Learning mathematics in inclusive classrooms: cases of visually impaired learners in Lesotho secondary schools

By

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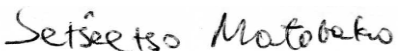
Declaration

I, Setseetso Matobako, declare that the Doctoral Degree research thesis that I herewith submit for the Doctoral Degree qualification PhD in Education degree at the University of the Free State is my own independent work.

All the references that I have used have been indicated and acknowledged by means of complete references.

I further declare that this work has not previously been submitted by me at another university or faculty for the purpose of obtaining a qualification.



Setseetso Matobako

21/01/2021

Date

Dedication

I would like to dedicate this work to my children Keanetse and Keitetse who I hope will take the accomplishment of this milestone as the challenge to outshine. I really want to dedicate this study to my wife Makeanetse and our children as a gesture of my great appreciation for their love, patience as well as their emotional support throughout my academic life. I would equally like to dedicate this work to my mother as a way of expressing my gratitude for her support in prayers, words of encouragement and also by having entrenched faith in me. This study is also dedicated to the rest of my family and friends as a demonstration of how grateful I am for their invaluable support and their confidence in me. Most importantly, I wish to shower my special dedications on my late sister Tšenolo Matobako, as a deep-rooted source of inspiration throughout my academic life. This has been because of my fond memories of her. She deserves this tribute, as she always believed unreservedly that my future is brighter than what I imagined.

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Any opinions, findings, conclusions or recommendations expressed in this research work remain the responsibility of the author and do not necessarily reflect the views of the Canon Collins scholarship.

Summary of the study

This study sought to establish how mathematics is taught in classrooms with visually impaired learners. It also examines how learners with visual impairment perceive and engage with the teaching of mathematics in selected schools of Lesotho. The framework of opportunities to learn (OTL) is used as the main theoretical resource. OTL is used as a lens through which conditions that facilitate effective teaching and learning of mathematics can be understood. OTL is considered resourceful for understanding what counts as valid experiences of learners with visual impairment. The study follows a qualitative approach and employs case study design.

The main data sources comprise narratives of three learners purposively selected in two schools as well as lesson observations. Semi-structured interviews with teachers are used for triangulation. Content analysis was used for analysing the data mainly extracted from the transcripts. The major findings suggest that mathematics teaching was predominantly conducted through verbal presentation and chalkboard use. The findings revealed that there were minimum opportunities to learn for learners with visual impairment in Lesotho regular classrooms. To a certain extent, learners regulated opportunities to learn in their learning of mathematics by choosing what can benefit them.

The findings also demonstrate that factors contributing towards how learners perceive and engage with the teaching of mathematics in inclusive settings include: restrictive provision and scarcity of textbooks, resulting in their dependence on their counterparts with functional vision to read for them; inadequate supply of essential equipment, ineffective use of assistive technology devices leading to their abandonment. This study recommends capacity building of mathematics teachers, through an intensive pre-service and in-service programmes to enable them to gain the appropriate skills that would meet the demands of teaching mathematics to learners with visual impairment in inclusive settings. The study recommends the provision of learning materials in accessible formats to learners with visual impairment to promote their independent learning without inhibiting coexistence with their sighted counterparts. The study recommends future studies to extend the scope of the study by increasing

the sample size and also find out teachers' perspectives of teaching mathematics to learners with special educational needs in under-resourced inclusive schools.

Key words: curriculum, learners with visual impairment, mathematics education, inclusive education, opportunities to learn, regular school.

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Abbreviations and Acronyms

AOTL	Actual Opportunities to Learn
AT	Assistive Technology
CATCH	Canadian Teachers' Charity
ECCD	Early Childhood Care and Development
ECoL	Examination Council of Lesotho
ESP	Education Sector Plan 2016 – 2026
ESSP	Education Sector Strategic Plan 2005 – 2015
FPE	Free Primary Education
GoL	Government of Lesotho
IEP	Individual Education Programme
JAWS	Job Access with Speech
LGCSE	Lesotho General Certificate of Secondary Education
LSEN	Learners with Special Educational Needs
MoET	Ministry of Education and Training
OTL	Opportunities to Learn
PCK	Pedagogical Content Knowledge
PWDs	People with Disabilities
RME	Realistic Mathematics Education
RTI	Response to Intervention
RSA	Republic of South Africa
SACMEQ	Southern and Eastern Africa Consortium for Monitoring Educational Quality
SEU	Special Education Unit
TRS	Textbook Rental Scheme
TTIs	Teacher Training Institutions
UK	United Kingdom
UNESCO	United Nations Educational, Scientific and Cultural Organization
US	United States
VI	Visual Impairment

Chapter one

1. Chapter one: Orientation and background to the study

1.1 Introduction

Curriculum reform is considered to have the potential to transform classroom practices to favour learners' educational needs. However, research shows that the outcomes of curriculum reforms hardly bring any significant change in actual practice far from what is anticipated by policy makers and curriculum developers. Ball and Cohen (1996: 7) observe that designers of curriculum tend to be extrapolative when creating learning experiences, suggesting, "they can anticipate only partially what particular children will bring to instruction and how easily they will learn." This would mean that the educational needs of learners who are not anticipated by curriculum designers might not be easy to address during lessons.

Ball and Cohen (1996) seminal piece emphasise that teachers' understanding and beliefs about what is important are some of the factors that strongly influence actual classroom practices. They further argue, "teachers are influenced by what they think about their students, about what students bring to instruction, students' probable ideas about the content at hand, and about the trajectories of their learning that content" (ibid.). This shows that teachers play a major role in shaping the enacted curriculum when faced with classroom realities. According to these researchers, "[t]his creates a gap between curriculum developers' intentions for students and what actually happens in lessons" (ibid.).

Existing studies on the education of learners with disabilities in developing countries show that the issue of access to education still dominates many debates in education (Farrell, 2016, UNESCO, 2009). The argument raised in these studies is that giving access to learners with special educational needs (LSEN) in regular schools can promote learning and contribute towards positive outcomes in terms of learner achievement (Dyson, Farrell, Polat, Hutcheson & Gallannaugh, 2004; Agunloye & Smith, 2015).

This chapter is intended to set out the orientation and background to the study. It outlines general aspects, which appear to have an impact on the academic experiences of learners with special educational needs (LSEN) in the context of Lesotho. The chapter starts with a description of the context in which the study was conducted. Following that, I pose the problem statement of the study, followed by an outline of the research questions. Furthermore, the chapter presents the aim and objectives of the study. Moreover, the significance of the study is described. Additionally, the summary of theoretical framework that informs the study will be conveyed, followed by a brief presentation of the research design and methodological orientation. Thereafter, I spell out the delimitation and limitations of the study. The chapter ends with the definitions of key terms and the layout of the chapters.

1.2 Background to the study

Lesotho has been experiencing consistently low learner performance in mathematics at both primary and secondary levels of schooling, as indicated by end level results presented by the Examination Council of Lesotho (ECoL) (2010 - 2015). Some studies conducted in Lesotho schools report about this low learner performance in mathematics (George, Kolobe & Moru, 2018). Furthermore, in the region, Lesotho appears to be amongst those countries with low learner performance in mathematics, as shown by the SACMEQ (Southern and Eastern Africa Consortium for Monitoring Educational Quality) performance scores (SACMEQ, 2011). In fact, Lesotho's performance score in mathematics has been consistently below the SACMEQ average (SACMEQ, 2011).

The statistics do not specify the performance of minority groups such as learners with disabilities, particularly visually impaired learners, and one can anticipate a relatively dire situation. This situation is thus a matter of concern for education stakeholders in the country. The study therefore seeks to address the concerns with learner performance in mathematics, but particularly for the learners with special educational in Lesotho through a study of the learners' experiences of classroom practice in regular schools.

1.3 Description of the context

I am of the view that in order to understand the issue under study, it must first be situated in its context. Therefore, in this section, I provide a description of the context in which the study has been undertaken. I begin by providing a brief description of the structure of pre-tertiary education system is articulated. I then present the current demographic trends of LSEN, followed by a brief history of special education in Lesotho. Finally, a review of the policy frameworks regulating special education matters locally is provided.

1.3.1 The Lesotho Education System

The schooling system in Lesotho has different levels including: Early Childhood Care and Development (ECCD) or Pre-primary, Primary Education, Secondary Education and Senior Secondary or High School Education. However, the Ministry of Education and Training (MoET) is gradually introducing the new schooling system, classified in terms of Basic Education and Secondary Education, as stipulated in the Curriculum and Assessment Policy Framework (MoET, 2009). The ECCD provides preparatory education for learners before they enrol into the Basic Education level of schooling. The ECCD centres have been established to cater for children with ages ranging from three to five years. The education programme at this level mainly focuses on the development of early literacy and numeracy skills with the aim of providing a strong foundation for future learning (MoET, 2013).

Another level of schooling, referred to as Basic Education, covers the first ten years of schooling, consisting of Grades 1 up to 10 (MoET, 2009). In other words, the Primary and Secondary levels have been merged together to come up with the establishment of what is called Basic Education. Officially, six-year-old learners start Grade 1, implying that they are supposed to have completed Basic Education at the age of at least 16 years. The remaining two years are called Secondary Education, which builds up from the Basic Education. Upon the successful completion of the Secondary Education level, learners obtain the Lesotho General Certificate of Secondary Education (LGCSE), which is the entry requirement for higher and tertiary programs.

1.3.2 Policy issues on Inclusive Education

The report from the World Bank project revealed that special education programmes have already been implemented at both Primary and Secondary Education levels, where the central focus was on the integration of LSEN into regular schools (Bongjoh & Ayiemba, 2007). However, there has never been any supporting policy document to ensure that the inclusive programme gets implemented in regular schools. Apart from that, there is an oversight within existing domestic legal frameworks about Inclusive Education - they seem to only focus on special education. One would argue that there might be little understanding of the concept of Inclusive Education locally. This suggests that there was no means to counter possible resistance from some schools or teachers to implement inclusive programmes in their respective schools. The issue of lack of local legal instruments, supporting inclusive programmes, needs to be resolved.

Meanwhile, there are a few official documents, which recognise the existence of the learners with special educational needs, which include: Education Sector Strategic Plan (ESSP) 2005 – 2015, Curriculum and Assessment Policy Framework and Education Sector Plan (ESP) 2016 – 2026, all developed by the Ministry of Education and Training (MoET, 2005; MoET, 2009; MoET, 2016). In 2005, the MoET developed the Education Sector Strategic Plan, which is a comprehensive ten-year roadmap, intended to guide transformation of the Lesotho education system. The Education Sector Strategic Plan was developed in order to address several educational challenges that transpire as a result of evolving societal needs. The document postulates strategic objectives for each Ministry's sector departments. The objectives are basically stated in the form of specific interventions that each of the MoET's department is mandated to achieve during the life of strategic plan.

One of the strategic objectives of the special education programme, as mentioned in the Education Sector Strategic Plan, was to increase access to education for learners with special educational needs. Here the target was mainly to "accelerate inclusion/integration of [LSEN] from 4.8% to 20% by 2009 and to 40% by 2015" (MoET, 2005: 107). To attain this target, the special education programme sought to, among others: integrate more regular schools into special education programmes at all levels,

and also rehabilitate them to accommodate LSEN; provide bursaries to under-privileged LSEN to ensure that they get access to educational opportunities. After taking into consideration that integrating LSEN into the mainstream schools might demand even more changes in the education system, the document further asserts that:

> The integrative approach, that is preferred for majority of learners at all levels of education, require a conscious effort on the side of Government to develop educational facilities, curriculum materials and assessment mechanisms that are accessible and user friendly to learners with special needs. The need for training educators […] has been recognised and needs to be an integral part of the capacity building in the education sector (MoET, 2005: 106).

One more issue that the Ministry aspired to achieve, as mentioned in the Education Sector Strategic Plan, seems to be provision of a facilitative environment for curriculum reform through development of a curriculum and assessment policy (MoET, 2005). The policy advocates for a rapid shift in approach in terms of curriculum design, which is envisaged promoting access, equity, quality and relevance, in order to deal with ever changing societal needs. As outlined in the Curriculum and Assessment Policy Framework, the MoET is committed to "introduce initiatives geared towards integration of learners with special needs into the education system and providing equal opportunities for all learners irrespective of gender and ethnicity" (MoET, 2009: 2). The policy supports empowerment of learners with core competencies throughout the education system levels. The policy envisaged curriculum, of which its main focus would be on the development of interpersonal skills, which are intended to improve positive relationships amongst learners, regardless of their circumstances in terms of cultural, social, religious or political differences and special needs (MoET, 2009).

As mentioned earlier, MoET has recently developed the Education Sector Plan in response to the prevailing educational challenges in the country and also to keep up with the current global trends (MoET, 2016). It is stated that the document is intended to address undesirable conditions, which tend to restrict access to quality education for learners with special educational needs. These challenges include: a few number of Inclusive schools at all levels of learning, which might have resulted in low

enrolments for learners with special educational needs; as well as rigid curriculum used at schools, which allegedly does not make provision for diverse needs of all learners. One of the strategic objectives aimed at addressing these critical challenges, mentioned in the document, is to expand provision of Inclusive Education into the education system and the target is “25% of primary schools and 5% of post primary schools [will be] inclusive by 2026” (MoET, 2016: 96).

Another strategic objective states that delivery of Inclusive Education will be strengthened. To attain these favourable outcomes, it is indicated that Inclusive Education Policy will be developed and implemented, which is expected to be fully operational within the life of ESP. It is assumed that the policy will provide guidelines that might ensure: curriculum modifications; provision of appropriate teaching and learning materials for learners with special educational needs; capacity-building of teachers on effective instructional approaches that can be employed in classrooms where learners with special educational needs are involved. It should be noted that the Lesotho Inclusive Education Policy finally came into existence later in 2019. Notwithstanding the fact that contents of a strategic plan are subject to review if implementation indicates the necessity to do so, however mentioning similar challenges and objectives adumbrated in the document also remaining unchanged might suggest that the previous strategic plan was definitely unsuccessful. Achieving these positive intentions geared towards Inclusive Education requires curtailing the existing stumbling blocks publicised in studies conducted locally (Mosia & Phasha, 2018; Mateusi & Naong, 2014). These studies emphasise that the main barrier is the lack of resources that comprise of an inclusive curriculum accompanied with appropriate teaching and learning materials, as well as teachers trained in inclusive education. Taking into account that there appears to be various factors, which seem to contribute in the unsuccessful implementation of educational initiatives locally, such as budgetary constrained (discussed below), the success of this idea is by far unrealistic.

The study undertaken by Urwick and Elliott (2010) reveals that Inclusive Education was faced with challenges, which emerged as a result of major development. Among the programmes introduced is the Free Primary Education (FPE) in 2000, which resulted in the exponential enrolment rate of learners in schools, including those with

special educational needs. It is reported that the infrastructural facilities and required resources proved to be inadequate in schools. In addition, escalation of the teacher-learner ratio necessitated MoET to increase the number of teachers in schools, some of whom lacked essential qualifications. As a result of these factors, one can conclude that instructional practice would be negatively affected. In fact, teaching approaches that require teachers to cater for the needs of individual learners could be impractical under such circumstances.

The outcomes of surveys conducted by these researchers demonstrate that the greatest number of teachers from the sample received no training at all on special education, while a meagre number of teachers received some pre-service and/or in-service training. Moreover, during their transition to Secondary Education, which was not yet free in 2007, the vulnerable groups, such as orphans and learners with special educational needs who went through the FPE programme received bursaries from the government (Urwick & Elliott, 2010). However, it is reported that more of the disadvantaged learners were still left out, perhaps due to limited budget allocation. According to these researchers this created an environment even less favourable for the successful implementation of the Inclusive Education policy. This discussion demonstrates that implementation of Inclusive Education policy awaits critical challenges, which might necessitate thorough preparations. The next section provides a detailed discussion of the problem statement.

1.4 Statement of the problem

The previous research conducted in classrooms has produced complicated data about the context and teaching of mathematics. Researchers, for instance, found that "teachers work with a broad range of students who come with different understandings and attitudes and who do not learn in the same ways. Teachers are also responsible for a variety of educational outcomes that require different approaches" (Ball, 1988: 10-11). While research on learners with special educational needs (LSEN) in regular schools is on the rise, among the issues identified by researchers as 'lacking', is a focus on classroom practices involving the LSEN (Shoulders & Krei, 2016). Similarly, research in Mathematics Education for the visually impaired has also identified classroom practices as being one of the less explored areas locally and internationally

(Maguvhe, 2015, Southcott & Opie, 2016). It is against that background that the present study proposes to address this noticeable research gap by investigating the visually impaired learners' experiences of learning mathematics in Lesotho regular classrooms.

Existing literature shows that low performance in mathematics is a global challenge, despite all the efforts that many countries have made. Reporting about the situation in the United States of America, Shute, Graf and Hansen (2006) indicate that learner performance in mathematics is relatively low in comparison with other developed countries. These researchers emphasise that in the US learner performance in mathematics upon completion their high school education has been far below the international average. In the context of Ireland, Prendergast and Treacy (2017: 126) found that "the reformed approach has coincided with a decline in students' technical algebraic skills." However, data gathered from practising mathematics teachers reveal that this decline can be attributed to a mixture of approaches being implemented in classrooms. According to these researchers, "[s]uch divergence of approaches can be linked to the common mismatch between the intended curriculum prescribed by policy-makers and the implemented curriculum that is actually carried out by teachers in their classrooms" (ibid.).

The situation of low achievement in mathematics among learners is not different in developing countries. Jameel and Ali's (2016) study provide differing perspectives of this with specific reference to the Pakistan context. Their research findings show that learners were not comfortable with the strictness of their teachers when teaching mathematics and they also view this subject as being naturally difficult. On the other hand, teachers perceive "lack of exercise and drill a major cause affecting the acquisition of concrete and abstract mathematical concepts" (Jameel & Ali, 2016: 133-134). Sa'ad, Adamu and Sadiq's (2014) research reports about low learner performance in Nigeria. Their research findings show that low learner performance in mathematics was as a result of a range of factors including: "students' negative attitude toward mathematics, anxiety and fear of mathematics, inadequate qualified teachers, poor teaching methods, inadequate teaching materials, overcrowded classes" (Sa'ad *et al.*, 2014: 32).

In research conducted in South Africa, Mji and Makgato (2006: 253) identified factors associated with low learner performance in mathematics and physical science as being, “teaching strategies, content knowledge, motivation [...] and non-completion of the syllabus in a year”. Mji and Makgato (2006) contend that teachers’ pedagogical content knowledge (PCK) is one of the aspects that may have an impact towards increasing poor performance in mathematics. According to these researchers,

> If educators are confident with respect to knowledge of the subjects they teach, have a grasp of common misconceptions learners present in the classroom, and possess strategies for inducing learners’ conceptual change through PCK then motivational issues would be much easier to handle” (Mji & Makgato, 2006: 263).

It is worth noting that a few studies carried out in Lesotho that I accessed also link low learner performance in mathematics to teaching and learning practices in the classroom. The results of a study conducted by George *et al.* (2018) in Lesotho primary schools revealed what they consider to be a contributing factor towards low learner performance in mathematics. They found that among the teachers entrusted to teach mathematics and science were those who had never passed these subjects at any level of education, “[t]hus making it difficult and uncomfortable for these teachers to teach these subjects effectively” (George *et al.*, 2018: 9). This implies that learners taught by such a calibre of teachers would lack adequate foundation in mathematics and science. Nenty’s (2010) study focused on secondary schools and found that the learner performance in mathematics at that level was also declining. The findings of his study revealed that learners whose performance in mathematics was unsatisfactory preferred to sit in the back row as far away from the teacher as possible, due to a poor attitude towards studying. The researcher is of the view that the learning of mathematics can be enhanced “through the manipulation of the spatial arrangement in the classroom” (Nenty, 2010: 98).

A study conducted by Elliott, Kurz, Tindal and Yel (2017) focused on mathematics instruction involving learners with special educational needs in the regular classroom setting. They found that learners with special educational needs did not benefit much in mathematics lessons when provided with the same instruction on the same content

standards. Their findings also show that this kind of instruction result in “large and persistent gaps in achievement” (Elliott et al., 2017: 156) compared with their classmates without disabilities. Reportedly, learners with special educational needs “consistently performed lower on both interim and summative measures of mathematics achievement” (Elliott et al., 2017: 156). Based on the findings of their study, these researchers conclude that learners with special educational needs might “need more rather than equal OTL to close the mathematics achievement gap” (ibid.).

Attard (2011) realises that there are a limited number of studies that feature learners’ views about mathematics teaching and learning. The findings of her study show that learners are cognisant of “pedagogies that lead to engagement in mathematics” (Attard, 2011: 363). Studies interested in Mathematics Education for the visually impaired also identified classroom practices as contributing towards low learner performance. Lambert’s (2020) study conducted in the United States (US) found that learners with visual impairment are among those who are significantly disadvantaged in classrooms where the teaching of mathematics focuses mainly on the use of printed materials. Her study recommends the “use of mathematical models [that] can be adapted to include students with visual impairments who can experience such models through touch and sound” (Lambert, 2020: 8). Similar sentiments are shared by Leo, Cocchi and Brayda (2017) who argue that learners with visual impairment studying subjects such as mathematics are at a disadvantage as they are normally taught by relying heavily on visual representation.

There are a limited number of empirical studies locally, which profile the learning experiences of visually impaired learners in mathematics classrooms. These provide a wide range of opportunities to expand the research in this area. Therefore, I contend that this is a problem worth investigating. My study sought to address this issue by undertaking an investigation into the experiences of visually impaired learners of mathematics in the context of Lesotho regular classrooms.

1.5 Research questions

In this study I sought responses to the main research question, which reads: What are the visually impaired learners' experiences of learning mathematics in Lesotho regular schools? In an attempt to address the main research question, the following sub-questions need to be explored.

Sub-questions:

1) How is mathematics taught in classrooms with visually impaired learners?
2) How do visually impaired learners perceive and engage with the teaching of mathematics in selected classrooms of Lesotho?
3) How can the experiences of mathematics teaching for visually impaired learners in Lesotho be understood and explained?

1.6 Aim and objectives of the study

The aim of this study was to investigate the visually impaired learners' experiences of learning mathematics in Lesotho regular schools. Therefore, the objectives of this study include:

1) establishing how mathematics is taught in classrooms with visually impaired learners;
2) examining how visually impaired learners perceive and engage with the teaching of mathematics in selected classrooms of Lesotho;
3) exploring how the experiences of mathematics-teaching for visually impaired learners in Lesotho be understood and explained.

1.7 Significance of the study

The study was not intended to provide solutions for the prevailing challenges encountered by visually impaired learners for gaining access to mathematical concepts. Its major purpose was to provide reliable and useful information about the prevailing situation on the ground. Actually, the findings of the study seek to contribute

to the scholarly body of research work, especially in the field of Mathematics Education. I am of the view that the findings will add value in the research concerned with LSEN. I am also of the view that the successful implementation of any intervention measures from the MoET depends on the outcomes of robust research work. Hence the findings of the study will offer assistance to the policy makers, curriculum developers, principals, teachers, as well as the parents or guardians of visually impaired learners.

1.8 Summary of the conceptual framework

In this study, Opportunities to Learn (OTL) is the main theoretical resource through which learners' experiences at the classroom level are construed. This conceptual framework featured in other empirical studies, which address learners' experiences in the field of Mathematics Education (Goos, 2004; Cawthon, Beretvas, Kaye & Lockhart, 2012). As this study aims at investigating visually impaired learners' experiences of learning mathematics, this framework is considered important for interpreting learning practices at classroom level. There are different interpretations of OTL and they are mostly inclined towards assessing the manner in which learners access mathematics content (Watson, 2003).

This framework has also been used in comparative studies interested in learner performance in mathematics (Floden, 2002). However, in this study OTL is considered very resourceful for understanding and explaining learning experiences of learners with visual impairment in classroom settings. In particular, the level of learners' participation and engagement during mathematics lessons are assessed using the idea of OTL. I am of the view that effective learning is likely to occur where there is an opportunity for full learners' participation and engagement. Additionally, the idea of OTL is used for examining whether the instructional materials, such as learners' books and study materials, present topics, activities and assessment tasks, in the manner accessible to visually impaired learners. Similarly, the learning resources are expected to provide additional help for learners in both inside and outside classroom settings.

Cawthon *et al.* (2012: 4) argue that, for the LSENs, OTL is concerned with "whether or not they have access to the regular education core curriculum … or a less rigorous

or even separate curriculum". In other words, OTL appears to be high when the LSEN have access to the 'core curriculum', as opposed to the 'less rigorous curriculum'. The emphasis made is that the education of LSEN should pre-eminently consider their needs. It is indicated that an individual education programme (IEP) should be developed for every learner. The researchers also point out that higher OTL is facilitated through placement of the LSEN in the least restrictive environment. These appear to provide additional resources for measuring OTL in the cases involving visually impaired learners. In fact, they form an integral part of the learning experiences of visually impaired learners in a classroom context. Therefore, this creates a possibility of investigating the learning experiences of the visually impaired learners within a specified period of time.

1.9 A brief description of the research methodology

This research is a qualitative case study that aims to investigate visually impaired learners' experiences of learning mathematics in two regular high schools. As the focus of this study is on school-based issues, each of the visually impaired learners in the targeted classrooms is considered as a distinct case. The advantage of using an approach involving case studies is that it allows an in-depth exploration of research questions and can result in eliciting rich evidence (Gustafsson, 2017).

In this study, the research population consists of visually impaired learners and mathematics teachers in the targeted classrooms of two regular high schools in Lesotho. Basically, this study only considers classrooms at secondary level, equivalent to Grades 8 to 10 in the Republic of South Africa (RSA) education system. I gathered detailed information about the experiences of individual learners during the teaching and learning of mathematics in the two high schools. Three major sets of data were collected in the course of study. The first part of data was gathered through direct observations of mathematics lessons in the three grades. The second part of data was collected through the narratives of the visually impaired learners. The last set of data was collected through structured interviews with mathematics teachers.

The data generated from transcripts of interviews for each of the three cases were coded and arranged into various categories that could better explain the visually

impaired learners' experiences of learning mathematics in inclusive schools. Basically, each of the three cases was explored and analysed independently. In consideration of the outcomes, comparisons were made in order to find similarities and differences between these cases.

1.10 Delimitation of the study

The study focuses on the experiences of the visually impaired in terms of improving their understanding of mathematics concepts at the classroom level. The research site comprises of the two regular High Schools found in Maseru city. The selection considered a mathematics stream or class in which the visually impaired learner(s) were placed. It is imperative for this study to consider the entire secondary level, in order to examine learning progression in all the three grades. This suggests that Forms A, B and C were targeted in each high school. As the contexts in each school are expected to differ, I shall compare and contrast the learners' narratives, which will emerge in each setting.

1.11 Limitations of the study

One of the limitations of this study is that the sample selection only covers one district, which is Maseru. However, the main reason for this selection is that these schools are the only ones in the country entrusted to offer access to visually impaired learners, including those who are totally blind. This also poses a challenge for keeping the identity of the schools anonymous. The other aspect, which appears to be a limitation of the study, is the time that will be taken for observing lessons. It would be ideal to observe mathematics lessons for the duration of at least one week in each grade. Usually seven periods are allocated for mathematics lessons. Seemingly, producing their transcripts would require more time and resources. That would only be possible if I deployed research assistants in these schools. However, the nature of the study requires me to be present in all classroom observations for reconstruction of mutual trust with the participants.

Indeed, a qualitative study requires a researcher to be present at the natural setting where participants experience the issue(s) under enquiry (Creswell, 2014). This would

also help the researcher to develop an understanding of the issue under study and the context at which it occurs. According to Creswell (2014), one of the characteristics of this research approach includes gathering information directly by engaging with the participants and observing them behave and act within their context. Moreover, the qualitative researcher should not only rely on the information collected by the third party, but also rather collect data by him/herself through direct observations or interviews, among others (Creswell, 2014).

1.12 Clarification of key concepts

Key words: mathematics education, curriculum, opportunities to learn, learners with visual impairment, inclusive education, regular school.

Mathematics education is a multifaceted field of study interested in teaching and learning of mathematics at different levels of education system including lower grades up to tertiary. Different studies investigate specific issues including teacher professional development, pedagogy and assessment as well as other issues that might end as the intervention of addressing lower learner performance in mathematics, such as Realistic Mathematics Education (Suurtamm, Thompson, Kim, Moreno, Sayac, Schukajlow, Silver, Ufer & Vos, 2016; Van den Heuvel-Panhuizen, 2020). The current study specifically was aimed at investigating visually impaired learners' experiences of teaching and learning of mathematics in regular classrooms.

Curriculum is very significant in influencing instructional practices. It can be argued that the success or failure of educational reforms rests upon the type of curriculum being used. This is because the main function of curriculum is to outline values, skills and knowledge that learners are supposed to acquire (Richler, 2008). Additionally, it prescribes teaching and learning approaches, assessment methods, as well as the instructional materials that can be used. This suggests that curriculum can function as a tool for providing quality education for all learners in terms of the opportunities it creates and the outcomes it produces (Richler, 2008).

It has been pointed out that curriculum regulates what learners should access and how they should access it. To add to that, one can argue that it can also regulate who

should access its contents and can as well prescribe the conditions, which might enable access. As indicated earlier, curriculum appears to be a major instrument that could steer up initiatives, oriented towards attaining equal access to worthwhile education for all learners, irrespective of their apparent differences. Richler (2008) raised a very strong argument in connection with how curriculum could be used to improve access to quality education. Richler (2008) argues that the development of curriculum should ideally be based on the understanding that learning occurs when learners are actively engaged in making sense of their own experiences. She certainly holds a view that the conception that only considers 'learning' as the acquisition of knowledge, would still lead to the development of a curriculum that does not cater for the diverse needs of learners.

Many countries have endorsed the idea of educating all children, including those with special educational needs, in a regular school system to ensure equitable access to quality education (UNESCO, 2009; UNESCO, 1994). The phrase "regular school" mostly features in international declarations and conventions and is also widely used in the literature about Inclusive Education (Agunloye & Smith, 2015, Ainscow, Dyson & Weiner, 2013). In the documents "regular school" and "general or mainstream school" are often used interchangeably when referring to an ordinary school which can provide access to all learners without necessarily giving the required support to the LSEN. However, regular schools should be transformed in order to become more inclusive and provide a conducive learning environment that supports appropriate teaching and learning to accommodate learners with different characteristics and/or disabilities (United Nations, 2006). The United Nations Convention on the Rights of Persons with Disabilities (UNCRPD) explicitly states that,

> those with special educational needs must have access to regular schools which should accommodate them within a child-centred pedagogy capable of meeting these needs. Regular schools with this inclusive orientation are the most effective means of combating discriminatory attitudes, create welcoming communities, building an inclusive society and achieving education for all; moreover they provide an effective education to the majority of children and improve the efficiency and ultimately the cost-effectiveness of the entire education system." (UNESCO,1994: viii-ix).

The notion of ‘opportunities to learn’ (OTL) is widely used in the field of mathematics education research. This idea is too broad and it is also open to interpretation from multiple theoretical perspectives. The focus may be on cognitive, social or affective dimensions of learning, curriculum and assessment design, issues of equity and access, or the broad policy and political contexts of learning and teaching (Goos, 2014). In this study, I focus on mathematics teaching and learning. OTL is used as a lens through which learners’ experiences of mathematics teaching are studied.

A learner with visual impairment is one whose visual acuity is not sufficient enough to allow effective participation in everyday classroom activities, which may require a sense of vision (UNESCO, 2001). Explicitly, visual impairment refers to differing degrees of loss of sight including “low vision, partial sight and blindness” (UNESCO, 2001: 48).

Inclusive Education refers to learning institutions and educational structures that allow access to all learners, irrespective of their diverse educational needs. For this to happen, transformations or reforms might be necessary in schools so that they can cater for a diversity of needs that learners may have. It also involves processes of identifying and reducing any barriers within and around the school that may have a negative impact on learning and participation in all aspects of school-life (UNESCO, 2001). To achieve Inclusive Education, it might be essential to make some alterations in curriculum materials in terms of the proposed instructional approaches as well as learning facilitation strategies (UNESCO, 2009).

1.13 Layout of the study

Chapter one provides the introduction and background of the study. It also maps out the aim and objectives, with the significance, delimitation and limitation of the study. The chapter also presents the summary of the conceptual framework in which the study is grounded. A brief outline of the research methodology is offered in this chapter, after which the road map of the study is outlined. Chapter two reviews the literature related to the Mathematics Education and empirical research focus on the experiences of the learners with visual impairment, thus giving the research a

theoretical base. The chapter also provides details of the conceptual framework upon which the study is anchored. Chapter three discusses the study methodology used in detail, including the approach and the design employed, sampling designs and procedures, as well as the ways in which validity, credibility and reliability of the instruments were enhanced. The manner in which data were collected and analysed is presented, with details of the ethical guidelines, which were adhered to in conducting the study. Chapter four provides data analysis and the presentation of the findings, taking each of the three participants as a unique case in the study, in light of the research questions. Chapter five presents cross-case analysis, interpretation and discussion of the findings. Chapter six summarises the findings, draws conclusions and makes recommendations. The chapter also recommends areas, identified as gaps, which can be pursued in the future studies.

Chapter Two

2 Chapter two: Literature review

2.1 Introduction

This study investigates visually impaired learners' experiences of mathematics teaching and learning in Lesotho regular schools. In order to address this issue, it is important to harmonise this study with previous studies, which have explored issues closely related to the topic under investigation. In fact, the review of literature serves as a framework for authenticating the significance of this study with what the scholars say, as well as for identifying existing gaps that remain unaddressed in the field (Creswell, 2014). Moreover, this literature review serves as a point of reference for comparing results of prior empirical studies, taking into consideration factors, such as the context in which they were undertaken, as well as the research methodology employed by them (Flick, 2009). Therefore, this study values the importance of a literature review for guiding its processes.

This pertinent literature survey delineates the empirical focus of the study in relation to debates dominating the field of Mathematics Education. Thereafter, it discusses literature pertaining to teaching and learning of mathematics. Moreover, the discussions are based on the mathematics pedagogy with specific reference to learners' role in teaching and learning of mathematics, teacher's knowledge about learners and the role of assessment in the facilitation of mathematics instruction. It also deliberates on the basic resources that support effective teaching and learning of mathematics. Learners' perspectives on the teaching and learning of mathematics also feature in the reviewed literature. The issue of visually impaired learners' experiences in regular school settings, which is central to this study, is also discussed. This section specifically draws attention to academic potential of learners with visual impairment, their experiences with the teaching and learning of mathematics as well as issues regarding how availability of resources or lack thereof affect their learning of mathematics. Furthermore, arguments about the academic potential of learners with visual impairment are explored. Finally, the chapter restates the conceptual framework and rationale for its selection and explains identified gaps in the literature.

2.2 Previous studies on the teaching and learning of mathematics

Almost two decades ago, Ball, Lubienski and Mewborn (2001) argued that the quality of teaching depends on the teacher's knowledge of the subject matter. These researchers suggest that educational research should focus more on teaching rather than on the teacher as this can create "the opportunities to examine closely the mathematical territory and demands of the work" (Ball *et al.*, 2001: 449-450). Ball (1988: 6) had earlier clarified that "[t]eachers' subject matter knowledge interacts with their assumptions and explicit beliefs about teaching and learning, about students, and about context to shape the ways in which they teach mathematics to students." Ball argues that understanding the subject matter entail many aspects including "knowledge, beliefs, and feelings about the subject" (Ball, 1988: 14). Ball categorises types of mathematics knowledge as propositional and procedural and then unpacks them as follows: "understandings of particular topics [...], procedures [...] and concepts [...] and the relationships among these topics, procedures, and concepts" (ibid.).

Österman and Bråting (2019) are of the view that procedural and conceptual knowledge should not be considered as contradicting ideas. These researchers came up with the idea of *operational skill,* which merges the two types of knowledge. Their argument is that for learners to understand mathematics they should acquire "both the contextual knowledge and the computational skill entailed in mathematical knowledge" (Österman and Bråting, 2019: 457).

Spillane's (2000) study reports about a teacher who lacked in-depth understanding of mathematics. The research findings demonstrate that the teacher's mathematics instruction was relatively traditional. The teacher reportedly relied more on the use of a textbook and that rendered "a paucity of opportunities for her students to "think" about mathematics" (Spillane, 2000: 317). Based on the findings of his study, Spillane propounds that "teachers' opportunities to learn about reconstructing their teaching are shaped in important ways by their identity or sense of self in their learning about practice" (Spillane, 2000: 322).

Heckman and Weissglass (1994) lament the use of traditional methods for teaching mathematics. According to these researchers, traditional methods fail to keep learners focused and engaged in purposeful activities. However, learners might have a little or no contribution on the selection of the teaching methods used by the teacher. Heckman and Weissglass (1994: 31) further argue that “No material or situation is free from the educator’s judgmental decisions about what is good and worthwhile” in the teaching and learning process.

Cohen’s (1990) seminal case study of Mrs. Oublier reveals that teachers implement the reform according to their understanding. This case shows that teachers might make efforts to introduce revised methods of mathematics teaching and learning prescribed by the reforms, but their instruction proves otherwise as they would still apply their old practices and experiences. This means that what a teacher perceives as revolutionised instructional practice came up to be a resemblance of the traditional way of teaching.

2.3 A shift towards pedagogy that addresses learners’ needs

Recently there has been a shift in research towards paying more attention to learners’ needs in the mathematics classroom. Van den Heuvel-Panhuizen (2020) advocates for a shift from didactic teaching methods towards the approach predominantly used in Netherlands and also introduced in other countries, called Realistic Mathematics Education (RME). Van den Heuvel-Panhuizen argues that RME is continuously open to new developments and innovations according to the ever-changing society and accumulated experiences of people. The emphasis made is that RME has recast learners’ mathematical experiences as one that should be meaningful, relevant and accessible (Van den Heuvel-Panhuizen, 2020: 6-7) and connecting this to the teaching of mathematics can promote learners’ independence and empowerment. Only when this applies to a theory, can it have lasting vitality and the power to extend without limit in both theoretical and applicable aspects. This is very much appreciated in RME. This approach also considers that learner’s individual conceptions and experiences have to be respected and taken as points of departure for teaching and learning.

Teachers are also considered as drivers of innovation and the appropriation of a teaching innovation is highly driven by their sense of the direct applicability of the ideas distributed by the innovation for their practice. The development of local instructional theories necessitates some alignment with the operative school mathematics curriculum. The researcher also emphasises the importance of teacher guidance during the process of mathematisation.

RME is described as continuously open to new developments and innovations according to the ever-changing society and accumulated experiences of people. RME does not only focus on mathematics as a field of knowledge but it is more concerned with teaching and learning that put focus on application of mathematics concepts. Implementation of RME demands teachers to strike a balance between how to work with the RME-based materials while on the other side following the enacted curriculum. Implementation of RME in a formal classroom setting,

> may involve many lessons, and may even be spread out over a number of years, thus enabling students to gain conceptual understanding of how the procedure works, where it might be used, and how it connects to other areas of mathematics. However, in England it is often expected that performing a mathematical procedure can and should be achieved within one or two lessons. In addition, moving from the faster rote-learned alternatives to slow learning may also encounter resistance from students. This can also occur in response to the challenge that an RME-based classroom culture presents to students when they have to explain their thinking and make connections, ask questions and generally take more risks than in the case of simply 'learning the rules' (van den Heuvel-Panhuizen, 2020: 10).

RME is not immune to criticisms and there is a long list of issues that are considered to be its pitfalls that include: "it as disregarding the mechanistic aspects of learning, the lack of guidance of the construction of knowledge, the excessive freedom that is given to students to construct their own solution methods, the limited attention for the process of de-contextualising, and finally the insufficient recognition of the value of mathematics as a cultural product" (Van den Heuvel-Panhuizen, 2020: 54). The counter argument advanced is that RME has been misinterpreted and the issues

raised against it are the opposite of what this idea stands for. In any case, the author acknowledges that RME does not consider “the mechanistic aspects of learning” as a priority. According to the researcher, the REM aims to stimulate learners to choose a solution strategy that best suits the problem at hand.

Another issue highlighted as a shortfall of RME is that it does not clearly articulate what is meant by context, and that can be open to multiple interpretations. According to the critics, pure numerical contexts can also be quite meaningful for students. The researcher contends that the RME takes a broad perspective of context into consideration. Clearly, there are differing perceptions about RME as Mathematics Educators in countries like Germany and Belgium are of the view that RME should move more towards mathematics as a context of its own and vertical mathematisation, whereas in Israel RME is perceived as the idea that encourages a shift of direction away from “highly procedural and rule-oriented mathematics to using the real world as a springboard for mathematisation” (Van den Heuvel-Panhuizen, 2020: 15). Mathematics Educators in Netherlands give emphasis to the meaning of ‘real’ and ‘realistic’, which according to them is aligned to learners’ experiential or emotional worlds with limited focus on reality in the external world. They perceive fantasy stories or games as real and realistic if learners themselves considered them as such. The Danish perspective gives emphasis to “the external objective reality of the surroundings in which [learners] live such as family, friends, school, the local, national or global community, and scholarly and scientific fields or areas of practice”. The researcher clarifies that the conception of ‘realistic’ in terms of RME may entail “problems based on real world situations and problems that leaners can experience as real”. The researcher also makes a point that the focus of RME is largely on: “contexts that lend themselves particularly well for evolving into a model that can be used for solving other problems or for eliciting helpful strategies, instead of on really complex daily life situations that require modelling and where mathematics has to be used to solve them” (Van den Heuvel-Panhuizen, 2020: 14).

Another study interested in Realistic Mathematics Education (RME) was undertaken by Özdemir (2017) and its purpose was to identify the classroom mathematical practices in the context of Turkey. Citing Cobb *et al.* (1997) they indicate that the process of mathematical practices requires the individual learners to develop their own

mathematical reasoning by active participation in activities, as well as discussing and analysing others' interpretations. The findings of the study show that mathematical practices were enabled with the help of a learning environment designed using principles of Realistic Mathematics Education. Özdemir (2017: 426) observe that the "environment allowed the participants to produce their ideas, examining and discussing about them in order to produce the correct mathematical idea". The study concludes that, RME has a potential to enhance emergence of effective mathematical practices and developing conceptual understanding (Özdemir, 2017).

Heckman and Weissglass (1994) state that traditional teaching strategies in mathematics do not essentially benefit learners as they fail to stimulate interest and engage learners in purposeful activities. They elaborate further that the practice of teaching mathematics in the abstract serves to limit the learning opportunities of some learners especially those whose background is of lower socio-economic status. According to these researchers,

> to effectively teach and effectively learn in situated cognition and/or cognitive apprenticeships, many traditional values and beliefs must make way for more democratic concepts in which assumptions of the dominant culture are questioned and cultures of the students are respected (Heckman & Weissglass, 1994: 31).

Heckman and Weissglass (1994: 29) realised that teaching of mathematics can yield positives outcomes for majority of learners: (1) if taught with other subjects in a real-world context, (2) if practical learning apprenticeships are developed, and (3) if educators articulate and challenge their own beliefs and values about mathematics, learning and teaching.

Of paramount importance, Heckman and Weissglass observe that effective learning of mathematics can be realised in situations that acknowledge the value of the learners as active participants in their learning and also encourage responsible democratic citizenship among the learners. One of the aspects essential for ensuring the effective learning of mathematics is a complete respect for learners' thinking and feelings. Another issue that these researchers mention as very important is that the teachers

should play a leadership role and negotiate with learners about their learning instead of being authority figures or importers of knowledge. They also warn against blaming learners for inadequate knowledge and further take notice of the fact that “difficulties in learning are a result of past experiences of educational failure, distressing experiences such as ridicule or criticism that have disempowered the learner, lack of experience in a situated environment, or a lack of support” (Heckman & Weissglass, 1994: 32).

Trevisan, Ribeiro and Ponte (2020) mention the learning opportunities generated by the use of the classroom as a professional teaching and learning environment. Some of the opportunities that they take notice of include: exploring ways that can promote learners’ active involvement in discussions. These could involve organising the time devoted to mathematical discussion practices for learners’ learning. The researchers view this arrangement as inclined towards a class developed from the perspective of inquiry-based teaching.

2.3.1 Learners’ role in the teaching and learning of mathematics

Briede (2016: 45) conducted a mixed method study in Latvia that aimed at investigating the relationship between the teaching approaches that teachers employed and learners’ “mathematical self”. The research participants were Grade 9 teachers and learners. Objectives of the study include finding out the teachers’ beliefs about effective teaching approaches and their perspectives on classroom practices. The findings of the study show that teachers’ instructional practices of mathematics are to a large extent affected by their beliefs, which are based on an individual’s philosophical view on mathematics and mathematics teaching/learning process in correlation with contextual factors that include teacher’s qualifications, work experience and the educational programme implemented at school.

The findings also indicate that apart from a learner’s cognitive skills, an important role in the mathematics teaching/learning process is played out by learner’s mathematical self, which includes learner’s perception of mathematics, a mathematics teacher and the learner’s attitude towards these. The researcher categorises these as qualitative indicators. Mathematical self-efficacy, self-conception and anxiety are considered to

be quantitative indicators. Briede (2016) notes that these indicators of mathematical self are interrelated and characterise the learner's individual affective factors that are related to mathematics. The study concludes that

> the use of constructivism in mathematics teaching/learning process contributes to establishing positive learning environment in the classroom with emphasis on cooperation and [learners'] active participation in the teaching/learning process and the development of their knowledge and skills, relating knowledge with the daily life necessities, the teacher's role as an advisor and learners' emotional well-being in the classroom thereby positively influencing their mathematical self (Briede, 2016: 45).

The findings of the study conducted by Genc and Erbas (2020) in Turkey show that the conceptualisation of mathematical literacy as a necessity for all learners might be unrealistic. However, citing Gardiner (2004) they emphasise that "not everyone needs to be mathematically literate at the same level, but they can all be more or less mathematically literate in accordance with their own needs and interests" (Genc & Erbas, 2020: 161). This suggests that learners have a potential to be mathematically literate but to different degrees. Genc and Erbas (2020) indicate that the teacher's belief is an essential ingredient for promoting mathematical literacy for all, through the use of appropriate instructional strategies. The study revealed that many teachers who took part in the study acknowledge that there are certain educational challenges hindering the effective development of mathematical literacy among learners. Some of the challenges that prevent them from acquiring mathematical literacy include: mathematics anxiety, lack of interest in mathematics and an apparent deficiency in basic arithmetic skills affecting some of the learners. According to teachers who were interviewed, developing mathematics literacy requires learners to have "a basic level of mathematics knowledge and skills to handle daily life problems" (Genc & Erbas, 2020: 162).

Teachers also complained that they hardly find learners capable of learning mathematics concepts for using or applying them effectively in everyday situations. They indicated that, a score of learners are "simply accustomed to the transmission of ready-made knowledge". According to Genc and Erbas (2020) many teachers were

exposed to rote-learning and expository teaching starting from the beginning at lower grades, and for them to teach in the context of mathematical literacy remains the major challenge. These researchers arrive at the conclusion that “what teachers are generally expected to do in class is to teach mathematics by drill and computation without conceptual understanding, if they all grew up in a rote education system” (Genc and Erbas, 2020: 163). Teachers also confessed “the mathematics teaching profile in the education system depends mostly on strict memorization and rote learning.”

Even though learners’ views are not covered that much, the study shows that some of them were unsatisfied with their performance in mathematics and they attributed this to “their lack of ability to search for information independently” (Genc and Erbas, 2020: 162). This suggests that they were compelled to rely on the information given by their teachers and that negatively affected their effective development of mathematical literacy.

The findings also revealed that there are other conditions beyond teachers’ control including high teacher-pupil ratio. This could pose challenges for teachers as they plan their classroom arrangement and also manage group work, especially without affecting the instructional time. Under such conditions it would be very difficult for teachers to monitor and assess learners’ work and as a result the provision of appropriate learning opportunities for mathematical literacy in such classes might not be realised. The findings also demonstrate that the time constraint and crowded classrooms had a negative impact on learners’ performance in mathematical literacy. Another finding of the study shows that,

> systemic challenges also pose significant barriers to the effective development of mathematical literacy. In this regard, the congested mathematics curriculum was considered as one of the significant systemic challenges that negatively influence the successful implementation of the learning outcomes and goals emphasizing mathematical literacy (Genc & Erbas, 2020:164).

Teachers were also dissatisfied as they described the curriculum they used as very intense requiring them to be more committed in terms of time and effort devoted for

realisation of its prescriptions. Even though changing the curriculum can be considered as having a potential to address issues of learning mathematics, other studies show that teachers teaching practices are often influenced by their beliefs, understandings and experiences (Ball & Cohen, 1996).

2.3.2 Teacher's knowledge of learners

Kaplan and Argün (2017) conducted a research with the main purpose being to determine mathematics teachers' diagnostic competency levels. They describe diagnostic competence as the ability to understand and analyse student thinking and this notion encompasses the following concept: "the components of teachers' general knowledge on learning processes and their skills at considering, scrutinizing, and interpreting student thinking" (Kaplan & Argün, 2017: 2143). These researchers present four levels of diagnostic competence, namely:

Level-1: A teacher who only considers a student's mathematical thinking;
Level-2: A teacher who considers a student's mathematical thinking and scrutinizes directly with a solution;
Level-3: A teacher who considers a student's mathematical thinking and scrutinizes by clarifying indicates diagnostic adequacy;
Level-4: A teacher who considers a student's mathematical thinking, scrutinizes by clarifying, and interprets indicates diagnostic adequacy (Kaplan & Argün, 2017: 2151).

Findings from the research show that teachers' knowledge of learning processes affects their diagnostic competences. On the basis of this, Kaplan and Argün (2017) conclude that knowledge of learning processes directly affects teachers' consideration, scrutiny and interpretation of learner thinking. These researchers argue "as long as teachers are error-oriented when diagnosing their students, they are not just unable to understand them, but are also unable to see that the source of error does not always originate from the students" (Kaplan & Argün, 2017: 2167).

2.3.3 Role of assessment in the facilitation of mathematics instruction

Suurtamm *et al.* (2016) state that assessment should be used to facilitate classroom instruction on a continuous basis. These researchers point out that assessment provides evidence of learners' progress in learning and also informs teachers about how to plan for the future instruction. The assessment principles should be designed in a way that provides opportunities for learners to engage in meaningful mathematics and demonstrate cognitive skills. Suurtamm *et al.* (2016) mention that the focus of mathematics education is on promoting learner engagement in developing content and process knowledge. These researchers argue that it can ensure that learners develop robust mathematical proficiency consisting of procedural fluency, conceptual understanding, adaptive reasoning, productive dispositions, and strategic competence.

Suurtamm *et al.* (2016) suggest that different types of assessment should be employed to assess complex processes such as problem solving, justifying or proving solutions, or connecting mathematical representations. According to these researchers this can be more beneficial than once-off tests that cannot adequately assess the complex nature of learners' mathematical thinking. They also report that in classroom assessment there is a need to use a range of assessment strategies that can create more opportunities for learners to demonstrate their learning and teachers should make use of formative feedback effectively on a timely and regular basis. Suurtamm *et al.* (2016) perceive that it is through assessment that learners can develop understanding of mathematics that is important to learn and mathematics that is valued. This means that both large-scale and classroom assessment should take into account not only content but also mathematical practices, processes, proficiencies or competencies.

2.4 Basic resources that support mathematics teaching and learning

Venkat and Graven (2017) argue that it is quite problematic to neglect what they consider fundamental elements for developing the quality of teaching in larger-scale interventions. These elements, according to the researchers, are the disciplinary knowledge base and professionalism. They are also of the view that there might be

differing conceptualisation of professionalism and knowledge base among mathematics teacher educators. Apart from this, there is no common ground for what content and approaches within teacher education activities might lead towards the desired goals (Venkat & Graven, 2017: 175). Citing Adler's (2000) and (2012) articles they indicate that there is a need to put more focus on resources. These according to them entail:

> human resources (including teachers' knowledge bases, their orientations to knowledge, collegiality in schools); material resources (including school equipment such as a photocopier, classroom equipment such as a chalkboard or a computer and mathematical equipment such as manipulatives and textbooks); and cultural resources (including language and the structuring of time) (Venkat & Graven, 2017: 164).

Adler's (2012) article focuses on secondary mathematics teachers' knowledge-in-use considered in terms of the 'grounds' that revolve around teachers' instructional practices with special attention to mathematical objects. She categorised knowledge resources in terms of mathematical grounds (empirical or procedural/conventional); experience-related grounds (professional or everyday) and curricular grounds (assessment or textbook-related). Venkat, and Graven (2017) contend that a reworked notion of resources has the potential to leverage change and can add value in discussions in ways that are related to the international mathematics teacher education literature.

Reporting on the context of Serbia, Maričić and Lazić (2020) underscores the importance of using abacus for teaching and learning of mathematics. They provide a list of how learners can benefit by using a Japanese abacus when learning mathematics. Some of the issues that the abacus promotes among learners are:

> Conceptual understanding of mental arithmetic and developing mental computation and problem-solving skills, gaining a clear mental picture of the structure of numbers, their magnitude and relationship, understanding the place value of a digit, but also developing motivation and positive attitudes toward mathematics (Maričić & Lazić, 2020: 57).

These researchers point out that an abacus can as well be a powerful tool in teaching learners with visual impairment and the evidence shows that their achievement in mathematics tends to improve if they use it.

2.4.1 Teacher professional development

Brownell, Sindelar, Kiely and Danielson (2010) brought forward an issue that needs careful consideration, which relates to the provision of relevant support to LSEN, so that they would learn specific content areas, such as mathematics and literacy, putting special attention on reading and writing. Bearing this in mind, Brownell *et al.* (2010) argue that it is necessary for special education teachers to be properly trained, so that they can acquire knowledge of subject matter together with the requisite skills, which would help them to confidently deliver content to LSEN at different levels of the schooling system. In other words, special education teachers should possess the skills of general education teachers, in terms of subject matter knowledge, on top of their competences already developed in special education training (Brownell *et al.,* 2010).

Drawing from previous studies they argue that general education teachers, trained in special education, would likely be in a better position of teaching literacy and mathematics to LSEN effectively. These teachers, by virtue of their rounded expertise, would be expected to be innovative in terms of designing helpful assessment strategies, as well as providing appropriate interventions, such as on-going support and remedial classes to foster development of the necessary skills in literacy and numeracy. It can be argued that the perceived aspiration is to create opportunities for LSEN to access the general education curriculum, and any failure to accomplish that can arguably ruin their chances of constructing authentic competences in the said content areas (Brownell *et al.,* 2010). The section below looks into the experiences of learners in terms of existing opportunities or barriers for accessing quality education in inclusive settings.

2.5 Learners' perspectives on the teaching and learning of mathematics

The issue of how a learner's attitude towards mathematics influence learning experiences has been widely researched in Mathematics Education. This also featured in Elçi's (2017) research, which was conducted with high school learners in Turkey. The purpose of the study was to investigate learners' attitudes towards mathematics. One of its objectives was to find out how the approaches employed by mathematics teachers in the classroom affected learners' experiences. The study revealed that some learners indicated that teachers' content knowledge is important for assisting them as it enables them to use a diverse representation of mathematical knowledge and give appropriate examples. Giving different examples can help learners develop a better understanding of the mathematical concepts that they did not understand initially. Learners showed satisfaction with this approach and this made them like mathematics a lot more.

However, some learners stated that they were taught the concepts that are not related to a real-life context. Some learners could not identify the relationship of the concepts being taught. All these made learners perceive mathematics as the field that focuses on discrete concepts and formulas. Another score of learners complained that their mathematics teachers had difficulties in articulating theorems, axioms and generalizations. According to these learners, the approaches used by the teachers affected their mathematics learning in a negative way (Elçi, 2017).

Similar outcomes emerged in Mazana, Suero Montero and Olifage's (2019) study that investigated learners' attitude towards mathematics in Tanzania. The purpose of their study was to find out the compelling reasons attributed to learners' liking and disliking of mathematics. It also sought to investigate the relationship between a learner's attitude towards mathematics and their performance in this subject. The results show that learners' attitude towards mathematics changes as they progress to higher grades. This means at lower grades learners' attitude towards mathematics tends to be positive, but takes a downward spiral as they progress in education. The study revealed that learners' performance in mathematics depends on whether they enjoy the subject or not, as well as their attitude towards it. One of the factors identified to influence learners' liking or disliking of mathematics is their aptitude; its variables are

learners' motivation and ability, which is linked to prior achievements. Citing Walberg's Theory of Productivity attribute, Mazana et al. (2019: 225) clarify that,

> students' motivation is indicated by the belief that they can learn mathematics, feeling of responsibility to undertake the mathematical tasks, finding mathematics interesting, perseverance, and a positive feeling that when they do mathematics tasks they are likely to apply the appropriate cognitive strategies. Prior achievement is related to the students' belief that positive results in previous examinations will support their learning of mathematics.

On the basis of the research findings, the researchers argue that a learners' attitude towards mathematics should not be considered as the only factor influencing their performance. They identified one of the factors that can lead to unfavourable outcomes in assessment to be the teachers' instructional practices, which tend to be didactic in nature. Other factors mentioned are limited resources, failure to understand instructions as a result of a lack of understanding of the medium of instruction, poor learning and examination strategies (Mazana *et al*., 2019).

Taking into consideration that learners often have a negative reaction towards mathematics, a study that was undertaken in Australia by Hill, Kern, Seah and Van Driel (2020) considers understanding learner well-being in mathematics education as an important aspect that can lead to an improvement of learners' experiences in terms of how they perceive and engage in mathematics instructional practices. These researchers argue that their focus in this study is not on the barriers to mathematics learning but it is centred around the aspects of mathematics teaching and learning that enable learners to "feel good and function well" (Hill *et al.*, 2020: 21) as they continue learning mathematical concepts. These researchers also believe that this can help in addressing the high incidence of learners' anxiety and disengagement in mathematics. Their study suggests a seven dimensional framework of student well-being in mathematics education and it comprises: relationships, accomplishment, positive emotions, perseverance, cognition, engagement and meaning.

Findings of this study demonstrate "the importance of both teachers and peers, engaging activities, […] fun, and motivational aspects, pointing to target areas to

improve students' experiences in mathematics" (Hill *et al.*, 2020: 20). To be precise, findings show that learners' mathematics well-being can be linked with how the teacher understands the learners' needs and provides appropriate support without being judgmental and this includes explaining concepts that are not well understood by learners. Apart from this, learners' mathematics well-being can as well be connected with positive relationships among peers in the classroom, whereby learners cordially support each other to learn mathematics. Understanding of mathematics concepts and getting some clarity where need arises is a very important aspect of learners' mathematics well-being. Mathematics understanding evokes positive emotions among learners, whereas lack thereof causes frustration for them and ultimately triggers negative emotions towards this subject.

Learners' performance in mathematics, including the successful completion of a given task or giving correct answers when asked questions are confidence boosters that impact their mathematics well-being. Learners' mathematics well-being is associated with their level of commitment when independently engaging in mathematics tasks without any form of distraction. Learners' mathematics well-being is interrelated with valuing the importance of meaningful or purposeful mathematics such that mathematics taught to learners can be useful in their daily lives. These researchers arrive at the conclusion that, "well-being is also values dependent, and the factors students value as important when learning mathematics are the same factors that promote MWB" (Hill *et al.*, 2020: 20).

2.6 Experiences of visually impaired learners in regular school settings

Most scholars interested in special education have been engaged in robust research studies that seek to explore ways in which access, equity and quality of education for LSEN can be improved. Some studies are specifically interested in finding out how issues of access to quality education can be achieved for learners with visual impairment. Equally so, other studies also have a particular interest in how the content of certain subject areas could be accessed by visually impaired learners. The discussion in this section is primarily centred on visually impaired learners' experiences of learning mathematics in regular school settings.

The narrative of Fukuchi (2009) elicits information about the typical experiences of LSEN, especial those with visual impairment. Even though he reports about personal experiences in the context of Japan, LSEN in other parts of the world might share similar sentiments. Apart from that, his experiences demonstrate that inclusion can be achievable. Moreover, these shared experiences can be used to develop useful strategies that could contribute to the success of inclusive practices elsewhere in the world. The general inference that can be made, based on this narrative, is that Inclusive Education was successful in this particular context.

Fukuchi (2009) explains that assistant teachers were very helpful in facilitating his learning. Despite availability of teaching and learning resources, he still encountered some challenges that in fact impeded his full participation in classes like mathematics, science and geography, among others, which usually require the use of figures and graphics. Apparently, these teachers used gestures or remarks that made it almost impossible for the visually impaired learners to easily follow lesson proceedings and as a result this was likely to negatively affect their active participation and engagement in classroom activities (Kurth, Lyon & Shogren, 2015). In any case, the assistant teachers made efforts to help them with access to information written on the board, by using specialised materials and even went further to give some explanations. It has been revealed that in most cases teachers verbally read out what they wrote on the blackboard.

It is also indicated that teachers avoided using gestures and pronouns like ‘it’ or ‘this’ in their speeches. He also reports that manipulatives, such as touchable models were used to augment the learning of some complicated concepts in some science-related classes. Most importantly the assessment strategies used catered for all learners’ needs. Teachers avoided the use of pictures when assessing learners with visual impairment. He then concludes that aspects emerging from this narrative have contributed to the creation of an inclusive learning environment (Fukuchi, 2009).

Rowlett and Rowlett **(**2012) conducted a qualitative study with the purpose of examining the experiences of visually impaired university students, as well as the perceptions of those assigned to offer them support for accessing mathematics. Two sets of data were gathered through semi-structured interviews with students and staff

from four universities in the United Kingdom (UK). The findings of this study presented a challenge, relating to the accessibility of content for students with visual impairments. Among the issues revealed by these findings is that the Braille format that was used in one university seemed to be unfamiliar to the students.

In addition, it is indicated that visually impaired students faced a challenge of accessing information when teachers used gestures. This appears to be a common challenge for the visually impaired, in view of other studies in this field. Visually impaired learners also battled to follow long equations, even when they were read aloud, which is a challenge, posed by memory. The conclusion drawn from this study is that the wide range of methods that can be used by visually impaired students for accessing mathematics content can pose a challenge of accuracy when producing written work. However, the researchers are optimistic that students with visual impairment can achieve good results if they could be granted enough support (Rowlett & Rowlett, 2012).

Agesa (2014) conducted a study with the purpose of exploring the challenges encountered by visually impaired learners in regular classes. The study particularly investigates how the curriculum in a regular school could be implemented, in order to achieve fruitful outcomes for visually impaired learners in the context of Kenya. The research population in this study comprises of learners with visual impairment, teachers and iterant teachers. Data were collected through use of questionnaires, interviews, as well as documentary analysis.

The results have revealed that participating learners felt that they were subjected to a high workload, yet the support they got from their teachers appeared to be insufficient. The results have also indicated that inclusive schools had a high teacher-learner ratio in the classrooms. This appears to be consistent with Abadzi's (2009) assertion that crowded classes are typical in most low-income countries. This phenomenon is usually characterised by ineffective teaching and learning (Abadzi, 2009). The most striking part of the research outcomes relates to the fact that in other circumstances teachers gave no attention to visually impaired learners in the class.

The researcher claims that teachers and head teachers appeared to be against the inclusion of visually impaired learners in their schools. The reason put forward was that such learners are likely to lower school standards. It is further indicated that due to budgetary constraints, schools were reluctant to accept learners with visual impairment; perhaps they would not be able to meet their learning needs in terms of teaching and learning materials. It can be argued that visually impaired learners would not be able to access quality education under such conditions. Certainly, mathematics teaching and learning would almost be impossible under such circumstances.

The above discussion has demonstrated that learners with visual impairment still encounter challenges for learning in inclusive school settings. The discussion has shown that Inclusive Education practices have a potential of improving equal access to education when the existing barriers could be minimised or eliminated where possible. On the contrary, there is an upcoming debate that takes a stance that the majority of LSEN have dismally failed to benefit from the Inclusive Education practices in regular school settings (Qu, 2015). As a result, Qu (2015) argues that special schools can be helpful to address the educational needs of most learners with disabilities. It is further indicated that:

> The condemnation of segregation and discrimination targeted at special schools may lack rigor and fairness, as this analysis shows that it is the whole education system that is heavily laden with disciplinary control, prescribed standards, rigid institutional boundaries, and academic competition that create exclusivity (Qu, 2015: 29).

However, this line of debate appears to be misdirected, as the special schools have always been in existence for decades and they were found to be less helpful for improving equal access to quality education. Apart from this, the researcher did not provide empirical evidence that demonstrates cases in which special schools benefitted LSEN. It is imperative to examine the academic potential of the visually impaired learners, in order to understand how their disability condition can or cannot deprive them opportunities to access general education curriculum in the inclusive settings. The section that follows discusses the academic potential of visually impaired learners.

2.6.1 Academic potential of the visually impaired learners

An empirical study conducted by Agesa (2014) reveals that the majority of teachers in regular schools strongly believe that visually impaired learners have the potential to perform well academically if they get adequate support in curriculum implementation. This is consistent with what has been reported by Arya (2014), namely that visually impaired learners in inclusive schools performed well academically in the same way as their fellow sighted classmates. However, some studies discovered that visually impaired learners show relatively low academic achievement in mathematics compared to their performance in other academic subjects (Beal & Shaw, 2008).

Additionally, Ukeli and Akem (2013) mention widespread discontent of stakeholders over the achievement gap between visually impaired learners and their sighted peers in mathematics. Drawing from the above discussion, undoubtedly learners with visual impairment are intellectually capable of performing well in school. However, their performance in mathematics is apparently far below average. It is for this reason that this study aims at exploring factors that could contribute to visually impaired learners' low academic achievement in mathematics. Evidently there are various factors that contribute to their low mathematics achievement, one of which relates to the unavailability of supportive resource materials.

Arya (2014) states that the majority of visually impaired learners, who had access to the general education curriculum in some regular schools in India, managed to get high academic scores. It is stated that provision of support structures, such as iterant teachers, might have contributed to the accomplishment of this desirable outcome. However, the most significant aspect, which appears to have improved learner performance, could be related to the manner in which the general education curriculum was used during instructional practice in inclusive class settings. It is argued that some of the requirements of curriculum adaptation in the inclusive classes include employment of a "multisensory approach" to teaching and the use of appropriate instructional materials, such as Braille materials. In support of teaching and learning, auditory, tactile and three-dimensional aids are also encouraged (Arya, 2014: 11).

It is also indicated that for the successful adaptation of the general education curriculum in inclusive classes, teachers should abide by certain rules, known as “modification, omission, duplication and substitution” with the purpose of catering for the needs of learners with visual impairment (ibid.: 11). In this context, modification deals with cases comprising of minor elements of exclusion, identified in the curriculum prescriptions and teachers are expected to effect alterations, which would ensure active participation of visually impaired learners during lessons. For example, if a picture is provided for the sighted learner, an embossed one should be provided, so that visually impaired learners can also access the information. In cases where certain concepts only appear in the instructional materials for the sighted learners, teachers are expected to make an effort to provide additional materials for the visually impaired learners and that situation is referred to as duplication.

Substitution could be described as a situation aimed to address issues, such as when the curriculum prescribes an approach that could be a challenge for visually impaired learners to access. In such cases, teachers are supposed to use a different method to cater for diverse learning needs in such a way that the set instructional objectives could still be achieved. Finally, in the context that curriculum content or prescriptions could not be adjusted to accommodate visually impaired learners, such issues could be left out and that is referred to as omission. One can argue that omission could not be an ideal alternative, as it seems to have certain elements of exclusion that could inhibit visually impaired learners from active involvement in the class. Although it is not explicitly indicated where these rules could be found, most probably they could be outlined in the policy or curriculum documents.

The issue of the academic potential of visually impaired learners was also reported in a research conducted by Shahed, Ilyas and Hashmi (2016) in institutions of higher learning. Their study sought to investigate how social support can contribute in advancing academic achievement and the self-efficacy of visually impaired students. The findings demonstrate significant correlations between these variables. These researchers conclude that visually impaired students can attain relatively improved academic scores in any field of study they registered for, if they get adequate support.

This also seemed to have a positive effect on their self-efficacy (Shahed *et al.*, 2016). Different forms of social support that appeared to be the most significant for improving academic performance of visually impaired students include health-related, therapeutic and counselling services, as well as parental support. These researchers argue that the perceived social support can be used for enhancing wellbeing and other positive beliefs among visually impaired students.

One of the recommendations of this study is that institutions should ensure that their facilities are refurbished, so that visually impaired students get the necessary support, which can contribute towards unleashing their full academic potential (ibid.). Another issue which emerged from the findings of the study, is that female students seemed to have out-competed males in terms of academic achievement. One of the reasons cited is that girls appear to have developed a work ethic on top of resounding competence in verbal communication.

It can be deduced from this discussion that some visually impaired learners were highly proficient in mathematics, which presumably enabled them to attain exceptional academic goals. Notwithstanding this remarkable achievement, some studies have shown that there are a significant number of those who still obtain unsatisfactory academic scores in mathematics, owing to various reasons. As already indicated, existence of barriers in regular schools appear to negatively impact the teaching and learning of mathematics to the visually impaired learners and that unarguably results in their low academic achievement.

A research article written by Jones, Smith, Hensley-Maloney and Gansle (2015) reports on a response to intervention (RTI) framework, which can be used to identify cases concerning the coexistence of learning difficulties and visual impairment. It emerged from their literature review that some professionals had been disregarding the likelihood of dual diagnosis of visual impairment and learning difficulties. As a result, learning difficulties have always been confused with visual impairment in cases where they coexist (Jones *et al.,* 2015). It can be argued that this perspective could be one of the reasons, which has contributed towards denying visually impaired learners opportunities of accessing the general education curriculum, in some contexts, as visual impairment would be regarded as one form of learning difficulty.

One has to concede that among visually impaired learners there are those with learning difficulties in certain school subjects, such as mathematics. It can also be inferred that such learners would be characterised by low academic performance. However, considering all learners with visual impairment as having learning difficulties would be a misconception. According to Jones and Hensley-Maloney (2015), dual diagnosis of visual impairment and learning difficulty amongst learners pose a challenge, which the concerned schools and educators should be aware of. They should also be informed about appropriate strategies that can cater for all the learners' educational needs.

This complication requires effective instructional interventions, which would help out learners who live with these conditions (Jones *et al.,* 2015). In their article, Jones and Hensley-Maloney (2015), argue that a teacher should realise that there are several forms of visual impairment and learning difficulty conditions, which may differ in terms of their degree and scope. They further postulate that a teacher should undertake prior investigations about a learner's actual condition, as that would help when selecting an intervention strategy, which can effectively address a learner's specific condition (Jones & Hensley-Maloney, 2015). It is also indicated that learners with coexisting visual impairment and learning difficulty may need other forms of support that can foster appropriate social skills, which could help them to socialise with peers, establish friendships and appreciate individuals' differences in terms of ability/disability. The intervention should also help learners develop independence in relation to mobility issues, which may include locating important destinations within their surroundings.
Other forms of support are basically aimed at advancing learners' perceived competences, which can help them to confidently exert a greater effort to attain outcomes similar to those of their sighted peers. Teachers are also encouraged to equip these learners with self-determination skills by making realistic examples, which portray successful people with disabilities (PWD) who can be looked up to as role models (Jones & Hensley-Maloney, 2015). The prevailing situation confronted by LSEN, especially those with visual impairment, necessitates concerted efforts from the stakeholders, in order to devise sustainable intervention measures. Discussions in the next section focus more on the effective learning resources for the learners with visual impairment.

2.6.2 Teaching of mathematics to learners with visual impairment

The literature reviewed by Miyauchi (2020) shows that learners with visual impairment often encounter barriers when learning subjects like mathematics despite their proven capability when studying other academic subjects. Research also shows that learners with visual impairment encounter a lot of challenges when learning mathematics, especially in the area of geometry and statistics where there is visual content. The results of research conducted by Gorlewicz, Tennison, Uesbeck, Richard, Palani, Stefik, Smith and Giudice (2020) suggest that learners with visual impairment had difficulties learning geometric figure representations. In fact, it was quite challenging for learners with visual impairment to create "a mental image of the shape due to the amount of information that was required to have in memory" (Gorlewicz *et al.*, 2020: 24).

Zhang and Malasig (2016) report on a case study undertaken by Chang and Bin (2013) focusing on developing an intervention strategy that could better suit the needs of an individual with visual impairment who had little or no visual experience. The study explored whether an individual with visual impairment was able to draw from a linear perspective. The findings show that after the intervention, the participant was able to cognitively accept the concept geometry as he was able to "select the correct oblique projection of a cube and no longer insisted that a cube can only be ideally represented by a square" (Zhang & Malasig, 2016: 3). However, it is reported that the participant had difficulty joining the corners of the cube. On the basis of these findings, the study recommends that early intervention of appropriate graphic teaching methods is required to enhance learning of learners with visual impairment. Zhang and Malasig (2016) point out that there is limited research that focuses on this issue. Rudinger (2020) reiterates this by indicating that the issue of best practices for instruction is not adequately addressed in educational research that involves learners with visual impairment.

An investigation conducted by Van Leendert, Doorman, Drijvers, Pel and Van der Steen (2019) revealed that the amount of time needed by learners with visual

impairment who used Braille for reading mathematical expressions was longer than that of learners who used print. The findings also show that “Braille readers had difficulties to efficiently align their reading strategies with the solution procedures required by the mathematical structure of the items [that were being provided]” (Van Leendert *et al.*, 2019: 68). This in agreement with the argument put forward by Bartz (2020: 223) that “blindness causes a generally slow pace of work, which can only be improved to a limited extent with the help of technical aids or the support of an assistant”.

In reviewing studies conducted in under-resourced settings, Rowes (2013) demonstrates that budgetary constraints did not allow appropriate provision of resource materials needed to help learners with visual impairment to access mathematics content. The study indicates that most learners with visual impairment performed below average in comparison to their sighted counterparts, studying at the same level, mainly due to the lack of supportive resources. Consequently, visually impaired learners were often compelled to discontinue studying mathematics (ibid.). The results of the study conducted by Giesen, Cavenaugh and McDonnell, cited in Rowes (2013), demonstrate that visually impaired learners at schools with higher levels of academic support, had higher achievements in mathematics than those in schools with less support.

Wairimu and Chomba’s (2020) study investigated teaching strategies used by mathematics teachers in classrooms accommodating learners with low vision in selected Kenyan primary schools. The findings show that the teaching approaches employed when teaching mathematics to learners with low vision did not differ significantly to those used for teaching sighted learners. The study also revealed that teachers were unaccustomed to teaching strategies that involved the use of technology. The teachers mentioned strategies that they were familiar with and considered them as being effective for teaching mathematics to learners with low vision and these include “use of real objects for learners to touch and manipulate, calling the child by name when speaking to him/her in a group, use of varying teaching styles, breaking down activities into smaller steps and question and answer” (Wairimu & Chomba, 2020: 121).

Citing Rukwaro and Kimani (2007), these researchers argue that the strategies used for teaching learners with visual impairments are not totally unique, but are similar to those used in the regular school system with little adjustments for improving their effectiveness. The strategies mentioned include,

> developing the lesson slowly, allowing enough time for exploration and individual perception through the use of all senses including vision, monitoring the learners progress closely and frequently as the teacher teaches and ensuring active participation of learners instead of passive listening. [...] Also the use of oral-aural presentations when teaching such as discussion, [...] dramatization and guest speakers" (Wairimu & Chomba, 2020: 120).

The study recommends teacher capacity-building for ensuring that teachers are upskilled with appropriate instructional strategies. This implies that teachers can play a major role of ensuring that effective teaching and learning of mathematics to learners with visual impairment occurs in regular schools when they are familiar with appropriate instructional strategies.

Maguvhe (2015) conducted a qualitative case study with the purpose of investigating factors, which appear to be barriers that prevent visually impaired learners from fully participating in mathematics and science classes. Data was collected through semi-structured interviews, which would allow the partially sighted participant to reflect on his past experiences of learning mathematics and science. The researcher analysed collected data by categorising it into appropriate themes. The findings have revealed that the challenges encountered for accessing mathematics seemed to revolve around teachers. It has been revealed that teachers lacked proper training in special education and that seemed to have contributed to their inefficiency in employing teaching strategies that would allow learners' access to mathematics and science.

It is also indicated that teachers appeared to have lacked much needed motivation and received limited support from mentorship programmes. Apart from that, the findings have revealed that the unavailability of assistive resources appeared to have a negative impact on effective learning for blind and partially sighted learners. In consideration of these findings, Maguvhe (2015) has concluded that effecting teaching

and learning of mathematics and science can be achieved when teachers are equipped with the requisite skills that would enable them to execute their mandate as expected. He also emphasised the need to orientate teachers about the diverse needs of learners with visual impairment.

The outcomes of a study conducted by Emerson and Anderson (2018a) found that it might be difficult for visually impaired learners to access information contained in mathematics textbooks. However, according to them, “the preponderance of visual images, [in] many mathematics texts are wholly or largely inaccessible to [learners] who are blind” (Emerson & Anderson, 2018b: 157). Their main argument seems to emerge from the fact that most important messages are conveyed in visual images in such a manner that there would be limited descriptions or explanations. Klingenberg, Holkesvik and Augestad (2019) seem to also share similar sentiments. They further argue that the textbooks full of pictures could possibly make it complicated for the learners with visual impairment to access information.

One would understand that availability of mathematics textbooks, whether loaded with descriptions or pictures, could serve no purpose to the blind learners if they cannot be translated to accessible formats, such as electronic textbooks and Braille. The latter has been likened with the high costs incurred when transcribing mathematics content, especially formulas to Braille, as it is purported to be time consuming (Maćkowski, Brzoza, Żabka & Spinczyk, 2017). These researchers state that mathematics textbooks in print often present “little explicit instructional information about structural information interpretations” (Maćkowski *et al.,* 2017: 6191).

In view of these existing barriers associated with mathematics textbooks, their article presents the interactive multimedia representation, developed in consultation with mathematicians and teachers of the visually impaired. They indicate that the computer-aided tools were used for creating interactive steps to find answers to mathematics exercises. Apart from this, they further report these tools also presents mathematics formulas in ways accessible for the visually impaired. In fact, the defined rules were used to read mathematical formulas aloud to the learners with visual impairment who have understanding of some mathematical concepts. The findings of the study seem to suggest that the majority of university students who are visually

impaired showed an understanding of mathematics formulas after using this interactive multimedia representation.

2.6.3 Availability and effective use of learning resources

As already indicated, the increasing enrolment of the learners with visual impairment in regular schools has been facing many challenges related to the limited provision of appropriate support in terms of resources. Arguably provision of these resources might facilitate their effective learning. It is considered imperative to review literature that deliberates on the kind of resources essential for the improvement of access to quality education for learners with visual impairment, with specific focus on mathematics learning.

A lack of appropriate and effective assistive technology has been regarded as an excuse for low academic achievement for learners with visual impairment in under-resourced schools (Phillimon & Chabaya, 2016). Other issues mentioned as having an impact on the effective use of assistive technology devices, include: “high cost of AT [assistive technology] devices, inadequate teacher training in the use of AT devices, rigid curriculum and negative attitudes of learners” (Wairimu, Chomba & Awori, 2018). These researchers seem to put full responsibility on the government for the provision of assistive technology devices to the visually impaired, in order to increase their opportunities to pursue careers in mathematics and science-related programmes. They also recommend that the pre-service programmes should include compulsory training in the use of assistive technology devices. Another recommendation is that the in-service training should be conducted to equip practicing teachers with the use of these devices.

In fact, recent research work reports that the use of assistive technology by the LSEN tends to motivate them (Erdem, 2017; Silman, Yaratan & Karanfiller, 2017). Some studies revealed that the assistive technology could be helpful in promoting effective instructional practice for visually impaired learners (Beal & Rosenblum, 2018; Tuwaym & Berry, 2018; Erdem, 2017; Sah, 2013). According to Sah (2013), it is very important to consider integrating the training of assistive technology devices to the learners with visual impairment, because these devices might help them to perform functions, which

would enable them to realise their full potential. Reportedly, assistive technology might lead to improved learner performance (Watson, Ito, Smith & Andersen, 2010).

The findings of a study conducted by Young (2013) largely established that assistive technology could be advantageous for the LSEN, but at times, learning how to manipulate these devices could be complicated and frustrating. In the same vein, Ampratwum, Offei and Ntoaduro (2016) acknowledge that some learners might have challenges with the use of assistive technology. They however, argue that challenges mainly emerge from individual learners' competences in the use of assistive technology, developed from the kind of training they received and the manner in which they responded to this training. This was also echoed by Jaleel and Anis (2018), whose study established that visually impaired learners' preferences seemed to be determined by their familiarity with the use of assistive devices.

The literature cited by Watson *et al.* (2010) reveal that the abandonment rate could range between eight percent (8%) and 75%. Nonetheless, in their study they reveal that there was absolutely no discontinuance of the assistive technology by learners. This makes them doubt the findings of the previous studies, as they mention one of their limitations as being the imprecise reporting of the time taken before discontinued use of the assistive technology. One could argue that it is pointless to do so, as abandonment of assistive technology is likely to occur at any stage. As according to Watson *et al.* (2010) the effective use of assistive technology could be judged on the basis of its continued use. This means that when learners continue to use the assistive technology devices, this could be a manifestation of their effectiveness. Otherwise their abandonment could be regarded as showing them to be less effective for learners. Even so, one could argue that abandoning assistive technology devices might come as a result of learners' attitudes, but not because they are less resourceful.

The discussion above seems to demonstrate that some intervention is required to help the visually impaired to access mathematics content in these inclusive settings. Nonetheless, the success of any intervention depends on the reliable information that can be gathered through rigorous research work. The next section discusses the conceptual framework that has been employed in this study.

2.7 Conceptual framework and rationale for its selection

The framework of opportunities to learn (OTL) is the main theoretical resource through which learners' experiences of learning mathematics are explored. Various interpretations of OTL converge towards assessing how learners access content from a particular subject area. As stated by Goos (2014: 439),

> The notion of 'opportunities to learn in mathematics education' is open to interpretation from multiple theoretical perspectives, where the focus may be on cognitive, social or affective dimensions of learning, curriculum and assessment design, issues of equity and access, or the broad policy and political contexts of learning and teaching.

According to some scholars OTL might be used to measure learners' level of access to educational resources (Cawthon *et al*., 2012). Alternatively, OTL can also be viewed as the situation that makes it possible for learners to study mathematics. For LSEN, OTL is concerned with raising learner engagement to ensure that they access the general education curriculum (ibid.). As such, a higher degree of OTL might be facilitated through placement of the LSEN in the least restrictive environment.

This suggests that placement of LSEN in regular schools which practice Inclusive Education would be regarded as demonstrating increased OTL. It can be indicated that the education of LSEN should pre-eminently consider their needs and that instructional approaches have to be altered in order to achieve this. The similar outcomes emerged in a research undertaken by Elliot et al. (2017). It is suggested that an individual education programme (IEP) should be developed for every learner with special educational needs. The presence or absence of an IEP can also be used for assessing OTL in an inclusive school setting.

There is a need to justify the selection of the OTL framework used in this study, in terms of its alignment, with the purpose of the study and research problem. In this study, OTL has been a very useful tool for understanding what counts as valid experiences of visually impaired learners in targeted regular schools. It has also been used to explore the classroom environment that learners with visual impairment were

exposed to and how that might contribute towards their learning experiences. Apart from that, OTL has also been useful for studying classroom instructional practices in the selected schools. Finally, the OTL framework has been used to measure the extent to which availability or lack of learning resources defined the experiences of learners with special educational in the classroom.

2.8 Identified gaps in the literature

The literature, which has been reviewed here, reveals crucial factors that appear to be barriers for the successful implementation of Inclusive Education practices in regular school settings. These are: (a) policy provisions, (b) curriculum, (c) learner placement, (d) teacher preparedness, (e) teaching approaches and (f) availability of instructional resources. In this study, the aspects, which have been considered as barriers in the literature, are recognised as the very ones that create opportunities to learn for LSEN in a regular school setting.

The research design employed in these studies, includes qualitative, quantitative, as well as single and multiple case studies. Most of these studies were school-based, while LSEN, together with their teachers, were the main target population. The research instruments that have been used include narratives, interviews, questionnaires and document analysis. Out of these instruments, narratives have been identified as having a potential to elicit relevant information about experiences of the individuals under study.

There is very limited literature that covers the voices of LSEN who are at school. Actually, most studies seem to have focused on the experiences of individuals with disabilities who are out of school. It also appears that different sets of data were collected, using semi-structured interviews and questionnaires where visually impaired learners were involved. In fact, classroom observations hardly featured. This implies that little is known about the dynamics of mathematics classroom practices, involving learners with visual impairment. Out of the identified gaps gleaned from the reviewed empirical studies, the present study tries to build its methodological approach and a detailed explanation is provided in chapter three.

2.9 Summary of the chapter

The chapter reviewed literature that focuses more on the discussions that emerge from the field of Mathematics Education. The first section discussed arguments made by prominent scholars in the field and their main focus is on the knowledge of subject matter. Afterwards, the chapter engaged in debates that show the importance of learner involvement in the teaching of mathematics. From there, the issue of basic resources required for teaching and learning mathematics are outlined. This literature review has also revealed the need to explore experiences of visually impaired learners in regular school settings. The review has presented experiences of visually impaired learners in both high and low-income countries. The methodological approaches used in the reviewed studies have been adapted for the purposes of this present study. The next chapter provides a detailed description of the entire methodological approach followed in this study.

Chapter Three

3 Chapter three: Research methodology

3.1 Introduction

This chapter provides a description of the methodological approach adopted in undertaking this study. It discusses the research methods employed for investigating visually impaired learners' experiences of learning mathematics in regular classroom settings. The chapter begins by restating the purpose of the study, the research questions and design. Thereafter, the researcher's position is explained and the description of the research site is provided. The procedure followed when selecting the participants of the study is articulated. The ethical considerations and research instruments utilised for data collection are also discussed. The process of data analysis is then briefly discussed. The chapter concludes with a discussion of the limitations of the study and a brief summary of the whole chapter.

3.2 Purpose of the study

This study was intended to assist researchers in understanding visually impaired learners' experiences of learning mathematics in regular schools. The findings of the study are meant to lay a solid foundation for future studies in this field. The study seeks to compare mathematics teaching in two regular schools and to establish how visually impaired learners cope with the instructional approaches employed in these two cases. This information is expected to be of use in assisting teachers to develop effective strategies for teaching mathematics to visually impaired learners. The findings of the study are also intended to provide assistance to policy makers and curriculum developers, to make informed decisions when engaging in educational transformation, given that the study also aspires to find out the opportunities presented in the policy documents, curriculum and instructional materials for visually impaired learners.

3.3 Research questions

It is essential here to restate the research questions that this study aspires to address. The main research question that seeks to generate data on the education of visually impaired learners in regular school settings, is as follows: What are visually impaired learners' experiences of learning mathematics in Lesotho regular schools?

To unpack the main research question, the following secondary questions proposed are:

1) How is mathematics taught in classrooms with visually impaired learners?
2) How do visually impaired learners perceive and engage with the teaching of mathematics in selected classrooms of Lesotho?
3) How can the experiences of mathematics teaching for visually impaired learners in Lesotho be understood and explained?

3.4 Research paradigm

It can be argued that a study, which has academic rigour, should be underpinned by a certain philosophical stance. According to Symon and Cassell (2004: 5), a robust research entails philosophical guidelines, which can be useful for understanding and interpreting results. Bernard (2006) also argues that a description of a specific phenomenon depends on the understanding of the results, as well as the employment of an appropriate paradigm. When describing what a research paradigm is, Cooper and White (2012: 15) say that it can be viewed as "a set of logically related assumptions, concepts, or principles that tend to guide our thinking and the important assumptions that we have about how the world functions". This implies that being familiar with the appropriate paradigm under which the study operates, can be helpful in keeping the researcher on the right direction in the research processes.

It is indicated that ontological and epistemological positions are fundamental in determining the choice of an appropriate research paradigm, within which the study operates (Bernard, 2006). There are various definitions of these positions and they all tend to emphasise that ontology focuses on the manner in which one views a phenomenon and that epistemology addresses how a phenomenon under

investigation can be known (Bernard, 2006; Cooper & White, 2012). Gephart (1999), cited by Symon and Cassell (2004), states that qualitative methods can as well be aligned with a wide range of epistemological positions. However, one has to be very careful when deciding on the paradigm that best fit into the research area of the study. In agreement with this, Bernard (2006) postulates that it is highly possible that different outcomes can emerge when the same phenomenon is looked at from different perspectives influenced by differing paradigms.

The research paradigm has methodological implications. It is therefore essential to select an appropriate paradigm that also has a significant bearing on the analytical framework. The choice of the 'correct' research paradigm will also help to avoid making judgements full of prejudice and stereotypes when analysing different sets of data (Bernard, 2006). This is consistent with Cooper and White's (2012: 128) statement that "the choice of methodologies tends to follow the paradigm within which the researcher operates". As such, the inappropriate choice of paradigm has a bearing on the use of methodologies that are unlikely to elicit useful data to address research questions pursued by a study. They also claim that some researchers tend to modify qualitative methodologies with an apparent influence of those of the quantitative research. They argue that any efforts to forcefully merge incompatible methodologies are likely to produce unsatisfactory outcomes. They further contend that attempts to adapt a "one-size-fits-all approach" are likely to falter in qualitative research, due to its high-level demands.

Taking that into consideration, it can be inferred that before deciding which paradigm should be chosen, it is important to find out its advantages over others. After that, it is also essential to study the paradigm critically, so as to identify its inadequacies (Bernard, 2006; Burrell & Morgan, 1979). Anyhow, employing different paradigms might also bring interesting and unexpected answers (Bernard, 2006). Even though it sounds like the idea of using a multiple paradigm approach is worthwhile, one can argue that it is still necessary to decide on its employment, based on the nature of the research. In fact, this approach, as well as a whole range of other research paradigms should be used in situations where they are applicable.

This study operates within interpretivism as a research paradigm, owing to the nature of the issues under investigation, as well as the research field in which the study is situated. Cooper and White (2012) argue that the interpretivist approach is essentially used when investigating a phenomenon or situations, taking into consideration the context in which they occur. This suggests that in studies, which operate within this research paradigm, a researcher might be at liberty to pursue a question that was explored before, applying it in a different context. Actually, this can also be useful for examining the effects of a similar event taking place in different contexts (Cohen, Manion & Morrison, 2007). What they indicate is that a focus on local understanding can be productive in providing more accurate explanations to issues that this investigation is based on.

It is essential that I give a justification for the preference for interpretivism as a research paradigm for this study. As this study seeks to understand and interpret the experiences of visually impaired learners of mathematics teaching and learning within inclusive settings, it appears to fall within this paradigm. The distinctive characteristics of studies, which fit into an interpretive paradigm, include:

> "A concern to understand the world as it is, to understand the fundamental nature of the social world at the level of subjective experience. It seeks explanation within the realm of individual consciousness and subjectivity, within the frame of reference of the participant as opposed to the observer of action," (Burrell & Morgan, 1979: 28).

This coincides with a description of an interpretivism research paradigm as expressed by Daymon and Halloway (2011). According to these researchers an interpretivism paradigm is said to be guided by:

> An ontological belief in the existence of multiple realities and are open to change, because the social world, not having a separate existence from the individual, is socially constructed. It is the manner in which the investigator interprets the social world that determines social reality, because investigators and research participants are involved in constructing social reality.

> Interpretivism is also interested in both the unique and the individual (Daymon & Halloway, 2011: 102).

They further indicate that an interpretive epistemology considers the individual, the context and the issue under investigation, as being distinctive. Also pointed out is that interpretivism is applicable in cases which are context dependent, whereby participants are actively involved in shaping their environment. In other words, the experiential background of the individual participants has a considerable influence on their understanding and interpretation of a situation or phenomenon that is under study (Daymon & Halloway, 2011: 102).

The research paradigm plays a significant role in influencing the research methodology employed in a study. The methodology basically describes the guiding principles and procedures employed in a study. It also determines the ways in which data collection and analysis processes are to be undertaken (ibid.). The next section discusses the research design and other related issues.

3.5 Research approach and design

3.5.1 Research approach

This study is purely qualitative in nature. Willig (2013) argues that in a qualitative study a researcher is interested in how people make sense of the world and how they experience events. In fact, a qualitative researcher focuses on the meanings attributed to events by the research participants themselves. The objective of qualitative research is to describe and possibly explain events and experiences, but never to predict. Qualitative researchers study people's lives, lived experiences, behaviours and emotions, taking into consideration the context in which these events occur (Creswell, 2014; Strauss & Corbin, 1990). This is consistent with Flick's (2009) assertion that qualitative research is a very useful approach, because it is oriented towards "analysing concrete cases in their temporal and local particularity and starting from people's expressions and activities in their local context" (ibid.: 21).

Additionally, qualitative research approach can also help the researcher to have a better understanding of different characteristics of the participants, as well as their experiences (Klingner & Boardman, 2011; Opie, 2004). Besides this, studying a phenomenon in its natural setting should help the researcher to develop an understanding of the issue under study and the context in which it appears. According to Creswell (2014), one of the characteristics of this research approach includes gathering information directly by engaging with the participants and observing them behave and act within their context. Moreover, the qualitative researchers should not only rely on the information collected by the third party, but also rather collect data by themselves through direct observations or interviews (ibid.).

3.5.2 Research design

This study is inclined towards a case study design, as it aims to investigate visually impaired learners' experiences of learning mathematics in two regular high schools. Hamilton (2011) comprehensively defines a case study as a kind of research that involves in-depth exploration of a particular entity or idea. Walliman (2011) indicates that case study designs are appropriate for qualitative studies and they usually involve the use of multiple data collection methods. Consistent with this, Hamilton (2011) says that a wide range of data sources are often used, but goes further to say that this is done, in order to build up strong evidence from targeted individuals about their views, perceptions and experiences, regarding the issue under investigation.

In addition, Hancock and Algozzine (2011) argue that a case study research focuses mainly on a representative of a group, an organisation or a phenomenon. In a case study, a phenomenon is studied in its natural context within a specified time. Researchers indicate that different forms of data sources, which are usually used in case studies include: codes from participants, anecdotes, narratives of participants, observations notes, video and audio records, which should help the researcher develop an understanding of the complexity of many variables in the phenomenon being studied (Creswell, 2014; Hancock & Algozzine, 2011).

The focus of this study is on school-based issues and each of the three learners with visual impairment from the targeted schools is considered as a distinct case. Basically,

each of the three case studies was explored and analysed independently. In consideration of the outcomes, comparisons were made, in order to find out similarities and differences between these cases. The advantage of using an approach, involving two case studies is that it allows an in-depth exploration of research questions and can result in eliciting rich evidence (Gustafsson, 2017). Hence findings drawn from these case studies can be "considered robust and reliable" (Baxter & Jack, 2008: 550).

The nature of the study necessitates that I directly elicit information from participants about their experiences. This would require the use of the learners' narratives. The key function of narratives is to "foster reflection and re-storying by the participants" (Clandinin & Connelly, 1989: 442). However, Moen (2006) indicates that the genuineness of narratives can sometimes be questionable as they can differ depending on the level of trust between the participants and the researcher. Taking this into consideration, cordial relations should be built between the researcher and the participants, in order to ensure trust (Casey, 1995). To achieve this, the researcher should engage with the participants on a regular basis (Moen, 2006: 64). This can also help in gathering detailed and in-depth data from the participants.

As indicated earlier, this study operates within the confinements of an interpretivist research paradigm. According to Cohen *et al.* (2007: 21) studies that fall under this paradigm are usually conducted in contexts, which attempt to study "the subjective world of human experience". Additionally, Yanow (2014) indicates that such studies often focus on one case at a time. The reason cited for this is that the researcher should be directly involved in a research setting, in order to develop understanding of 'local meaning-making'. This enables the researcher to account contextually for a particular setting when analysing large amounts of collected data.

Moreover, Maxwell (2008: 221) makes an assertion that this kind of research approach is useful for "understanding the particular context within which the participants act and the influence this context has on their actions". Maxwell also argues that qualitative research studies often use a relatively small sample and as a result this enables the investigator "to understand how events, actions, and meanings are shaped by the unique circumstances in which [they] occur" (Maxwell, 2008: 221). The interpretive

approach can also be useful for examining the effects of a similar event taking place in different contexts (Cohen *et al.*, 2007).

3.6 Position of the researcher

The role as a researcher is intended to have a minimum impact on the outcomes of the study. The benefit of this is that by studying the situation and taking a neutral position, might help the researcher to gain more insightful information (Bogdan & Biklen, 2003; Flick, 2009). On the contrary, this poses a threat of accessing requisite information as a result of being a stranger to both teachers and learners. To overcome this challenge, I carried out regular visits to the research site with the aim of building pleasant relations between the concerned parties. The main reason for this was to become accustomed to the participants so that they could be more prepared to impart information without too many doubts.

3.7 Description of the research site

It is essential to provide a description of the research site, in order to paint a clear picture of the context in which this study was conducted. This could help a reader to have a better understanding of the factors that might have shaped experiences of the visually impaired learners. The research was undertaken in two regular high schools located in one district of Lesotho. In this section I describe the contextual features of the two high schools.

3.7.1 Research site 1: School A

The first research site is a government-owned school, giving access to visually impaired learners with a low vision condition. It is worth noting that learners admitted in this school are those who might require little or no support of some assistive devices, as they can read printed materials and also write using pen and paper. The admission requirement in the school is the same for all learners and there are no restrictions whatsoever for a certain group of learners. There is a teacher whose main responsibility is to identify learners with visual impairment and to help them to undergo

a screening process. She is also mandated to take care of their welfare within the school premises.

The school provides support to visually impaired learners in the form of magnifying devices and also tablets with installed software that enlarges print. The only three magnifiers that the school has, were however placed in the school administration office, which the bursar and secretary operate from when performing their daily routines, including serving parents or any other visitors. The school is also in custody of only two tablets, supposed to serve all visually impaired learners. All learners were day scholars, as the school does not have boarding facilities.

3.7.2 Research site 2: School B

The second research site is the high school under proprietorship of a church. It is an all-girls school that gives access to all visually impaired learners, regardless of their gender. It admits learners with visual conditions ranging from low vision up to severe cases like total blindness. For them to be admitted in the school, learners with a visual impairment are required to be competent in writing and reading materials in Braille format. The school provides academic support for these learners in the form of some assistive equipment. To this end, there are a number of devices called Perkins Braillers, readily available for learners and also the magnifying devices placed in accessible areas. The magnifiers are intended to be utilised by learners with moderate low vision. There are also twelve tablets similar to the ones mentioned earlier for low vision learners.

The school has facilities, such as the library and a computer laboratory for the visually impaired learners. Their computers are installed with software called JAWS for them to access information in audio form. There is a building known as CATCH Centre, used by the visually impaired to write tests, as well as assignments. They also use it as a resting place during breaks. This building also has offices for the teachers responsible for the welfare of these learners. The responsibility of these teachers, among others, includes transcribing print material to Braille format for the learners. They also transcribe learners' work from Braille format to print for teachers who might not be

conversant with Braille for assessment purposes. The school also has boarding facilities where most of the visually impaired learners reside.

3.8 Research participants

This study sought to understand visually impaired learners' experiences of learning mathematics in regular classrooms. I, therefore, identified and selected appropriate participants for the study. The selection was made with the purpose of gathering in-depth and detailed information, in order to develop understanding of the participants' experiences and how such experiences are constituted, albeit without making any predictions (Seidman, 2006).

3.8.1 Learners with visually impairment

The main participants in this study were visually impaired learners. The study was primarily interested in learners in the junior secondary level, equivalent to Grades 8 to 10 in the South African schooling system. The overall statistics of registered learners for both cases in targeted classes was 37 in 2018. Actually, the number of learners with visual impairment differed in the two cases. There were six registered learners with visual impairment at the secondary level in School A. There were four learners in Grade 8 who were evenly distributed in the three streams; whereas in Grade 9 there were two learners, each distributed in two streams.

In School B, the number of learners with visual impairment who were registered in 2018 was 35 altogether. At the secondary level the overall number of visually impaired learners was 24. In Grade 8 there were nine learners, whereas in Grade 9 there were eight and finally in Grade 10 there were 14 learners. Fortunately, none of the participants declined to take part in the study. Hence I decided to include all learners with visual impairment at the targeted grades as the participants in this study. However, their number was reduced as it was established that the participants in the same grade seem to have common experiences and that was done in order to avoid replication of the results.

3.8.2 Teachers

In the targeted classes the total number of teachers involved in this study was two. Their choice was based on whether visually impaired learners were present in classes they teach. One teacher was engaged in School A that is under government proprietorship. She was teaching both Grades 8 and 9. She was an ordinary teacher with no formal training in special education and was nonetheless expected to teach visually impaired learners. She was a qualified teacher and a Bachelor's degree holder. Similarly, in School B, which is church owned, I engaged one teacher who was responsible for teaching both Grades 8 and 9. He held a Bachelor's degree qualification and had mathematics as one of his major field of study.

3.9 Ethical consideration

In this study ethical issues have been adhered to. Essentially, the focus of ethics was more generally on protecting all participants in the research process. Apart from this, I needed to be very careful about the sensitivity of the research, as it involved vulnerable groups. I was also expected to ensure that anything that might subject the participants to endangering incidents was avoided (Flick, 2009; Willig, 2013). Having considered the nature of participants in this study, I decided to conceal the identity of the schools by not mentioning their exact location. This was done in order to protect the identity of participants who were engaged in the study. However, for the purpose of keeping track of the conversation, I systematically converted the names of the schools and participants from their real identities to fictitious ones (Yin, 2013).

Before undertaking any investigation, I wrote consent letters to the concerned authorities, including the school principals, seeking their permission to access the two schools. The letters clearly explained the purpose of the study. I also asked for learners' and teachers' consent before carrying out any investigation in their classrooms. As I personally delivered the letters to both concerned authorities and the participants, I was able to answer all their questions about the study and also to address the concerns of some participants. Bell (2010: 160) maintains that researchers should ensure that participants are made fully "aware of the purpose of the research and that they understand their rights".

I also took the forms and consent letters written in an accessible language (i.e. Sesotho) to the concerned parents/guardians in person, in order to ask for their permission to conduct research involving their children. That proved to be profitable as some parents were illiterate and at times I was compelled to read for them. Apart from that, some parents needed more explanation about the purpose of the study and they also asked a series of questions, including the one that enquired about the safety of their children during the research process. Through face-to-face interaction I was able to address all their concerns and during the process cordial relations and trustworthiness were built.

I was able to categorically assure the participants that their participation in the study was on a voluntary basis and that they could withdraw at any time. I explained that there would not be any consequences or victimisation for withdrawing from the research study. I also gave an undertaking that the information gathered in the study confidential. Kennett (2014) indicates that a researcher should be cautious when conducting a study involving human beings. It was, therefore, a requirement for I to follow appropriate procedures to seek clearance before commencement of a data collection exercise. An ethical clearance application was submitted to the University of the Free State's Faculty of Education's ethics board, before carrying out any investigation. Data were only collected after I received the approval of ethical clearance from the ethics committee.

3.10 Data collection methods

This section provides a discussion of data collection methods used in the research study. Bell (2010) argues that data collection methods are selected based on the type of data that the researcher requires, in order to come up with a comprehensive research model. Therefore, the researcher should be decisive about the choice of the appropriate methods, which could be useful for particular purposes, and data collecting instruments must be designed in accordance with these methods. In the present study the data collecting instruments were designed with the intention of drawing detailed information about learning experiences of visually impaired learners in these two regular high schools.

One of the requirements of a qualitative approach includes gathering data in multiple forms to ensure reliability and validity (Creswell, 2014; Cohen *et al.*, 2007). The three sets of data that were collected in the course of this study were shaped by the research orientation. The data collection instruments employed in this study included: narrative interviews, structured interviews, as well as lesson observations. Their descriptions are sketched out below.

3.10.1 Interviews

The interview was considered to be a useful tool for collecting data from visually impaired learners, as well as their teachers. There are a number of advantages of using interviews when collecting data. Basically, interviews enable participants to provide detailed information, including some historical background of the issues under investigation. More so, interviews also allow a researcher to have control over the line of questioning. Interviews are widely used in most qualitative studies to elicit information about the experiences of the participants on the specific issues under investigation.

3.10.1.1 Narrative interviews with visually impaired learners

It is essential to provide a discussion on narrative interviews as they are regarded as the major source of data in this study. In fact, narratives refer to the kind of interviews sought to gather data, which are more comprehensive about personal life histories or of concrete situations that the targeted participants had experienced (Riessman, 2001). Usually narratives consist of bulky units of information collected in a series of interviews with the particular research participants. When reporting the results in narrative inquiry, the researcher usually gives the account, based on the themes emerging from the stories of the participants and supports the arguments by quoting exact statements (Heigham & Croker, 2009).

These narratives are shaped through regular engagement between the researcher and the participant. Flick (2009) indicates that the narrative interviews are more sensitive and responsive to participants' viewpoints. However, the researcher would

have a major role to play in the preparation of procedures generating the narratives. Furthermore, the researcher should ensure that the narratives have direct links with the issue under study and verify that they also generate data that answer the research questions.

As mentioned earlier, a major source of data in this study are narrative interviews with visually impaired learners in two regular schools. Actually, narratives of the selected learners in each of the three grades of the two cases are gathered in the form of audio records and transcripts. As a matter of principle, I engaged with the participants on a regular basis to get detailed and in-depth information about their experiences of mathematics-teaching and learning practices in their regular classroom settings. The data produced through these narratives address the research question, which sought to find out the lived experiences and perceptions of visually impaired learners concerning the teaching of mathematics in selected classrooms of Lesotho.

3.10.1.2 Interviews with teachers

Semi-structured interviews were used as another data collecting instrument in this study. The semi-structured interviews were preferred, because of their advantages. One of the advantages is that it is less restrictive and allows some freedom on the part of the participant (Bush, 2012). In a way, the participants can express their views about issues under study and are not strictly channelled to answer specific questions asked by the interviewer. Willig (2013) argues that the semi-structured interview provides an opportunity for the researcher to hear participants' side of a story about a certain situation they were involved in or perhaps their personal experiences. The questions I asked guided the conversation and also sought more clarity or requested further details. Moreover, the questions or comments ensured that the participants provided the kind of data that sought to address the research questions.

As this study is oriented towards a qualitative case study, the main requirement is to produce different kinds of data to compliment and validate the major component of the produced data. Semi-structured interviews were used as instruments for collecting data from mathematics teachers of the selected grades in each case. The semi-structured interviews were basically used to unearth the teachers' perspectives on

visually impaired learners' experiences of learning mathematics in these regular schools. The information was used for triangulating the narratives of the visually impaired learners. As indicated earlier, a maximum of two teachers participated in the study.

3.10.2 Lesson observations

Another useful component of the data in this study was gathered through direct observations of mathematics lessons in the targeted classrooms. The observation notes, audio and video records, including transcripts were produced. Direct observation can be a very useful source of data, because of various reasons. Actually, direct observations might enable a researcher to have first-hand experience of the activities as they occur (Creswell, 2014; Flick, 2009). In this way, I was expected to get more insightful information on the circumstances, which might have shaped the experiences of the participants. This also helped me to develop more understanding of the issues under investigation.

However, Dawson (2009) argues that the researcher is likely to face challenges in accessing participants, in order to carry out observations. She highlighted the importance of finding 'the gatekeeper' who can facilitate any meetings between the researcher and the participants. The purpose of the meetings would be for establishing rapport between the concerned parties and later on to make arrangements, including scheduling the observations. The special education unit played a major supportive role in light of the groundwork on logistical issues, as well in providing additional information. It is further indicated that the researcher would be expected to produce field notes even though direct observations often go together with the use of recording devices, such as audio and video recorders (Dawson, 2009). The advantage of using video recorders is that they are likely to contain further details of communication, as well as unexpected moments, which could not be easily noticed, with a single glance of the naked eye (Creswell, 2014).

In this study, I deployed three video cameras during mathematics lessons in the selected classrooms. The first camera focused on the activity of the teacher. The intention of gathering information on the teacher's activity was for evaluating the kind

of instruction and learning facilitation that manifested during the mathematics lessons. The second camera focused on the entire class for capturing data on the interactions of learners during mathematics lesson. The third camera recorded the activities of visually impaired learners with the purpose of profiling their learning practices in terms of engagement and participation in the given tasks during the lessons. It also focused on the materials they use and the kind of assistance they get from the teacher or their colleagues.

Three consecutive mathematics lessons (i.e. single and double lessons) were observed in each of the three grades. The purpose of this was mainly for observing the learning practices used, when a newly introduced mathematics concept was followed, until it reached its finality. In one school I observed three grades while in another school, I observed two grades as I was confined by the presence of visually impaired learners in only Grades 8 and 9. The total of 16 video records and transcripts have been produced. The collected data helped in assessing what constitutes and shapes visually impaired learners' experiences of learning mathematics.

Table 3. 1: Summarises how research instruments have been employed for data collection.

Data collection methods	**Issues under study**	**Research objectives**
Narrative interviews	Visually impaired learners' experiences of learning mathematics in regular schools. Visually impaired learners' general perceptions about mathematics teaching and learning.	exploring visually impaired learners' experiences of learning mathematics in regular schools setting. examining how visually impaired learners perceive the teaching of mathematics in their classrooms.
Semi-structured interviews with teachers	Teacher's perspective on learners' experiences. Teacher's perception about mathematics teaching within the inclusive setting.	establishing how mathematics is taught in classrooms with visually impaired learners.
Lesson observations	Learner engagement and participation. Time allocated for instruction. Teaching aids or resources. Teaching approaches. Assessment strategies.	examining how visually impaired learners engage with the teaching of mathematics in selected classrooms.

Table 3.1 provides a summary of how the research instruments described earlier have been utilised and it also outlines the targeted sources of data and the kind of information gathered.

3.11 Data analysis

The sets of data were grouped employing a strategy commonly used in qualitative research (Maxwell, 2008), called categorical content analysis. This method of data analysis basically operates in such a way that it enables the identification of "categories by selecting utterances from a text, which are then classified and grouped together" (Heigham & Croker 2009: 307). This method entails arranging data into appropriate themes. Basically, in this study, each of the three sets of the gathered data was analysed, employing content analysis. A narrative analysis was used for analysing data collected from learners with visual impairment as it "provides a means to consider the multi-layered ways in which research participants understand their situations" (Squire, Andrews & Tamboukou, 2013: 15).

The information gathered through interviews with teachers, classroom observation notes, as well as the video and audio recordings were used to triangulate learners' narratives. Interpretative analysis was used for analysing these data sets. According to Yanow (2014: 148) interpretative analysis can be useful to give a contextual explanation for a particular setting, in order to establish "what is meaningful there". Taking into consideration that the two schools under study might differ in context, it was essential to uncover what constituted the learners' experiences of learning mathematics in each case.

Basically, the analysis of data is guided by the conceptual framework informing this study - "opportunities to learn". Some notable aspects emerging from the literature depicting opportunities to learn are as follows:

1) assessing the level of learners' participation;
2) observing the degree at which teaching aids or resources used during lessons were accommodating visually impaired learners;

3) scrutinising presentation of mathematics concepts in the instructional materials, whether it allowed learners with visual impairment to access information;
4) evaluating the curriculum materials which are used in the selected schools and whether they present learning outcomes in such a way that create opportunities for inclusive instruction or are adaptable in regular classrooms;
5) evaluating whether lesson plans made provisions for visually impaired learners and also how those plans got effected during lessons;
6) finding out whether there were individual education plans (IEPs) prepared for learners with visual impairment during lessons;
7) assessing the extent to which time allocated for a lesson is used;
8) observing the kind of teaching approaches and assessment strategies, used during instructional practice.

The research questions guide the entire analysis process. This is in line with Kothari's (2004) argument that analysis of the data covers some procedures for the presentation of the findings emerging from the collected data. This entails the organisation of these data in such a way that provides answers to the research questions. I consider this a priority, in order to ensure that gathered data from the different sources are relevant and also useful for offering credible responses to the research questions. Notwithstanding the fact that the main data source in this study comprises of learners' narratives, as I mentioned in the previous chapter, relevant data sources such as teachers' interviews and field notes, together with video records of the observed lessons were also carefully identified, in order to produce valid and reliable answers to each of these questions. The first sub-question is primarily answered using information from field notes, transcripts of lesson observations and also teachers' interviews to some extent. To answer the second sub-question, transcripts of learners' narratives, lesson observation and field notes are largely used in this regard. Table 3.2 provides a summary of how different data sources are intended to address secondary questions. It also shows the main issues emerging from the relevant data sources.

Table 3. 2: Data sources relevant for each secondary research question.

Secondary question	Data source	Issues under study
1) How is mathematics taught in classrooms with visually impaired learners?	field notes, transcripts of lesson observations and teachers' interviews	• Instructional materials, • Curriculum materials, • Time allocated for instruction, • Teaching aids or resources, • Teaching approaches, • Assessment strategies, • Teacher's perception about mathematics teaching within the inclusive setting.
2) How do visually impaired learners perceive and engage with the teaching of mathematics in selected classrooms of Lesotho?	transcripts of learners' narratives, lesson observation and field notes	• Visually impaired learners' experiences of learning mathematics in regular schools, • Visually impaired learners' general perceptions about mathematics teaching and learning, • Learner engagement and participation.

This section matched data sources to the appropriate research question, in order to guide the data analysis process. It should be noted that it is essential to take into consideration issues that might be limitations to the current study. The next section therefore pinpoints these issues and discusses their significance in this study.

3.12 Limitations of the study

Marshall and Rossman (1999) indicate that every study is susceptible to some limitations. It is important for me to delineate the limitations of the study at the outset, as this demonstrates that I am familiar with this reality. This could also be helpful in that I would not make unjustifiable claims about the certainty of the outcomes in relation to what really transpired during the course of the investigation. Limitations of the study usually originate from the theoretical framework and research design that the researcher employed (Marshall & Rossman, 1999). When the limitations have been outlined, the reader is kept abreast of what the study is all about and the specific context in which it is situated. In this regard, this research study is no exception hence I have outlined some limitations associated with it.

A qualitative research design integrates the collected data, using a variety of research instruments (Maxwell, 2008). Hence, in this study, there were large amounts of data

gathered through different research instruments and reconciling these pieces of information required a great deal of effort and time throughout the analysis process. Another challenge associated with this issue was that, if I might not have been careful enough, there were chances that I would end up with large amounts of data that were less than resourceful. Unfortunately, that could be realised very late in the analysis stage (Kennett, 2014). This implies that resources and time used for data collection would have been fruitless and I would be required to go through the same process all over again.

The participants in this study were a group of vulnerable members of society. The major challenge, which was likely to emerge, would be the reluctance of participants to divulge precise information. For example, if ever they had experienced discrimination before, there would be a little apprehension about the kind of treatment they would get after disclosing some evidence. As this study is interested in finding out visually impaired learners' experiences of learning mathematics, a possible challenge associated with this includes the fact that the participants would feel that I intruded into their private space, which they might regard as exposing their weaknesses, especially when this was related to their performance levels. Cohen *et al.* (2007) highlight that some issues in educational research might be sensitive and the researcher should always be cautious when dealing with them. Researchers argue that sensitivity is inherent, to a large extent, in the social context in which the study is undertaken and in the possible research outcomes, which might negatively affect interpersonal relations of the concerned parties (Cohen *et al.*, 2007; Flick, 2009).

The other aspect, which appears to be a limitation of this study, is considering targeted participants as distinct case studies. The challenge of using case studies can often involve high costs for collecting different forms of data. Additionally, the use of different sources of data can as well be time-consuming during data capturing and analysis processes (Baxter & Jack, 2008). However, to address these challenges the selected participants attended schools at close proximity and this minimised travelling costs, as well as time taken to cover distances between the places.

Furthermore, a limited number of lessons to be observed can be another limitation. It would be ideal to observe mathematics lessons for the duration of at least one week

in each grade. Usually seven periods are allocated for mathematics lessons. If three grades in each school would be observed over that period, that would require more time and resources. That would only be possible if research assistants are deployed in these schools. However, the nature of the study required me to be present in all classroom observations for constructing mutual trust with the participants.

3.13 Summary of the chapter

This chapter has attempted to address issues relating to the methodological approaches that the study has embraced. It has also discussed the purpose of the study with the intention of presenting the research goals. The chapter has presented the research questions, which this study sought answers to. It further deliberated on the research paradigm underpinning the study. More so, it has discussed the research design, as well as an explanation of the researcher's position. It also provided a description of the research site, after which it explained how the participants were selected. Additionally, the chapter addressed ethical issues binding this study. Thereafter, the chapter explained how research instruments would be employed for collecting data and also how data would be analysed. It concluded with a discussion of possible limitations and a brief summary of the whole chapter.

Chapter Four

4. Chapter four: Data analysis and presentation of findings

4.1 Introduction

This chapter presents an account of how learners with visual impairment experience mathematics teaching in Lesotho. The study sought to find answers to the main research question: What are the visually impaired learners' experiences of learning mathematics in Lesotho's regular schools? In order to address this research question, the following sub-questions are also explored:

1) How is mathematics taught in classrooms with visually impaired learners?
2) How do visually impaired learners perceive and engage with the teaching of mathematics in selected classrooms of Lesotho?
3) How can the experiences of visually impaired learners in the mathematics classrooms of Lesotho be understood and explained?

The main focus of this chapter is to find answers to the first two sub-questions. The chapter specifically focuses on data presentation and analysis, involving a representative set of experiences in each of the targeted grades in the chosen schools. A detailed description of the approach employed for presenting the findings, is provided below.

The previous chapter has already provided an explicit justification for the selection of the research site and the sample choice. The narratives of each of the selected learners with visual impairment are presented and triangulated by the lesson observations and interviews with the teachers. The narratives cover learners' experiences in relation to mathematics teaching where they were involved. This is because the experiences of the individual learners with visual impairment have significant connections with their learning of mathematics, and these are better portrayed through their stories (Tracy, 2013).

The emergent findings are organised into themes and further divided into categories and sub-categories. This is consistent with Lodico, Spaulding and Voegtle (2010), who argue that qualitative research involves the reading and review of data to discover themes and patterns that emerge.

In order to ensure that the findings provide answers to the research questions, the themes were derived from the first two secondary research questions. Sub-categories mostly emerged from the findings and differed per individual case. Therefore, the sections of this chapter are arranged in terms of the individual cases. I find this pertinent in guiding the presentation of the findings in a more comprehensive manner. The view held here is that reporting on participants' stories concerning their experiences of teaching and learning, especially in inclusive settings (Connelly & Clandinin, 1990), would help to better understand their situation. In the section below, I present the participants' narratives backed up by interviews with the teachers, observations' notes and the analyses of video clips.

4.2 Case study 1: The story of Pheello: Oozing with confidence in mathematics, but antagonistic in character

This section focuses on Pheello's learning experiences of mathematics in his classroom. Table 4.1 provides the background information of Pheello, including his age, visual impairment condition, home background and a brief academic history.

Table 4. 1: A summary of Pheello's personal and school backgrounds.

Personal information	Age	17	
	Sex	Male	
	Current condition of visual impairment	Partially sighted	
	Cause of visual impairment	Born visually impaired	
	Braille training	Mohloli oa Bophelo Centre for the Blind	
	Performance in mathematics at Grade 7	1 (highest symbol as per previous categorisation)	
Family Background	Number of siblings	6	
	Next of kin	Parents	
	Responsibility for payment of his educational needs	Social Development	
	Home	Maseru rural	
	Residence	A village in the Eastern side of Maseru	
	Day scholar	Yes	
	Mode of transport from home to school	Public transport/on foot	
School background	Current school	School B (all girls' school admitting learners with visual impairment, including boys)	
	Grade	9	
	Learner population in class	31	
	Learners with visual impairment in class	5	
	Mathematics teacher profile:	Qualifications	Diploma in Secondary Education, BSc Education – maths and geography, Honours degree – curriculum studies
		Training in Special education	None
		Experience in teaching learners with visual impairment	9 years
		Teaching experience	14 years

Pheello comes from a rural area, situated in the southeast of the capital, Maseru. At the time of the research, Pheello was seventeen years old and in Grade 9. The learner

was born visually impaired with only one eye that is functional. When talking about his eyes, he said, “I am not able to explain properly what my one eye can see. I just see blurred figures with it. I am not able to see how things are shaped with it.” Pheello explained further that, “When I read fine print from close range, or if I am reading from a distance, I don’t see properly”. Besides this, Pheello gave the following detailed account of how the visual impairment condition affected him throughout his academic journey:

> I was struggling to access information [on the board] and I was also too slow when writing. Sometimes the light that came through the window used to strike on other parts of the chalkboard whereas other parts of the chalkboard were dark. I would sometimes see where there was light. But if I started at the darker side or where there was light, I could not see on the other side.

Pheello further indicated that his sight deteriorated when he went for Braille training and gave the following explanation:

> My sight was relatively high, but deteriorated in 2015 when I got Braille training. I would say that I realised that it was during the period I was learning Braille literacy. They [trainers] told me that “you have partial sightedness and learning of Braille mainly involves the use of fingers not eyes, as you are already visually impaired.” I regarded that as wasting my time as I found no point in using sense of touch as my eyes could still see. I then learned the alphabets of Braille using my eyes.

Pheello, however, seemed not to be aware of the consequences of reading Braille with eyes, the extract below captures how this affected his vision.

> Later on, I realised that what I used to see from afar, I was no longer able to see properly, it was in fact faint. It was then that I realised that my sight had deteriorated. After that, I started using fingers to read Braille, in order to conserve the little sight that I have. However, the lost sight could never be recovered.

This discussion suggests that Pheello had a challenge when reading small print or reading from a chalkboard and his pace of writing was progressively negatively affected. It is also evident that Pheello’s sight deteriorated along the way and this could have made his vision ineffective for participation in classroom activities, especially those that require a sense of vision (UNESCO, 2001). Despite having vision-related

challenges, Pheello was still pursuing his studies. Ihekaire and Anyanwu (2012) argue that the vision-related problems have a detrimental effect on the learning of the affected children and can also prevent them from pursuing their academic aspirations. However, consideration of the latter case may suggest that Pheello was determined to be an exception in this trend.

In the next section, the presentation of data focuses on the classroom-sitting arrangement, which is central in understanding Pheello's learning experiences. After that, I then focus on the actual instructional and assessment practices in Pheello's classroom during the mathematics lessons.

4.2.1 Learner population and sitting arrangement in Pheello's classroom

Pheello's classroom was fairly spacious, allowing the teacher to move around with relative ease, and also had a fair supply of light from the windows as shown in Figure 4.1.

Figure 4. 1: Spatial distribution in Pheeello's classroom with visually impaired learners sitting in the front row.

The overall number of learners in the classroom was 31, including five learners with visual impairment. In the two lessons I observed, learners with visual impairment were all sitting in the front row and Pheello shared a desk together with another visually impaired learner (Figure 4.1, second picture). Pheello provided the following explanation when asked about the sitting arrangement in his classroom, "The sighted [learners] are allocated seats according to their performance. As for us who are visually impaired, we are allocated permanent seats in the front row." Sitting in the front row could benefit Pheello, because he still has some residual vision that can help him read information on the chalkboard. In response to a question about why learners

with visual impairment were sitting in the front row, Pheello's teacher explained that, "The fact that some [learners] have a low vision condition is why we place them in front. The fact that they do the same subjects, they prefer sitting together so that they can move out without a struggle."

The response suggests that learners with visual impairment were allocated seats in the front row to allow them easy access to information on the chalkboard. This issue was also noted in Habulezi and Phasha's (2012) study that in some cases, learners with visual impairment are placed in the front row where the teacher is often positioned to optimise their listening capacity. It is noteworthy that listening plays an important role in the learning of learners with visual impairment especially, in situations when what is written on the chalkboard, might be illegible. While this arrangement was useful for access to information and movement, it also had the possibility of restricting the interaction of learners with visual impairment with their sighted counterparts. In response to a question regarding on how he was coping when sitting next to someone who is also visually impaired, Pheello explained thus:

> I realised that he [visually impaired learner] does his work independently and I also do my own work unassisted. Even when I was sitting with the sighted learner it was the same situation. Even when I was sitting next to her [sighted learner], I often didn't ask her for help. I only looked for her assistance when I needed her to read for me.

The first part of this extract gives the impression that during lessons, Pheello worked unassisted, even when sitting next to the sighted learner, implying that he did not fully depend on anyone. The last sentence in the extract, however, shows that there were instances when Pheello needed someone to read for him and sitting next to the visually impaired learner might have been a disadvantage in those instances. When talking about the disadvantage of the visually impaired learners sitting next to each other, Pheello's mathematics teacher said:

> It affects learning in a negative way. […] The help that I can give, it doesn't have another helping hand […]. When I get out, there is no one who is like if I am saying I am just like ploughing and sowing. There should be someone who is watering. So we don't have that this year. Where we have these students helping others that helps, because even when you get out of class

> he could ask someone sitting next to him, unlike when he has the company of the person who is the same as him.

This discussion suggests that the kind of sitting arrangement in Pheello's class might not be advantageous for learners with visual impairment, especially in the instance where they needed help from the sighted learners.

4.2.2 Teaching of mathematics in Pheello's classroom

Here I present data with respect to the teaching of mathematics from Pheello's perspective. This is triangulated with what was observed during the mathematics lessons, as well as from the point of view of his mathematics teacher, who at the time of the research had been teaching him for about two years.

4.2.2.1 Pheello's perspective on the facilitation of mathematics lessons

When sharing his experiences regarding how mathematics lessons are taught by his teacher, Pheello reported that, "When he [mathematics teacher] arrives in the classroom he starts by marking our work. After that, he continues with a lesson." Pheello expanded that, "Towards the end of the lesson he [the teacher] would give us homework on a daily basis". This was confirmed during the two lessons I observed. I observed that the teacher started a lesson by marking learners' exercise books, which were piled on the front desks. After that, he introduced the topic for the day's lesson. Pheello narrated how his teacher would continue to deliver the lesson:

> When he is about to start a new topic, he gives us notes. He thinks we are taking them, but I never take them. I listen very attentively. I only listen to important elements that would be required when I attempt to answer a specific question. I know very well that I would not be required to give a definition of something in mathematics.

This extract shows that the teacher gave notes to learners when introducing a new topic. However, Pheello's remark suggests that he does not copy the notes. Even though Pheello claimed to, "listen very attentively" during the lesson, he seemed to listen only to what he considered useful when answering a particular question and disregarded some information he considered irrelevant, including definitions.

When answering a question about whether his mathematics teacher made an effort to ensure that his handwriting is legible to him on the chalkboard during lessons, Pheello said, “It’s not with all teachers that I can see information displayed on the chalkboard.” He explained further that, “I am able to read maths and geography. […] I am able to read information written by all CATCH centre’ teachers.” Apparently, his mathematics teacher is one of the “CATCH centre teachers” who were employed to support learners with visual impairment. Pheello’s statement demonstrates that his vision allowed him to read what his teacher had written on the chalkboard. This rules out the possibility that he was not writing notes, because of the illegible handwriting. It suggests instead that he might be making conscious choices about what he considered relevant or not.

Aside from relying heavily on his sense of hearing, Pheello appeared to be dependent on his memory. This had a likelihood of posing a challenge of accuracy when he produced written tasks, as he indicated that, “[i]f I incorrectly memorise the example, I would get incorrect answers. […] I often consult the one who got a correct answer. I could even take an initiative of writing it down.” He further explained that, “Last year I relied more on memorising things. This year we dealt with many topics that I didn’t have a clear understanding of.”

This suggests that memorisation plays an important role in Pheello’s learning of mathematics concepts. He seems to be aware that his success depended on memorising correct information. However, data shows that memorisation did not help him deal with topics that he found challenging. Memorisation, while not encouraged by scholars seems to be somewhat important for this visually impaired learner. The research conducted by Beal and Shaw (2008) shows that visually impaired learners relied on memory for dealing with word problems, accessed through an audio device. However, these researchers argue that learners with severe visual impairment encountered challenges when the working memory demands of comprehending some word problems, were too great. This demonstrates that there are some instances when the use of memory becomes unhelpful to learners with visual impairment.

When addressing a question about whether the teacher used strategies that cater for his educational needs during the lesson, Pheello had this to say, “My teacher is highly

competent in teaching learners who are visually impaired." Pheello justifies his teacher's competence when he stated that, "I think you noticed that he would be writing and talking at the same time." This was evident in the two lessons I observed. For example, during one of the observed lessons, the teacher continued with the lesson as captured in the following segment.

Teacher:	So, today we are coming to deal with multiplication of decimal fractions or numbers. [He writes the statement on the board as he speaks. He repeats the same statement two times] […] But before we worked with that, we helped ourselves with a reminder of place value. […] [W]e are going to highlight on what is called decimal places [He writes that on the board]. Like you highlighted earlier when you [are] adding and subtracting decimal numbers, you have place value. But when we add and subtract we made sure that we add and subtract only numbers that fall under the same place. *Akere re ile ra lumellana?* {Is that what we agreed on?}
Learners (in unison):	Yes sir.
Teacher:	Even with this one we have to get a highlight of what is called decimal places. For example, Sefatela [not a real name] refreshed our minds with the place values that we have. And you reminded us that we have units, tens, hundreds, *hana ke efeng moo*? {What should be here?} [He lists them on board.]
Learner:	Thousands.
Teacher:	Thousands [He repeats after the learner], and so on. You can have a decimal point and beyond a decimal point we have other place values which are tenths, hundredths, thousandths and so on. [He writes all these on board as he speaks as shown in Figure 4.2 below.]

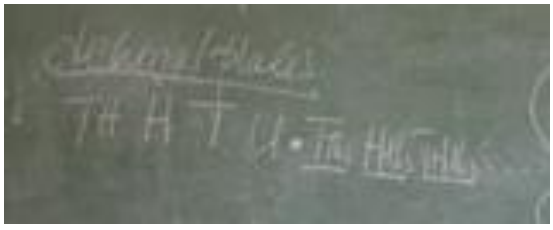


Figure 4. 2: Place value of decimals written on the board.

The vignette demonstrates that the teacher was talking and writing at the same time during the lesson. This kind of teaching approach seemed to create better opportunities to learn for Pheello, as he could access information through listening and reading from the chalkboard. This resonates with the view, which advances that teachers should be cognisant of the modalities of learners and try to reach each one of them regardless of their differing learning styles (Furner, Yahya & Duffy, 2005: 22).

When asked about the teaching strategies he normally employed during mathematics lessons, which he felt are helpful to cater for the needs of learners with visual impairment, Pheello's teacher said:

> I believe in discussions. Even though they take a lot of time, when they try to discuss, everyone has a view. Everyone can voice what he knows. So that helps a lot to know what the other one knows, what someone thinks and what someone could try. That helps [them] a lot to correct each other. So I prefer discussions, because they mostly use verbal expression, they can talk – and talk a lot. So when they talk they enjoy, because it's the sense they can use.

This view, however, seems to be incongruent with the information provided by Pheello and what I observed, as the teacher was not seen facilitating any discussions during the period of observation for the current research. Nonetheless, some studies have reported on the importance of discussions in teaching mathematics. Kaymak (2020) connects discussion with peer teaching and goes further to argue that it is an effective tool that creates opportunities to assess learners level of understanding and makes room for making corrections where necessary. Stockero, Leatham, Ochieng, Van Zoest and Peterson (2020) share similar sentiments and are also of the view that discussions enhance learners' thinking during class and give them a chance to hear their peers' ideas and explanations.

Based on the evidence presented, it can be concluded that the teacher mainly facilitated mathematics lessons in Pheello's class by talking and writing at the same time. The discussion also shows that the teacher provided the learners with written notes when introducing a new topic. However, it appeared that Pheello may not have taken full advantage of this opportunity to learn, as he deliberately decided not to write notes. Pheello seemed to depend more on his sense of hearing and memorisation. In addition, Pheello was of the view that his mathematics teacher's handwriting was legible enough. This implies that Pheello still had an opportunity to use his residual vision to access information displayed on the chalkboard, but consciously decided to rely on memorising mathematics concepts that only help him to answer specific questions. He, however, co-constructed the aspects of mathematics that he wanted to learn, even though this can lead to minimisation of his opportunities to learn mathematics concepts.

Earlier on, Pheello indicated that his mathematics teacher preferred giving homework for learners at the end of a lesson and marked it the following day. The next subsection reports on Pheello's experiences with respect to how he dealt with homework that his teacher provided on a daily basis.

4.2.2.2 Significance of homework in Pheello's learning of mathematics

Pheello gave me an explanation on how his mathematics teacher assesses his work by saying, "He would only give classwork after completing a topic […]. Sometimes he would turn it into homework, so that we would submit it the next day." Pheello's teacher confirmed this when he responded to a question on how he assesses learners with visual impairment, "I assess them just like any other student. I give them homework, exercises and tests."

This statement reflects that the teacher expects learners with visual impairment to do the homework just like anyone else. The teacher further explained that, "[y]ou have observed me for two years now. You have seen that I don't come with marked work into class. I mark everyone around the class. That helps me to give feedback to every one of them, sighted or not." It seemed that the teacher's intention of giving learners homework and marking it in class was to give everyone instant feedback. However, what was observed somewhat negated the teacher's statement, since the teacher was seen marking a pile of books and giving them back to their owners afterwards without saying anything. It is therefore not entirely accurate for the teacher to claim that he marks the work in class and gives individual feedback all the time.

In response to a question on whether he ever made time to do the homework, Pheello said:

> Maybe 20 minutes would be remaining before the end of a lesson when we are given homework. I will use that 20 minutes to write that homework or I will write it during the study time in the morning. […] We commence our lessons at 8.00 hrs. Between 7.00 hrs. and 7.30 hrs. I will write homework. Thereafter, I continue reading.

It emerged that there were some instances when Pheello was not able to do homework. He clarified as follows, “The issue is that our mathematics teacher gives us homework frequently. I am no longer able to write all this work […]. Sometimes when I get here at school in the morning, I really don’t have enough time for doing such homework.” This was evident in one of the lessons I observed. While the lesson was still in progress, the teacher realised that Pheello did not submit his work for marking and he was heard saying to him:

Teacher: I can see that you haven’t done your homework, *uena monna* (you man) [a loud laughter of learners is heard]. Where is it? [He is silent and a blank sheet of paper and Perkins Brailler are seen in front of him] Hence no wonder why you arrived late today.

This excerpt suggests that Pheello might have decided to arrive late purposely as it appeared that he had not done the homework. When addressing my question later on whether he had done the homework or not, Pheello made this confession:

> Yes, I did not do it. […] Sometimes we are told at short notice that tomorrow we will be writing a geography test. […] I leave most of my notes here at school, as my school bag is too small for carrying these files. When I arrive here, I have to prepare for the geography test. When I get to mathematics class, the teacher would teach me and the marks I might get won’t affect my overall performance at the end of year. But the marks I would get in the geography test were going to be recorded. I would then prioritise geography, as a result I would not have time to write the homework. I would then think of a trick I would use to avoid being asked about the homework.

The extract suggests that doing the mathematics homework at the time was judged as less important, relative to the geography test for Pheello, as that would not have a considerable bearing on his overall performance. It also demonstrates that Pheello consciously prioritised tasks that would contribute towards his overall performance at the end of year. The sad part of his remark shows that he was perhaps able to do more reading only when he was at school, as he could not carry all the files containing his notes in his bag when going home.

Unlike all other visually impaired learners, it emerged that Pheello was made to stay off the school residential premises. He divulged that as follows, “When I was about to

sit for final exams in December, I got suspended from the school's boarding facilities." Pheello said the reason that led to his suspension was that he assaulted one of his classmates who is also visually impaired.

The discussion reflects that homework was very significant in Pheello's learning of mathematics, as his teacher preferred giving it out on a regular basis. It also emerged that at times Pheello was not able to do his homework as expected. In addition, the discussion shows that Pheello was able to write homework while at school, as he left all his files there when going home. Thus, it seemed to be difficult for him to do homework or to read his notes at home. It could be inferred that the suspension of Pheello from boarding facilities may have affected his opportunities to learn, as he could only do homework or read notes during the morning study period at school.

4.2.2.3 Teacher's late arrival for the lessons

It emerged that Pheello's mathematics teacher had a tendency of arriving late to class. Pheello described this in the following manner:

> We can predict the time he would be arriving in class. Sometimes he would arrive at the second period, yet he had a double lesson. I would wait here [at CATCH Centre] for 10 minutes, and then go to the classroom. When I don't find him, I come back. I would then wait for him for the same amount of time and go back to class again. I would then conclude that he might come in the next period. Sometimes I would find him in class five minutes earlier than my predicted time. That also makes us come late for class.

When addressing a question on how the teacher's late arrival for lessons had affected his time for studying mathematics, Pheello said, "Even if it limits time for our studies, it has not come to my realisation." This statement suggests that Pheello was not as worried about the considerable time he might have lost and the consequences thereof on his learning of mathematics.

The discussion above reveals that the teacher often arrived late for mathematics lessons, which could reduce the possible time for instructional practice, culminating in the loss of opportunities to learn. The evidence presented seems to demonstrate that a teacher can be responsible for the ineffective use of time, often caused by consistent

late arrival. This seems to be inconsistent with the argument raised by other scholars that teachers often complain about insufficient time to cover the syllabus (Urwick & Elliott, 2010; Mosia & Phasha, 2018).

4.2.3 Pheello's perceived competence in mathematics: Satisfactory but inconsistent

My view of the mark sheets showed that there was some inconsistency in terms of Pheello's scores achieved in mathematics in the current grade. When asked about his competence in mathematics, he responded thus, "In this school [he pauses] my performance in mathematics seems to be fluctuating. Here in Form B it seems to be declining." He continued to explain, "It is something that I already mentioned […] that I don't really have adequate time for my studies." The quotes above suggest that Pheello perceives his suspension from the school's boarding facilities, as well as the scarcity of assistive devices, as major contributing factors that have negatively affected his performance in mathematics.

When asked about visually impaired learners' competence in mathematics, his mathematics teacher responded as follows:

> Their performance is not different from that of their sighted colleagues. I said it goes with the intelligence of each and every kid. With the Form B's, I used to have Mpoetsi [not a real name] topping the whole class, sometimes Pheello does that.

On the basis of the teacher's response, there seems to be no significant gap between learners with visual impairment and their sighted counterparts in terms of their performance in mathematics. This contradicts the claim that visually impaired learners tend to show relatively low academic achievement in mathematics as compared to other school subjects (Beal & Shaw, 2008). In addition, the teacher holds the view that learners' performance could be determined by the individual's brilliance. It is noteworthy that he also mentions Pheello among the top achievers in mathematics. This outcome might be rare, but it is consistent with the findings of a study conducted by Elnour and Saad (2020), which established that the visually impaired learners could outperform their sighted classmates when provided with opportunities to learn. It

emerged from the second interview I had with Pheello that he continued to perform relatively well in mathematics, as he allegedly passed in the mid-term examination. In his words, Pheello mentioned that "[…] after calculating the average results of monthly tests, I obtained a symbol C in mathematics [ranging between 60% and 69%]." It seems that despite the prevailing challenges confronting him as a visually impaired learner, Pheello still manages to perform relatively well. He recounts his performance in mathematics since the beginning of the year in this manner:

> What I know is that I used to get 70's and 80's. My performance was fluctuating. At times it improved and in other instances it seemed to decline. You would find that in some tests, I become playful whereas in some I show some commitment.

This could mean that Pheello's performance in mathematics was somewhat inconsistent, even though it was relatively satisfactory. The fact that he associates getting low marks with being playful and high marks as showing some determination, reflects that he realised that his performance could improve if he were to exert more effort. Pheello seems to realise what might have affected his performance in mathematics, as he explains:

> If I put a lot of effort from the beginning, the outcome would be different. In February […] I impressed my teachers as I performed well in most subjects at the end of that month. In March I obtained sixties. I believe my performance was good in June, but was affected by some results of monthly tests.

This statement gives the impression that Pheello's performance in mathematics was relatively satisfactory and he also recognised that exerting more effort can contribute towards even more improvement of performance. This suggests that a learner with visual impairment can also have the potential to perform well academically, similar to the sighted colleagues in inclusive classrooms. Other studies (Agesa, 2014; Arya, 2014) reported a similar issue regarding satisfactory performance of the visually impaired learners, however, they further emphasised that for these learners to achieve this, adequate support from their teachers is mandatory.

4.2.4 Inadequate learning materials

The discussions in this subsection are based on the challenges that Pheello encountered as a result of the unavailability of learning resources, such as textbooks in accessible formats, as well as the scarcity of assistive devices.

4.2.4.1 Selective provision of textbooks

It became evident that Pheello lacked textbooks when he confessed that, “I don’t have any textbooks. I borrow them from my classmates who are sighted.” He, however, points out that he made attempts to enquire from his sponsors as to why he has never been given access to textbooks since his arrival at this school. He makes the following remarks:

> At that time, we did not know whether textbooks were being paid for or not […] or whether we are supposed to get them at all. I received information from one lady working in the Social Development, […] she told me that everything is paid for, including the textbooks.

This statement suggests that the Ministry of Social Development paid all the money, which made Pheello eligible to receive appropriate learning materials. However, to his dismay, he still received no textbooks from the school. Pheello’s teacher also revealed that the school makes provision for textbooks for all learners, except the learners with visual impairment. When asked for reasons that might have led to this omission, the teacher had this to say:

> I don’t think publishers are told that we have visually impaired learners and that they should try to produce learning materials for them. The low vision students are also not given books, but I don’t know why that might be the case. Maybe we have a perception that they are all blind.

This statement demonstrates that Pheello was not the only one who had no textbooks, but his visually impaired colleagues also suffered the same disadvantage at the school. The issue of the unavailability of textbooks for learners with visual impairment was also noticed during classroom observations. When the teacher gave learners some tasks from the mathematics textbooks, some learners with visual impairment

had to shift from their seats and join their classmates so that they could also access a textbook. Pheello and another female learner with visual impairment remained in their seats and did not engage in the task. When asked how the unavailability of textbooks had affected his work, Pheello remarked that, “This is the issue that makes me not do my assignments at home and I am often compelled to copy another learner’s work upon my arrival at school in the morning.”

The discussion reveals that the teacher gave learners tasks from the textbook, perhaps disregarding the fact that the learners with visual impairment were not provided with any textbooks. Consequently, Pheello, together with his visually impaired classmates, had to be dependent on the sighted learners who were provided with textbooks. Pheello’s opportunities to participate actively in all classroom activities were thus minimised as a result of textbooks not being available. This is consistent with Dakwa (2014), who argues that visually impaired learners might be disadvantaged in inclusive schools, due to a lack of reading and writing resources. Kao and Mzimela (2019: 7) perceive a lack of appropriate resources to support learning of learners with visual impairment in classrooms as a lack of responsiveness to learners’ needs.

4.2.4.2 Scarcity of assistive devices

Pheello gave an account of the scarcity of Perkins Braillers in his school and how that has affected his learning:

> I think you noticed we were taking them to class last year. This time, one does not know who is supposed to use Perkins. When we are not doing any exercises in class we are supposed to leave them. […] Perkins [Braillers] are often not there when we try to look for them.

Pheello further disclosed the challenges that he, as well as his visually impaired counterparts, always encounter in terms of the short supply of Perkins Braillers in the school this way:

> There are only [a few] functional Perkins in this school. […] I would test whether they are working by placing a paper, and then try to write with it. When I realise that it’s not working, I take another one and carry out the

> same test procedure until I find the one that is still functional. That process consumes a lot of time. At times you would not find them at all, you then go to the library and it is missing. Sometimes we go to classes without them and we would not be able to do any work.

This was evident in one of the lessons I observed. Pheello was seen moving out of the classroom after they were given a mathematics task. He left after the lesson had been going on for 26 minutes and 20 seconds and came back after the lesson had been going on for 31 minutes and 49 seconds, carrying a Perkins Brailler. The time interval that he spent outside the classroom was five minutes and 36 seconds. This means that he fell behind others in this process. Seemingly, Pheello spent far less time doing classwork than his counterparts, because he sometimes went out during the lesson, probably to fetch a Perkins Brailler.

His teacher offered the following explanation when asked about Pheello's observed routine exit whenever he gave them a mathematics task during the lesson, "I think when he gets to class there might not be a Perkins in the cupboard. He is compelled to go back to check whether he could find one." The teacher further clarified that:

> We have fewer Perkins than the number of learners [with visual impairment]. In the past there were enough Perkins for everyone. We used to give everyone his or her personal Perkins in the beginning of the year to use and keep. Each one of them had to return the Perkins assigned to them at the end of the term. This year learners are supposed to put them in the cupboard where everyone can freely access them.

This seems to be consistent with Pheello's statement, which alluded to the recent scarcity of Perkins Braillers in his school. When asked further about whether he was concerned that he could miss out on some classroom activities and why he did not consider fetching that device before the lesson started, Pheello said, "If they were enough I would be doing exactly that."

The statement gives the impression that in the past Pheello used to carry a Perkins Brailler to the classroom, but the recent situation did not allow him to remain in the classroom throughout the lesson. When asked whether there were any alternatives to Perkins Braillers, Pheello said, "I often use a pen in mathematics classes. Sometimes when the Perkins are not enough, we write some tests using pens." This implies that

Pheello had an alternative when these assistive devices could not be accessed, because his residual sight enabled him to use a pen.

It was observed in the two consecutive lessons that Pheello was using a pen to work out answers, after which he typed that on a Perkins Brailler. His mathematics teacher confirmed this when he said, “If you look at Pheello, he is still using a Perkins, but he also works with a pen.” This gives the impression that Pheello was not using a pen as an alternative, but he was using it together with the assistive device in mathematics lessons. Pheello explained how he had benefitted from using a pen in this manner:

> I realised that it would be very important to use a pen. When using a pen, I minimise chances of finding wrong answers, because I used it for a very long time. […] I personally recognised that whenever I have written information with a pen, someone who I stay with can easily help me.

This revelation implies that when using a pen, Pheello was in a better position to get correct answers in mathematics exercises and it also made it easier for him to get help from someone who is not conversant with Braille. His mathematics teacher also had this to say:

> […] the Perkins we have are too old. They are really worn-out now and it’s a challenge using them. Sometimes […] what they have written does not reflect what they [learners with visual impairment] were intending to do. Maybe they found [out] that “if one can still use a pen why do I then struggle with a Perkins that cannot do what I want?”

These assertions imply that Pheello was using a pen, because of insufficient Perkins Braillers that were working properly. It also seemed that using a pen for Pheello was for increasing his chances of finding accurate answers.

The findings presented so far suggest that the inadequate supply of Perkins Braillers to learners with visual impairment affected their learning experiences. The foregoing discussion submits that the situation of scarcity of the Perkins Braillers may have forced Pheello to move out of the classroom from time to time, which might have led to him missing out on some of the lesson activities. Consequently, Pheello resorted to the occasional use of a pen in mathematics lessons, as a result of the limited supply of any functional assistive devices. The unavailability of assistive resources appears

to have a negative impact on learning of the learners with visual impairment. This corroborates one of the findings from Maguvhe (2015), which demonstrates that learners with visual impairments encounter challenges to pursue mathematics and science subjects, due to limited provision of the resources.

4.2.5 Summary of Pheello's learning experiences of mathematics

Data show that Pheello's mathematics teacher always uses verbal presentation and also writes on the chalkboard, using a legible handwriting during instruction. The placement of learners with visual impairment in the front row seems to favour Pheello to a certain extent. This is because his residual vision still allows him to read from the chalkboard, even though it is with great difficulty. The teacher gives notes whenever he introduces a new topic. However, Pheello does not take notes and his teacher appears not to be aware of this. Pheello only chooses to listen to information that he considers helpful in his learning. His teacher also prefers giving homework on a daily basis. As a day scholar at the time, Pheello was able to do homework only at school during study period; as a result, he was not always able to do the homework as expected.

In addition, the case study evidence demonstrates that there are a number of factors that contribute towards Pheello's learning experiences of mathematics within a regular classroom setting. For instance, Pheello could not always afford to be present in class for the entire lesson, because of the scarcity of assistive devices. This seemed to affect his level of engagement in classroom activities, resulting in the loss of opportunities to learn. It was also observed that Pheello could not take part in doing classwork when given exercises from the textbook. This demonstrates that the unequal provision of textbooks to the sighted learners only constrained Pheello's opportunities to learn. Despite these prevailing challenges, Pheello appears to be competent in mathematics in terms of his performance on assessment tests. His teacher also attested to this when he indicated that Pheello always appears amongst the five regular top performers in mathematics.

4.3 Case study 2: The story of Phethahalo: The candid and upright personality

This section provides the presentation of data focusing on Phethahalo's learning experiences of mathematics in a regular classroom. It begins by briefly presenting Phethahalo's profile summarised in Table 4.3 below. This is done for the purpose of understanding the conditions that might directly or indirectly shape his learning experiences.

Table 4. 2: A summary of Phethahatso's personal and school backgrounds.

Personal information	Age	19
	Sex	Male
	Current condition of visual impairment	Severe partial sightedness
	Cause of visual impairment	Allergy
	Braille training	Resource Centre for the Blind
	Performance in mathematics at Grade 7	Advanced (highest symbol as per current categorisation)
Family Background	Number of siblings	1st child out of 2
	Next of kin	Parents
	Responsibility for payment of his educational needs	Social Development
	Home	The outskirts of Leribe, but spent most of the time at Teyateyaneng in Berea
	Residence	School boarding facilities
School background	Current school	School B
	Grade	Grade 8
	Learner population in class	55
	Learners with visual impairment in class	7
	Mathematics Teacher	Taught by the same teacher with Pheello

Phethahalo is a nineteen (19) years old, Grade 8 learner at school B. He was born on the outskirts of the Leribe district, in the northern part of Lesotho. Sharing his academic journey, Phethahalo described his primary education at Teyateyaneng in the Berea district as follows, "I only did grades 1, 2 and 3 [at that school]. Then I went to Queen 2 [hospital in Maseru] as I had more problems with my eyes. When I was from Queen 2, I was informed that I had to attend the school for learners with visual impairment."

Phethahalo explained what transpired upon his arrival at a primary school that accommodates learners with visual impairment in this manner, "I started at Grade 1 because I had to study Braille." This description suggests that the fact that he had already completed Grade 3 at his previous primary school was not factored in at his

new school. He made it clear that he actually considers himself to have completed his primary education at the school for learners with visual impairment. This is how Phethahalo narrated for me how he became visually impaired:

> It was in 2004 when I first discovered that my eyes had problems. I had allergy and that caused my visual impairment. […] I heard that mine [allergy] had been caused by dust during windy weather. […] When it [allergy] emerged my eyes were itching and I began to rub them vigorously. […] I was not aware that I was causing damage to my eyes. They said the front part of both eyes has been destroyed.

Talking about his level of visual impairment, Phethahalo described his condition as thus, “I am not able to see anything written on the chalkboard. […] It is my sight, which fails me. I don’t see too far.” When asked how he accessed information displayed on the chalkboard, he stated that, “[w]hen I am in the classroom I am required to listen attentively to what the teacher says”. This assertion suggests that Phethahalo’s visual impairment condition could affect his learning of mathematics, especially when chalkboard use is involved.

Data point to the fact that Phethahalo had some difficulty accessing information displayed on the chalkboard, because of his visual impairment. He relied a lot more on his sense of hearing for learning. This implies that he mostly accessed information from the teacher’s verbal communication during class time. The severity of Phethahalo’s visual impairment compelled him to complete his primary education at a school that accommodates learners with visual impairment.

4.3.1 Classroom size, learner population and sitting arrangement

In this section, I discuss Phethahalo’s experiences in terms of the learning environment at his school. There were 55 learners in Phethahalo’s classroom, including nine learners with visual impairment. I observed that all the learners with visual impairment sat together in pairs in the front row. When asked about who arranged the seating in class, Phethahalo responded as follows:

> As learners with visual impairment we are told to sit in the front row, not at the back seat. We had been told that we should sit in the front row so that we could listen attentively […] so that even when the teacher has given us

> some task to do, he would start by marking our work and also provide us with some explanation whenever necessary.

This suggests that the placement of the learners with visual impairment in the front was designed to help the teachers monitor their progress, including marking their work first. However, if the intention of this placement was for ease of access to the information on the chalkboard, it was clearly not helping to someone like Phethahalo who has a severe visual impairment condition. His mathematics teacher confirmed this by stating:

> […] with someone who is totally blind, any sitting arrangement is fine. It is just that we could not take them too far to the back, because they will struggle with their movement. But those who are totally blind, they can sit anywhere around the class, because the board doesn't say anything to them.

This statement implies that learners with severe conditions of visual impairment, like Phethahalo, might be at liberty to sit anywhere in the classroom, because it was impossible for them to use their vision to access information displayed on the chalkboard. The placement of learners with visual impairment in front was mainly intended to ease their movement and to enable the teacher to give more attention to them during class activities and/or assessment.

Phethahalo was clearly pleased with his current school environment. An assertion he made points to this, "I feel satisfied attending school here […] because here everything is quite good." Despite showing his satisfaction with the environment in his school, I observed that the desks were rather too closely packed, due to the high enrolment at school, as illustrated in Figure 4.3.

Figure 4. 3: High learner population in Phethahatso's class.

The teacher also confirmed the congestion in Phethahalo's classroom by saying, "The size of the classroom is very small and it is supposed to accommodate a maximum of 40 [learners]." He also pointed out that, "We have an abnormal class. We had to squeeze some seats on that opposite side." When responding to a question about the rationale for using that classroom, the teacher said, "That one is not our decision. We just come, 'Oh ho! Today I have to deal with this kind of situation'." Phethahalo's teacher even complained, "These boys are too many. You couldn't try any combinations, because the class is so congested." The teacher further mentioned that in the previous year, "[he] would take better [sighted] students and pair them with the struggling ones with visually impaired so that they can teach each other." From his remarks, it seems that the classroom size, as well as the number of learners with visual impairment, who were mostly boys, restricted him from arranging learners in pairs or from trying other combinations. Figure 4.3 shows that learners with visual impairment were indeed placed in the front rows of the classroom. Since the class was congested, it proved difficult to move around the class, especially when the teacher needed to give individual attention to the learners.

4.3.2 Teaching mathematics in Phethahalo's class

Phethahalo shared his experiences regarding how mathematics is taught in his class, "Upon his arrival, he teaches and then gives us an assignment. Before then he marks our homework, if he gave us some on the previous day." This suggests that the teacher begins by marking learners' work before the actual teaching for the day. Once again, homework appears to be an important element of instruction in Phethahalo's class. The next subsection provides a detailed account on how learners' homework is used as a yardstick to guide the activities of the lesson in Phethahalo's class.

4.3.2.1 Learners' homework as a yardstick to guide lesson activities

Phethahalo described what occurs normally during mathematics lessons in the following extract:

> We often don't have written classwork in maths lessons. Most of the time, Sir doesn't give us written classwork. When he gets into class, he teaches

> us and thereafter he gives us an assignment. We all know that we are going to be given an assignment everyday whenever he is present. […] It appears as if he doesn't want to use written classwork most of the time.

This declaration shows that the teacher preferred giving an assignment to learners on a regular basis at the end of a lesson. This was the case also in the two lessons that I observed. I was also able to see that learners' feedback indeed informed the teacher about their progress in terms of what was taught previously, as the extract below reflects his remark after marking learners' work:

> Teacher: When marking you I can see that some of you still have [some] problem to write a number as a product of its prime factors. […]. So we are presenting numbers as the product of prime factors [He writes the statement on the board]. Before you do anything you have to remember prime numbers. […]

This statement suggests that the marking informed the teacher that a considerable number of learners did not understand the concept of prime factorisation. The following extract illustrates how the teacher undertook remedial action using the exercises that he had given learners previously as homework.

> Teacher: We are going to present a number as a product of its prime factors. That means a number that you are given should be the end product of multiplying the prime factors. Okay?
>
> Learners [in a chorus]: Yes, sir!
>
> Teacher: And then I say, for example, if you are given to present […] let's take 18. We said 18 as a product of its prime factors [writes on the board]. […] That means we have to multiply prime factors of 18 to get 18. The question is what are those factors? We know that the set of prime numbers is the set of 2, 3, 5, 7, 11 and so on. So if that is the case, we can first check factors of 18 [writes on the board].

The teacher also demonstrated two methods for expressing a number as the product of its prime factors, as shown in Figure 4.4 below.

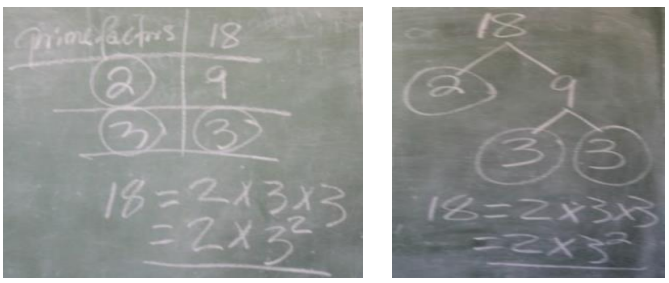


table method tree method

Figure 4. 4: Expressing 18 as a product of its prime factors.

This exchange suggests that the teacher used remediation, based on the learners' feedback on homework. It is also revealed that when teaching mathematics concepts, the teacher seemed to prefer verbal expression and chalkboard use. Issues that he emphasised were written on the chalkboard. It was also evident that the lesson was characterised by oral questions from the teacher and learners' oral responses. Data show that Phethahalo's teacher was using the 'chalk and talk' teaching method. According to Rowlett (2010), this method is arguably inaccessible for learners with visual impairment. When talking about how he decided to conduct a remedial lesson, Phethahalo's teacher explained that:

> Unlike the groups that we had before, they [current group of Grade 8 learners] don't have any foundation. They don't have content. Most of them you could see they have been pushed - pushed - and pushed. So when they get here we need to derive [diagnose] some of the content they have and they are empty. […] So it is a very difficult thing to find that you have to put something in an empty vessel.

The quote above suggests a rather negative perception by the teacher on the capacity of his learners. For him, they appear like "empty vessels", which he has to fill with information. With this declaration, the teacher clearly subscribes to a transmission model of learning. He also blames this on the promotion sustained at his schools. It is also noteworthy that his attitude is likely to influence the way he teaches mathematics to these learners, which in turn may affect their success. Suleymanov (2015) argues that a teacher's attitude towards learners, particularly those with special educational needs, can contribute to their success. Even though the perception of the teacher appears to be negative, Phethahalo was happy with how mathematics lessons were conducted in his class:

> We are taught well in a manner that makes us understand. We feel recognised in the classroom. Because the good thing is that when a teacher enters the classroom, he knows well that he is going to teach learners with visual impairment and those who can see. So that he knows how to engage those with sight and us who are visually impaired.

The implication here is that Phethahalo was satisfied with the manner in which his mathematics teacher engaged the two diverse categories of learