that we can feel.

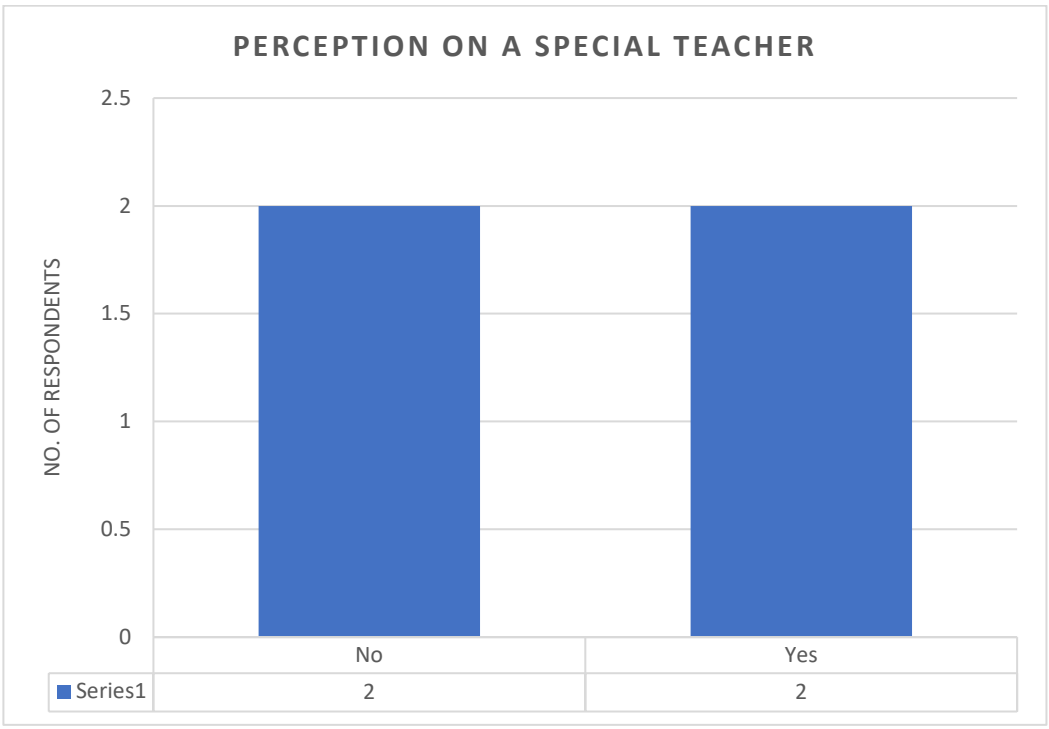

Figure 14: LVI Perception of Special Teacher

Responses on whether the LVI has a special teacher have indicated mixed feelings, as depicted in *Figure 4.5.* Two LVI have indicated that they have a special teacher (L1 and L3), and L2 and L4 have indicated that they do not have one.

Perhaps it is a subjective point of what a special teacher would be to an LVI in this case. Despite the lack of adequate resources, using Braille seems effective in the teaching and learning experience for Mathematics. Learners also learn about symbols in the Braille subject, so this is a stepping stone. All the respondents (learners) are satisfied with teaching symbols in the Braille class as it helps them in the mathematics class.

4.4.4 Participants' Views on Curriculum Choice

Various views were given by participants (teachers and LVI). The views are comprehensively discussed below.

Teachers' Views on Curriculum Choice

However, despite an inclusive education environment in Namibia, there is a sentiment that adequate resources are not availed for the system to function effectively and efficiently, particularly when dealing with Mathematics as a subject. The curriculum changes are not at the centre of the challenges but rather the availability of educational materials and continuous capacity building. The responses from teachers on what changes should be made in the curriculum to benefit LVI, to whichT1 indicated that:

No changes because it can also be adopted if we have resources.

In the same vein, T2 shared the same sentiments:

No changes. Teachers should be trained and ensure all materials, especially textbooks and teaching materials that are user-friendly for the blind, be provided.

T1 and T2 have all indicated that the examination caters for LVI by replacing drawings and using a Zy-fuse heater. The responses were as follows:

T1: Some topics, like drawing, are replaced during the exam.

T2: Yes, they use teachers from the special school; the Zy-fuse heater is used for diagrams. The blind learners answer questions where they do not draw.

On the part in which Mathematics topics should be removed, one of the respondents (Teachers) admitted that excluding some questions may limit the LVI on their preparedness for university. On the other hand, the teacher (T1) supports replacing some of the mathematics topics that should be removed from the national exam now. The National Institute for Educational Development (NIED), an institution responsible for curriculum development and basic education reforms in Namibia, represents individuals who protect the interest of special needs learners, including the LVI (NIED, 2022).

Learners' Views on Curriculum Choices

All respondents have confirmed that it is compulsory at their school to do Mathematics, and compared to other subjects, they are more challenged with Mathematics since it requires many drawings. Most respondents have indicated that Mathematics as a mandatory subject is good; however, its challenges limit them from achieving their academic ambitions. The comments made by each one of the respondents are as follows:

L1: *No challenge because the study field does not need my eyesight.*

L2: *The study field I want to choose requires History and Science, but I do not want Science because it is tough.*

L3: *The challenge is that we have to choose a study field that can accommodate our disability; for instance, I want to become a businessman, and I need to write a business plan that requires much paper but is expensive to purchase stationery for the blind.*

L4: *It is tough because I have wanted to become a Scientist or Mathematician my whole life, but now I cannot be a doctor because of challenges due to my disability.*

4.5 Findings from the Observations

This section presents findings from observation. Only the school with LVI enrolled in taking Mathematics during the observation time were observed.

Therefore, the findings were from one school that enrolled four secondary LVI for the 2019 academic year. The opinions presented are based on the school and cannot be generalised. The findings were grouped into major themes with sub-themes.

The major themes included the classrooms with sub-themes as indicated in the table above, such as; the number of learners, seating arrangement, noise level as well as stationery; the teaching and learning process with sub-themes such as teacher's preparation, teaching and learning activities, classroom interaction, feedback and classroom instruction activities. The observation also focused on the provision and accessibility of study materials and the forms of assessments. The researcher observed the observation during lessons, and only Mathematics teachers with LVI were observed. A

checklist was used to record information. The observation instrument mainly helped to answer the question as to what extent the learners with Visually Impairment meet the specific objectives in the mathematics syllabus.

4.5.1 The Classroom

Most lessons took place in a small classroom with a maximum of 12 learners per classroom. Most class groups had one learner that needed a Braille machine; hence that could not see on the board. The classroom chairs and tables were used by a specific learner every day. There was an order when learners entered the venue, and learners moved in an orderly manner and chose their seats randomly. Most LVI preferred to sit at the back of the classroom, far away from the chalkboard. LVI similarly entered the classroom with the guidance of a friend but, in some instances, on their own.

LVI, however, voluntarily selected the back seat on one side of the venue, far from the chalkboard and the teacher, as they could not see what was written on the board. A set of brailed documents was used in one of the observed lessons.

There was a sitting order in the classroom, meaning learners could not sit anywhere they wished, and no preference was given to the blind learners.

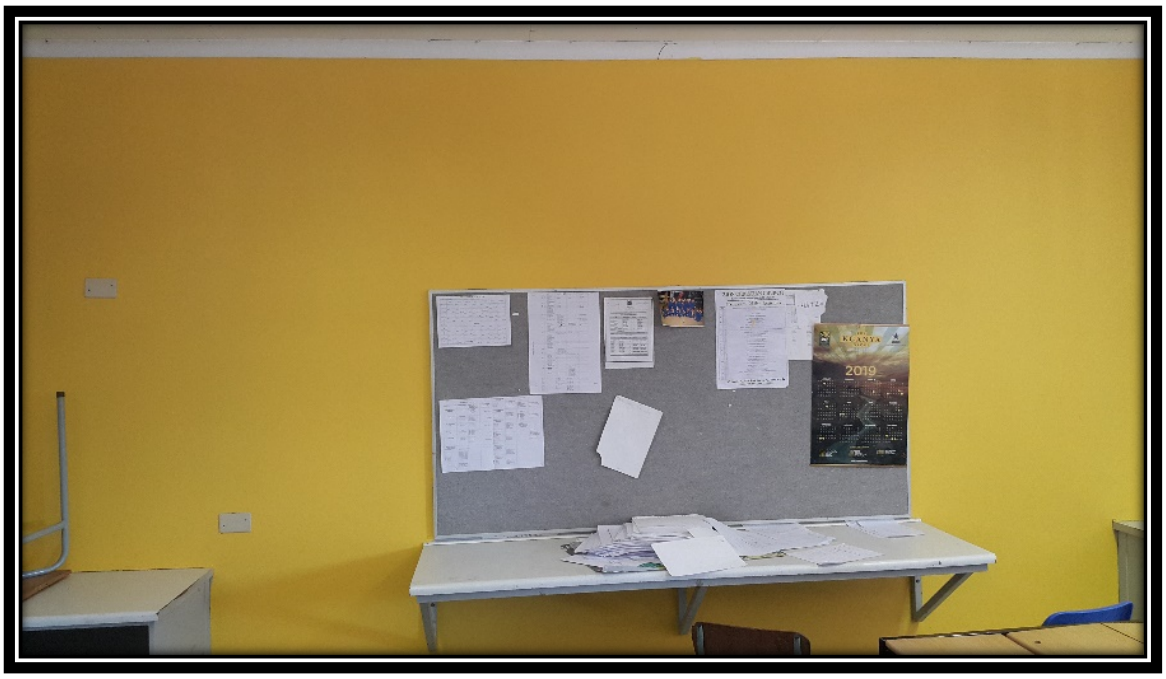

Figure 15: One of the Classroom Walls at the Special School

The lighting was sufficient, and the windows allowed natural lighting and sufficient ventilation. The classrooms, including the door, were painted yellow, and chalkboards were painted black for learners with low vision to see clearly. The teacher stated that a group of learners did a study, and the result was that for the learners with low vision, the yellow colour on the walls and doors is more visible and clearer (*Figure 15)*. The teacher stood in front of the classroom most of the time during presentations and explanations. Hence, the teacher later goes to the back of the classroom to explain to the LVI once the others are busy with classroom activities. In most lessons, it was a challenge for the teacher to move around during the presentation because they had to explain to the learners with low vision and write notes manually on the board; hence the time was limited.

Observations indicated much disruptive noise from the learners' movements to and from the chalkboard, sometimes disturbing the lessons. The teacher, on several occasions, took charge of the class, managed, and created a conducive learning atmosphere.

Teaching and Learning Process

The researcher observed that most of the teachers used the traditional teaching method. Lessons were mostly presented through writing on the blackboard, where the contents covered were presented, and learners had to copy. During lessons, teachers talked and gave many examples for LVI to follow, although sometimes the teachers would forget about them and use terms such as “as you can see on the diagram”. However, LVI remained wondering and looked lost. Although learners could hear what the teachers were talking about, the challenge was that they could not follow the lesson since they were not availed with a copy of the lesson in Braille format. Other learners could read on the blackboard and make their notes. In one class, LVI slept as they were bored by the lesson. For the two weeks of observation, the Braille alphabets of the school were being serviced; hence LVI were only listening as the learning process. On very few occasions, the teacher tried to give attention to and detailed explanations to LVI.

Figure 17: The Blackboard in One of the Classrooms at the Special School

The blackboard presentation (as in figure 4.7.) was visible for the partially sighted learners. It had sufficient information, but the teacher did not pay attention and give detailed explanations of the visual information, such as lines, tables, symbols and charts on the blackboard, to ensure that LVI benefited from all the information presented. In some lessons, T2 used collaborative teaching methods where learners worked in pairs/groups. Some of the lessons were presented as class discussions. In one lesson based on measurements, the teacher grouped the learners to work on a practical teaching activity where learners had to measure the length of the classroom.

Interestingly, the teacher allowed learners with visual impairments to choose their preferred group. The instructions were in the learner's textbook during group tasks in about eight lessons. In other lessons, learners were given classwork from the textbook, but there was no copy in Braille. LVI relied on fellow learners who could read written texts. Both teachers commonly used the demonstration method. In one class, the researcher was impressed by how well the teacher prepared for the class. For a practical orientated lesson on Geometry with many interesting activities. The teacher brought reality to the classroom, and one could see that learners were having fun doing the activities. The teacher prepared a sample of cut-out boxes in different shapes that learners could feel, and the teacher described the different angles formed.

Interestingly, the teacher preferred LVI to feel the materials they worked on for activities. During the lesson, the teacher remained supportive of LVI. The teacher demonstrated the angles to all while narrating the process. The teacher also sat closer to LVI and slowly demonstrated the angles using the boxes. T2 used the Zy-fuse machine to draw the different shapes learners could feel and relate to the topic. However, before the teacher demonstrated, the teacher alerted the LVI about the same task and asked them if they could do the activity. However, a challenge was observed during this kind of task: time management. Most of the tasks required more than one day. Thus, most learning objectives were not met, such as the learners being expected to draw was not met as there was a lack of equipment for learners to draw. Thus, they learnt by listening.

Overall, the observer paid special attention to how the feedback was given to learners, particularly LVI. Teachers gave written feedback on the blackboard, which learners read for themselves on the board and did corrections. However, by observation, giving feedback to LVI in written form was challenging. The LVI used the Braille machine to write written tasks such as topic tasks, tests, homework, class activities and examinations. It was observed that both teachers are competent in reading and writing Braille; thus, both were able to Braille and debrail. Although teachers marked the assessment paper, LVI could not read them without assistance. From the researcher's observation, T2 took time to provide one-on-one feedback to LVI.

Provision and Accessibility of Learning Material

Most subjects had prescribed textbooks and recommended reading materials and other relevant documents. Besides, some subjects had printed notes and different handouts of notes. In all the lessons observed, no notes were made available to LVI. None of the lessons observed had textbooks in Braille, recorded teachers and audio study materials. With handouts and printed materials, teachers had to make it accessible to the LVI in the format they could read by taking them to the special computer for Braille. The talking calculator was never available to LVI during the lesson, and the Braille machines were being serviced. Thus, LVI had nothing to do during the lesson and would sometimes lie in their arms during the lesson. Both teachers did not make use of teaching aids. They mostly used blackboard presentations and traditional teaching methods without using teaching aids. Amongst the lessons observed by the researcher, only two were teaching aids: the cut-out box pieces to represent angles and Zy-fuse paper with different shapes.

These were the classes that were more practically orientated. Teachers brought different items to class; learners felt touched and used the materials. The researcher observed that most participants focused mainly on auditory and less on visual, kinaesthetic and tactile learning methods.

Mathematics is a practical subject that requires learners to draw and do many exercises to comprehend the content taught in a lesson; LVI was mostly left behind due to a lack of appropriate resources to allow them to do all activities, such as drawing, required of them. The specific objectives stipulated in the prescribed Mathematics syllabus do not fully cater for the LVI at the school, and hence the assessments are done differently for these learners based on what they can do and not what is expected of them by the syllabus.

4.6 Summary

This Chapter presented participants' responses from the interviews and findings obtained from observation. The next chapter presents the summary, conclusions and recommendations based on the findings and discussions unpacked in the previous chapter.

CHAPTER 5: SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This Chapter summarises the findings from the study, draws conclusions from the findings and presents attainable recommendations. The summary, conclusions and recommendations are based on the research objectives and are presented in the following order first, the researcher presents the strategies used by Mathematics teachers in teaching LVI. Secondly, the researcher discusses mathematics teachers' challenges in teaching blind learners. Thirdly, the researcher discusses the extent to which learners meet the specific objectives in Mathematics, Furthermore, conclusions are drawn and presented, and some recommendations are given.

5.2 Summary

The study sought to investigate mathematics teachers' challenges in teaching secondary school learners with visual impairment in the Khomas region. It also sought to observe how Mathematics teachers taught LVI and established the suitability of Mathematics resources for LVI. The study further identified relevant teaching strategies for LVI in the Mathematics classroom and the teacher's professional development in teaching LVI. Finally, the study focused on the challenges of the LVI's mathematics teaching and learning process.

To find answers to the research questions stated above, a qualitative design was used because of the nature of the research problem. A homogeneous sampling strategy was used; the study sample was purposefully selected to select participants from one special school in the Khomas Education Region. This study used semi-structured interviews and an observation schedule to collect participant data. The data collected was organised by grouping the data into subheadings related to the research questions, and the information was examined using interpretations based on the researchers' comprehension. The findings of the study, under the research questions, revealed the following results:

- Mathematics teachers find it challenging to teach LVI due to a lack of teaching resources, such as brailed textbooks, during the research period. With the change in the curriculum, the school did not have a single-brailed textbook and teaching materials for learners to understand the content.

- Mathematics teachers use the Zy-fuse machine to create teaching material for the learners, such as drawing for the LVI to follow during the lesson, by feeling the shapes as the teachers describe them, which they have to process and relate to something they cannot see but feel.

- In the finding, the researcher also stated to the participants that Braille machines are usually fixed by specialists that come from South Africa. Thus, teaching is a big challenge when the machines are out of order. It was further stated that in the Khomas region, when learners write a cluster exam, the papers are not delivered

on time as the exam papers have to be transcribed for the LVI; as a result, there is a delay in the exam process for the LVI which affects equity in education.

- Learners with visual impairment find Mathematics more challenging than other subjects, especially when teachers are teaching on the board and they have no way to follow and are given homework as they do not have textbooks and thus depend on the other learners to read for them the questions.

- LVI also find it difficult to do calculations as they do not own talking calculators; hence the calculators are also said not to have all the functions. As a result, they cannot do some calculations.

- LVI find the following topics most challenging in Mathematics: Geometry, Polynomials, Graphs and Algebra, as the school sometimes has a shortage of the special paper for the ZY fuse machine for the teachers to draw them in order for them to follow.

During the study, it was also found that there are various degrees and types of visual impairment classified by NIED, which are low vision, partial sight and blindness, and for this study, the focus is on learners with blindness (National Institute for Educational Development, 2014).

The teachers both indicated that they were well prepared to teach the subject content to LVI, although, in terms of teaching strategies and availability of resources, it was observed that the teachers were moderately prepared to teach LVI; however, as responded by most of the learners and the teachers, these resources are inadequate for the mathematics class.

It was observed that the female learner, L4 has a high interest in Mathematics compared to the male students, with most probable performing better than the rest of the participants. The recent UNESCO report, "UNESCO's Global Education Monitoring Report," supports the above, where the gender gap in Mathematics now favours girls (Rasmeni, 2022). Hence, a female LVI may be more interested in Mathematics than a boy learner, making it easier for the teacher.

Although researchers such as Johnson (2014) advocate and supports that for a human theory of learning, it is important to assert that educators should facilitate learning and create structured learning environments with differentiated instructions, this does not support learning for LVI. A learner-centred approach is seemed to be the best in teaching, as pointed out by the respondent (teachers); more resources, particularly financial, are required (Josua, (2013) in order to realize this in Namibia. Further studies on this topic are suggested for further understanding the challenges of teaching Mathematics for LVI, particularly from the primary school level, since that may form the basis of the current learner's performances. Most participants acknowledged that some topics from the mathematics syllabus, such as drawings, are challenging to teach and explain to the LVI.

Mathematics teachers acknowledged that they had never attended any Mathematics training, workshops or professional development training since they started teaching at the special school. As expected, it was observed that they require training on how to teach some topics in the mathematics syllabus to the LVI.

One of the Sector Policy on Inclusive Education's main objectives includes expanding access to and providing quality education, especially for educationally marginalized learners (Ministry of Education, 2013, p. 4). The findings from this study are that the LVI is not moving towards achieving this objective since learning and teaching resources for the LVI are not adequate at the special school.

This study found that Mathematics teachers have bad pedagogical experience with LVI as they had not been exposed to the specific teaching methods for LVI at the university; hence, there was also no special training given at the school, but they just had to teach themselves. Moreover, it is noted that platforms for review and identification in addressing challenges on barriers in the education system guiding principles Sector Policy on Inclusive Education document (Ministry of Education, 2013) of which NIED makes efforts to emphasize LVI. Imperatively the study took cognizance of the fact that although systems, policies and procedures are in place, which would allow addressing the challenges faced by the mathematics teachers for LVI, the issue of bureaucracy in terms of requesting teaching materials through the existing systems has also been observed as a challenge, and such sentiments were however, not expressed explicitly by the respondents.

Consistent with the finding from Sheyapo (2017), who, in a study, "Perspectives of lecturers on pedagogical inclusion of Students with visual impairments at higher education Institutions in Namibia", found that "some lecturers were reluctant to empower themselves, take the lead and accountabilities in inclusive practices" (p.133). Noting that one of the respondents (teacher) was also a management member of the school in this study, it was limiting, and perhaps biases in this regard were inevitable.

The Sector Policy defines Special Schools on Inclusive Education as "Schools where education is offered to learners with disabilities, i.e., separately from their peers and general school settings" (Ministry of Education, p.3). Furthermore, as per this policy, the existing Special Schools are to be transformed into "Resource Schools"; this has not been achieved since this study was conducted.

Furthermore, scholars Waterfield, J. and West, B. (2008) argued that there is a need for adapting to the learner's name and also allowing for the LVI to record lessons while further providing breaks in between lessons with the use of descriptive and visual cues as an add on to these lessons. It has been consistent with the observations during the lessons; more visual materials are required when teaching the learners.

This study also agrees with Morelle and Tabane (2019) in which, just as it is in South Africa, the Namibian education system does not cater for LVI, although such provisions are made in the laws and policies of inclusive education. Despite teachers being highly trained, Quality Assurance and Standards officers ought to organise and hold regular

workshops, seminars and refresher courses administered within special schools with LVI to sensitise Mathematics teachers on current and changing trends as well as strategies for teaching Mathematics, and this was also found in a study by Manjuru (2014) on the "Pedagogical challenges facing mathematics teachers of learners with visual impairment at Thika Primary School for the blind, Kiambu County".

Finally, the findings have also revealed that the physical environment of the classroom and the school is conducive for the teachers and learners to teach Mathematics and other subjects in general.

5.3 Limitations of the Study

This study focused only on the LVI with loss of vision; it is important that in the future, a study of this nature should also include research on sighted learners to understand the challenges teachers face and overall, on the aspect of inclusive education at secondary schools. Hence, it would have expanded the research in a way that more opinions would have had an impact on the findings. Only two teachers and four learners were interviewed, so the targeted population would have been expanded to include LVI and their respective primary school teachers.

Another limitation is that this was qualitative research which may have also required the respondents to be given questions for quantitative research to validate the findings better.

However, given the circumstances of the LVI respondent, quantitative research was impossible as the learners could not answer using a questionnaire as the researcher could not read in Braille.

5.4 Conclusions

The study's findings can only be generalized to the mathematics teachers in the Khomas region teaching LVI. From the findings, the mathematics teachers at the special schools indicated that they have the knowledge, experience, and skills to teach Mathematics to learners with Visual Impairment. However, changes in the teaching environment can affect the teaching and learning process. If the implementation of the curriculum is not well planned, it can make it difficult for teachers at special schools to teach effectively and efficiently, as they should go the extra mile from an ordinary teacher in the creativity of the lesson.

All the special teachers need to be involved in the whole process of curriculum change, from the planning/designing phase to the implementation phase. Teachers should provide feedback to the Ministry of Education on the challenges they are experiencing in implementing the curriculum to ensure that the necessary improvements are made. These teachers should, most importantly, be provided with sufficient training from experts in the field based on any changes made for the LVI to understand the lesson as the teacher is fully prepared. Appropriate teaching materials should be provided on time for the learning and teaching process to be effective. In order to have effective teaching and learning taking place, there should be teaching and learning materials accompanied by assistive devices.

Most of these assistive devices are hard to get due to high costs; these exorbitant prices have been concurred with many other researchers, such as Josua (2013), who found in his research, that LVI find it difficult to be included and access quality education due to the cost of required assistive device.

The study concludes that challenges faced by Mathematics teachers at the special school can be rectified with the availability of teaching resources, in-service training and teacher involvement from the school in curriculum development. The latter conforms to Manjuru (2014), who indicated that LVI Mathematics teachers should often attend refresher training and workshops and ensure active and working discussion groups throughout the learners‟ educational process. They should continuously remind the other teachers to relate Mathematics with other regular subjects during instruction.

5.5 Recommendations

- This study suggests further research on the need for refresher training and workshops for Mathematics teachers teaching the LVI. The latter may assist scholars in understanding the challenges faced by teachers, and the type of skills in which they may need to be capacitated would likewise allow and create a conducive atmosphere for teachers to analyse appropriate instructional methods for use in specific Mathematic areas, brainstorm and exchange ideas on handling Mathematics to their learners.

- Research the roles of Institutions such as NIED and others in promoting inclusive education, particularly in teaching the LVI. Institutions such as the Namibian Federation for the Visually Impaired and the African Braille Centre are entrusted with acquiring and supplying resource materials. They ought to ensure apparatus such as Abacus and Cuberithms are made locally to reduce the importation cost and thus make them affordable. However, these institutions have not been featured in this research, hence the need to continuously research this subject matter. The National Institute for Educational Development (NIED), responsible for educators' curriculum development and professional development, should ensure that Mathematics teachers of learners with visual impairment are adequately involved in designing and developing the mathematics curriculum for LVI. This would provide developers with insight into challenges anticipated among the learners. The curriculum developers also ought to research the possible increase in the time allocated to teaching mathematics, and they should emphasise the implication of increasing weekly lessons for learners with visual impairment. It would be in the interest of the mathematics teachers of LVI to be part

of the curriculum developers and designers while incorporating computer literacy, knowledge and skills in Mathematics teaching to help LVI to tabulate mathematical data accurately. They should urgently ensure a speedy supply of the syllabus, Braille textbooks and other instructional materials.

- However, LVI mathematics teachers should not be considered ineffective based on their learners' poor performance. They should concentrate on their effort to overcome their individual and the learners' challenges and instead create mathematical interest and serious attention towards teaching mathematics.

- Suggested further research: Teaching Mathematics to LVI, especially in specific areas such as Algebra that the learners in the study perceived most difficult, Graphs of function, Geometry and Construction where the teachers encounter numerous challenges in drawing angles and graphs.

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APPENDICES

APPENDIX A: Ethical Clearance Certificate from UNAM to Conduct Research

UNAM
UNIVERSITY OF NAMIBIA

ETHICAL CLEARANCE CERTIFICATE

Ethical Clearance Reference Number: FOE /485/2019 **Date: 21 August, 2019**

This Ethical Clearance Certificate is issued by the University of Namibia Research Ethics Committee (UREC) in accordance with the University of Namibia's Research Ethics Policy and Guidelines. Ethical approval is given in respect of undertakings contained in the Research Project outlined below. This Certificate is issued on the recommendations of the ethical evaluation done by the Faculty/Centre/Campus Research & Publications Committee sitting with the Postgraduate Studies Committee.

Title of Project: The Challenges Faced By Mathematics Teachers In Teaching Blind Secondary School Learners In The Khomas Region

Researcher: AMANDA ESMEROLDA EISES

Student Number: 200932063

Supervisor(s): *Dr H.M Kapenda (Main) (Co) Dr. E. Tobias*

Take note of the following:

(a) Any significant changes in the conditions or undertakings outlined in the approved Proposal must be communicated to the UREC. An application to make amendments may be necessary.

(b) Any breaches of ethical undertakings or practices that have an impact on ethical conduct of the research must be reported to the UREC.

(c) The Principal Researcher must report issues of ethical compliance to the UREC (through the Chairperson of the Faculty/Centre/Campus Research & Publications Committee) at the end of the Project or as may be requested by UREC.

(d) The UREC retains the right to:

(i) Withdraw or amend this Ethical Clearance if any unethical practices (as outlined in the Research Ethics Policy) have been detected or suspected,

(ii) Request for an ethical compliance report at any point during the course of the research.

UREC wishes you the best in your research.

Dr. E. de Villiers: HREC Chairperson

Ms. P. Claassen: HREC Secretary

APPENDIX B: Permission Letter from UNAM to Conduct Research

UNAM
UNIVERSITY OF NAMIBIA

RESEARCH PERMISSION LETTER

Student Name: Amanda Esmerolda Eises

Student number: 200932063

Programme: MASTER OF EDUCATION: MATHEMATICS OF EDUCATION

Approved research title: The Challenges Faced by Mathematics Teachers in Teaching Blind Secondary School Learners in the Khomas Region

TO WHOM IT MAY CONCERN

I hereby confirm that the above mentioned student is registered at the University of Namibia for the programme indicated. The proposed study met all the requirements as stipulated in the University guidelines and has been approved by the relevant committees.

The proposal adheres to ethical principles as per attached Ethical Clearance Certificate. Permission is hereby granted to carry out the research as described in the approved proposal.

Best Regards

---

29 August 2019

Name: DR H.U. KANDJEO-MARENGA
Director: Centre for Postgraduate Studies
Tel: +264 61 2063275
E-mail: directorpgs@unam.na

Date

APPENDIX C: Permission Request Letter to the Executive Director, Ministry of Education, Art and Culture to Conduct Pilot Study the Oshana Region

Amanda Esmerolda Eises (Mungunda)
Cellphone: 0814499126
Email: amandaesmeroldae@gmail.com
P. O. Box 1290, Rundu
August 30, 2019

Ministry of Education, Arts and Culture
Government Office Park
Executive Director

Dear Mrs. Steenkamp

RE: REQUESTING PERMISSION TO CONDUCT RESEARCH FOR MASTERS PROGRAM

I Amanda Esmerolda Eises (Mungunda), am a registered Master of Education (Mathematics Education) student, at the of University of Namibia, my student number is: 200932063. As part of the curriculum, students are required to do a research project in partial fulfillment of their respective qualification. My research title is: *The Challenges Faced by Mathematics Teachers in Teaching Blind Secondary School Learners in the Khomas Region.*

I, therefore humbly request your good office to grant me permission to collect data required to complete my pilot study from, Gabriel Taapopi Secondary School and Eluwa Special School in the Oshana Region. The procedures will involve conducting of formal interviews with the mathematics teachers and the blind learners, as well as classroom observation. Deliberate measures will be taken to reduce disturbances to the schools' normal activities and secure informed consent from teachers.

I, attached the, Ethical Clearance Certificate and the Research Permission letter from the University of Namibia as per your requirement.

Thank you very much for your kind co-operation in this matter.

Looking forward to your positive prompt response in this matter.

Yours in Education
Mrs. A.E Eises (Mungunda)

APPENDIX D: Permission Request Letter to the Director Ministry of Education and Culture to Conduct Pilot Study in the Oshana Region

Amanda Esmerolda Eises
(Mungunda) Cellphone:
0814499126
Email: amandaesmeroldae@gmail.com
P. O. Box 1290, Rundu

August 30, 2019

Ministry of Education, Arts and Culture
Oshana Regional Council
Director

Dear Ms. H.M. Amukana

RE: REQUESTING PERMISSION TO CONDUCT RESEARCH FOR MASTERS PROGRAM

I, Amanda Esmerolda Eises (Mungunda), am a registered Master of Education (Mathematics Education) student, at the of University of Namibia, my student number is: 200932063. As part of the curriculum, students are required to do a research project in partial fulfillment of their respective qualification. My research title is: *The Challenges Faced by Mathematics Teachers in Teaching Blind Secondary School Learners in the Khomas Region.*

I, therefore humbly request your good office to grant me permission to collect data required to complete my pilot study from, Gabriel Taapopi Secondary School and Eluwa Special School in the Oshana Region. The procedures will involve conducting of formal interviews with the mathematics teachers and the blind learners, as well as classroom observation. Deliberate measures will be taken to reduce disturbances to the schools' normal activities and secure informed consent from teachers.

I, attached a written permission from the Executive Director of Ministry of Education, Art and Culture to conduct this research, I have also attached the, Ethical Clearance Certificate and the Research Permission letter from the University of Namibia as per your requirements.

Thank you very much for your kind co-operation in this matter.

Looking forward to your positive prompt response in this matter.

Yours in Education

Mrs. A.E Eises (Mungunda)

APPENDIX E: Permission Granted by Director, Ministry of Education, Art and Culture to Conduct Pilot Study in the Oshana Region

REPUBLIC OF NAMIBIA

OSHANA REGIONAL COUNCIL
DIRECTORATE OF EDUCATION, ARTS AND CULTURE
ASPIRING TO EXCELLENCE IN EDUCATION FOR ALL

Tel: 065 - 229800/25
Fax: 065 - 229834

Private Bag 5518
Oshakati

Enquiries: Hileni M Amukana
Ref. 13/2/9/1

Ms. Amanda Eises Mungunda
Cell: 0814499126
Email: amandaesmeroldae@gmail.com

SUBJECT: PERMISSION TO CONDUCT RESEARCH PROJECT IN OSHANA REGION

Your letter dated 0 September 2019 on the above caption bears reference.

Kindly be informed that permission is hereby granted to conduct research study at Gabriel Taapopi Secondary School and Eluwa Special School in Ompundja Circuit, Oshana Region.

This permission is subject to the following strict conditions; **(i)** There should be minimal or no interruption on normal working schedule **(ii)** Ethical issues of confidentiality and anonymity should be respected and retained throughout this activity i.e. Voluntary participation, and consent from participants and **(iii)** the permission is valid for the entire academic years 2019/ 2020.

Both Parties should understand that this permission could be revoked without explanation at any time.

Furthermore, we humbly request you to share your research findings with the Directorate of Education, Arts and Culture, Oshana Region. You may contact Mr. G.S. Ndafenongo, the Deputy Director; Programs and Quality Assurance (PQA) for the provision of summary of your research findings.

We wish you the best in conducting your study.

Yours sincerely,

OSHANA REGIONAL COUNCIL
DIRECTORATE OF EDUCATION, ARTS & CULTURE
OFFICE OF THE DIRECTOR
06 SEP 2019
Private Bag 5518
OSHAKATI
REPUBLIC OF NAMIBIA

06/09/2019

HILENI M. AMUKANA
REGIONAL DIRECTOR

Cc: Inspector of Education: Ompundja Circuit

All Official Correspondence must be addressed to the Regional Director

APPENDIX F: Permission Request Letter to the Executive Director, Ministry of Education, Art and Culture to Conduct the main Study in the Khomas Region

Amanda Esmerolda Eises (Mungunda)
Cellphone: 0814499126
Email: amandaesmeroldae@gmail.com
P. O. Box 1290, Rundu
August 30, 2019

Ministry of Education, Arts and Culture
Government Office Park
Executive Director

Dear Mrs. Steenkamp

RE: REQUESTING PERMISSION TO CONDUCT RESEARCH FOR MASTERS PROGRAM

I Amanda Esmerolda Eises (Mungunda), am a registered Master of Education (Mathematics Education) student, at the of University of Namibia, my student number is: 200932063. As part of the curriculum, students are required to do a research project in partial fulfillment of their respective qualification. My research title is: *The Challenges Faced by Mathematics Teachers in Teaching Blind Secondary School Learners in the Khomas Region.*

I, therefore humbly request your good office to grant me permission to collect data required to complete my study from the, School of the Visually Impaired in Windhoek, Khomas Region. The procedures will involve conducting of formal interviews with the mathematics teachers and the blind learners, as well as classroom observation. Deliberate measures will be taken to reduce disturbances to the schools' normal activities and secure informed consent from teachers.

I, attached the, Ethical Clearance Certificate and the Research Permission letter from the University of Namibia as per your requirement.

Thank you very much for your kind co-operation in this matter.

Looking forward to your positive prompt response in this matter.

Yours in Education
Mrs. A.E Eises (Mungunda)

APPENDIX G: Permission Granted by Executive Director, Ministry of Education, Art and Culture to Conduct the main Study in the Khomas Region

REPUBLIC OF NAMIBIA

MINISTRY OF EDUCATION, ARTS AND CULTURE

Tel: +264 61 293 3206
Fax: +264 61 293 3922
Enquiries: Ms. C. Vries
E-mail: Catherine.Vries@moe.gov.na

Private Bag 13186
WINDHOEK
Namibia

File: 11/1/1

Ms. Amanda Esmerolda Eises (Mungunda)
Cell: 081 449 9126
Email: amandaesmeroldae@gmail.com.

Dear Ms. Eises (Mungunda)

SUBJECT: REQUEST FOR PERMISSION TO CONDUCT RESEARCH AT THE SCHOOL FOR THE VISUALLY IMPAIRED IN KHOMAS REGION

Kindly be informed that permission to conduct an academic research for your Master's Degree on *"The Challenges Faced by Mathematics Teachers in Teaching Blind Secondary School Learners in the Khomas Region"* at the School for the Visually Impaired in Khomas Region, is herewith granted. You are further requested to present the letter of approval to the Regional Director to ensure that research ethics are adhered to and disruption of curriculum delivery is avoided.

Furthermore, we humbly request you to share your research findings with the Ministry. You may contact Mr. G. Munene at the Directorate: Programmes and Quality Assurance (PQA) for provision of summary of your research findings.

I wish you the best in conducting your research and I look forward to hearing from you upon completion of your study.

Sincerely yours

Ministry of Education, Arts and Culture
Office of the Executive Director
2019 -09- 05
Private Bag 13186, Windhoek, Namibia

Sanet L. Steenkamp
EXECUTIVE DIRECTOR

Date 5/9/19

All official correspondence must be addressed to the Executive Director

APPENDIX H: Permission Request Letter to the Director, Ministry of Education, Art and Culture to Conduct Study in the Khomas Region

Amanda Esmerolda Eises
(Mungunda) Cellphone:
0814499126
Email: amandaesmeroldae@gmail.com
P. O. Box 1290, Rundu

August 30, 2019

Ministry of Education, Arts and Culture
Khomas Regional Office Windhoek
Director

Dear Mr. G. Vries

RE: REQUESTING PERMISSION TO CONDUCT RESEARCH FOR MASTERS PROGRAM

I, Amanda Esmerolda Eises (Mungunda), am a registered Master of Education (Mathematics Education) student, at the of University of Namibia, my student number is: 200932063. As part of the curriculum, students are required to do a research project in partial fulfillment of their respective qualification. My research title is: *The Challenges Faced by Mathematics Teachers in Teaching Blind Secondary School Learners in the Khomas Region.*

I, therefore humbly request your good office to grant me permission to collect data required to complete my study from the, School of the Visually Impaired in Windhoek, Khomas Region. The procedures will involve conducting of formal interviews with the mathematics teachers and the blind learners, as well as classroom observation. Deliberate measures will be taken to reduce disturbances to the schools' normal activities and secure informed consent from teachers.

I, attached a written permission from the Executive Director of Ministry of Education, Art and Culture to conduct this research, I have also attached the, Ethical Clearance Certificate and the Research Permission letter from the University of Namibia as per your requirements.

Thank you very much for your kind co-operation in this matter.

Looking forward to your positive prompt response in this matter.

Yours in Education

Mrs. A.E Eises (Mungunda)

APPENDIX I: Permission Granted by Director, Ministry of Education, Art and Culture to Conduct Study in the Khomas Region

REPUBLIC OF NAMIBIA

KHOMAS REGIONAL COUNCIL

DIRECTORATE OF EDUCATION, ARTS AND CULTURE

Tel: [09 264 61] 293 9411
Fax: [09 264 61] 231 367/248 251

Private Bag 13236
WINDHOEK

File No : 13/2/9/1

Mrs A E. Eises (Mungunda)
P.O. Box 1290
Rundu
Contact:081 449 9126/081 205 8011

REQUEST FOR PERMISSION TO CONDUCT RESEARCH

Your letter dated 30 August 2019 refers.

Permission is hereby granted to you to conduct research for your Master of Education Degree titled "the Challenges Faced by Mathematics Teachers in Blind Secondary School Learners in the Khomas Region" at the School for the Visually Impaired.

The following must be adhered to:

- Permission must be granted by the School Principal;
- Teaching and learning should not be disrupted;
- Teachers and learners who will take part in the research should do so voluntarily;
- A copy of your thesis with the findings/recommendations must be provided to the Directorate of Education, Arts and Culture, Khomas Regional Council.

I trust this confirmation will assist.

Yours sincerely

12/09/2019.

MINISTRY OF EDUCATION, ARTS AND CULTURE
PRIVATE BAG 13236 WINDHOEK
13 -09- 2019
DIRECTOR
KHOMAS REGION

Gerard N. Ayles
Director of Education, Arts and Culture

Page 1 of 1

APPENDIX J: Consent Letter

PARTICIPANT INFORMED CONSENT/ ASSENT FORM

TITLE OF THE RESEARCH PROJECT: CHALLENGES FACED BY MATHEMATICS TEACHERS IN TEACHING SECONDARY SCHOOL LEARNERS WITH VISUAL IMPAIRMENT IN THE KHOMAS REGION

REFERENCE NUMBER:	200932063
PRINCIPAL INVESTIGATOR:	Mrs. A.E Mungunda
ADDRESS:	32070, Windhoek, Pionierspark
CONTACT NUMBER:	0814499126

You are invited to take part in a research project. Please take some time to read the information presented here, which will explain the details of this project.

The Research Ethics Committee has approved this study at The University of Namibia. It will be conducted according to the ethical guidelines and principles of the international Declaration of Helsinki, South African Guidelines for Good Clinical Practice and Namibian National Research Ethics Guidelines.

This study will explore the challenges mathematics teachers face in teaching secondary school learners with visual impairment in the Khomas region by addressing the following research questions: What strategies are used by Mathematics teachers to teach LVI? What are the challenges teachers face in teaching Mathematics to LVI? To what extent do LVI achieve the learning objectives specified for Mathematics?

This study will be conducted at the school of the Visually Impaired in Khomasdal, which is based in the Khomas region; however, there are other inclusive schools in the region which does not offer Mathematics to LVI; hence the other inclusive schools for LVI, and they are not in the Khomas region. The total number of Participants to be recruited will be four LVI from grades 8-10 and 2 mathematics teachers. The population of this study will be 6 participants, of which the total number of LVI is four at the secondary school level.

The study will aim to reveal how the teaching of mathematics is facilitated in inclusive schools for LVI and establish ways and means that will meet the needs of the learners in a more adaptive approach.

The researcher will first seek permission from the Executive Director of the Ministry of Education, Arts and Culture and the school of the Visually Impaired. Upon permission, the researcher will schedule appointments with participants and their parents to give them consent forms to sign.

Informed consent will be applied by informing participants about the research's purpose and allowing them to decide whether or not they want to part-take in the research. Confidentiality will likewise be applied; the learners' identities will not be revealed. Once the learners agree to take part in the research, their parents and caretakers of the learners will be asked to sign the assent forms on their behalf. The study will not have a randomization process that may occur as all the blind learners at the site will be used in the study.

As a participant, you will be observed for two weeks in your Mathematic lessons and interviewed. The interview will be 30 minutes long, and the researcher will observe the Mathematic lessons for two weeks.

The research will benefit the participants and future blind learners in terms of Mathematics as a subject to be taught in a more adaptive approach as the researcher plans to share the findings with other Mathematic teachers who can use it to teach blind learners as the Ministries responsible. The study does not have any risk.

If you say no, this will not affect you negatively in any way whatsoever. You will also be free to withdraw from the study at any point, even if you initially agree to participate. Participants should seek their parent's permission to participate in the research study.

Participants can contact the Centre for Research & Publications at research@unam.na if they have any further queries or encounter any problems. You can also contact the Research Ethics Committee **at +264 061 2063061** pclaassen@unam.na if you have any concerns or complaints.

You will receive a copy of this information and a consent form for your records.

Declaration by participant

By signing below, I ……..……. agree to take part in a research study entitled (challenges faced by mathematics teachers in teaching secondary school learners with visual impairment in the Khomas region).

I declare that:

a) I have read or read this information and consent form, written in a language with which I am fluent and comfortable.

b) I have had a chance to ask questions, and all my questions have been adequately answered.

c) I understand that participating in this study is voluntary, and I have not been pressured to participate.

d) I may choose to leave the study at any time and will not be penalized or prejudiced.

e) I may be asked to leave the study before it has finished if the study doctor or researcher feels it is in my best interests or if I do not follow the agreed-upon study plan.

It was signed at (*place*) .....…..…… on (*date*) ……...……. 2019.

..... **.....**

Signature of participant Signature of witness

Declaration by investigator

I *(Mungunda A.E)* declare that:

- I explained the information in this document to …….
- I encouraged him/her to ask questions and took adequate time to answer them.
- I am satisfied that he/she adequately understands all aspects of the research, as discussed above.
- I did/did not use an interpreter. (*If an interpreter is used, the interpreter must sign the declaration below.*

Signed at (*place*) .....…..……. on (*date*) ……...……. 20….

Signature of investigator Signature of witness

12. Declaration by the interpreter

I *(name)* declare that:

I assisted the investigator (*name*) ……. in explaining the information in this document to (*name participant*) …….……. using the language medium of (Braille).

APPENDIX K: Data Collection Instruments Used in the Study

Interview Schedule

Interviewee Background

Learner:

How long have you had visual impairment?

How long have you been studying mathematics?

What is your educational background? Briefly explain.

When did you learn the Braille alphabet? Do you use Nemeth code?

Why did you choose to study mathematics?

Which field do you want to study in university (what do you want to become)?

Teacher:

How long have you been teaching Mathematics to learners with Visually Impairment?

What is your educational background? Briefly explain.

Did you learn the Braille alphabet? Do you use Nemeth code?

Why did you choose to teach at this school?

Challenges Faced by Teachers and Blind Learners in Learning and Teaching Mathematics:

Learning Perspective

1. What do you think when you compare your mathematics learning with other subjects?
2. What are your feelings about your learning process in Mathematics?
3. What resources do you use and are available in studying mathematics? Tape record or Braille alphabet?
4. What are the braille books you use available? What about talking calculators?
5. Which lesson (topic) in mathematics is challenging at the secondary level? Why?
6. How do you study geometry and lessons that require you to draw?
7. Which questions do you solve in exams? Which are out of the case?
8. What challenges do you face in learning mathematics?

Teaching Perspective

1. What do you think of teaching mathematics to learners with visual impairment?
2. What are you feel about the teaching process?
3. What resources do you use in teaching mathematics to blind learners?
4. What books do you use and provide to blind learners?

5. Does the Ministry provide the school with resources to make teaching blind learners easier?
6. How do you teach geometry, graphs of a function and construction lessons to blind learners?
7. Which questions do the learners solve in the exam, and which are out of the exam?
8. What challenges do you face teaching mathematics to blind learners?

Equity Principle

1. How do you compare yourself with sighted students in learning mathematics?
2. What are the advantages and disadvantages of this situation?
3. Is there any different attitude towards you from the sighted learners?
4. What kinds of attitudes is it? Are they positive or negative? From readers? Are they making it easier or harder?
5. What do you think about equity in classes?
6. How are the exams in schools, do you get extra time, and what do you think about the assessment process?
7. Where do you use mathematics in your real life? Do you have problems in your life?

Teachers' Training and Professional Development

Learners

1. What do you think about your mathematics teachers? According to their knowledge and teaching, what should be done? Are they qualified enough in distinct teaching methods to satisfy your needs in this special situation?
2. What are the challenges that you face as a result? What are the major opportunities that you have?
3. Do your mathematics teachers give you challenging questions? Are the challenges hard enough for your learning?
4. How do your teachers prepare materials for your understanding? Do these materials helpful for you?
5. Which activities are chosen, and how are they helpful for your learning?
6. Do you have a special teaching teacher in your school? Do they make tutoring (extra classes) in mathematics?
7. What do you think about reading and teaching mathematical symbols?
8. How do you give answers to the exams? How do you solve mathematical problems?

Teachers

1. What teaching method do you use, and how does it benefit your learners?
2. Did you receive any training in teaching at a special school, and to what extent?
3. Does the government provide you with the required teaching material and support to teach mathematics to Blind learners?
4. What do you think about teaching mathematics to blind learners?
5. How do you prepare teaching material for blind learners in your classroom?
6. Do you receive training in braille, and why?
7. Did the school receive training from NIED on how to teach the new curriculum to special learners?

Curriculum Choices

Teachers

1. What do you feel about the mathematics curriculum offered in school that caters for the needs of blind learners?
2. What changes do you feel should be made to the curriculum in order to benefit blind learners?
3. How do you modify your lesson plans to cater to blind learners?
4. Does the exam cater for blind learners? How?

5. Do you think some math topics should be removed for blind learners during the national exam, and why?
6. Are there representatives for the special needs learners at NIED for the implementation of the curriculum?

Learners

1. What challenges do you have with practical subjects such as mathematics and science?
2. What challenges do you face in choosing study fields?
3. Is it compulsory to do Mathematics at the school, and what do you feel about it?

APPENDIX L: Research Instruments Observation Sheet

Observation of interactions between the teacher and students during classroom instructions:

Topic: _____ **Grade**: _____ **Date**: _____

Description of behaviour(s) observed	**Yes**	**No**
1. The teacher uses activities that make mathematics a more demonstrative and reachable subject in his or her class		
2. The teacher uses teaching activities that draw on the teaching for understanding mathematics to blind learners.		
3. The teacher uses enlarged printed handouts and provides other learners with brailed notes to follow during the lesson.		
4. The teacher allows students to interact constructively with one another in building and integrating new knowledge from experiences		
5. The teacher teaches clearly and allows students to make connections to meaningful contexts outside the classroom		
6. The teacher encourages all students to participate in their learning process actively		

7. The teacher provides students with rich ongoing assessments and feedback that foster an understanding of mathematics		
8. The teacher encourages students to think beyond what they already know.		
9. The teacher puts the students' needs into consideration.		
10. The learner has learning materials such as brailed textbooks/ notes for the lesson.		
11. The teacher encourages students to learn through inquiry, discovery, and demonstration.		
12. The teacher instructs students to be engaged in the lesson through mental mathematics.		

2. How does the teacher teach topics that require visual aid and drawing?

Any other observation: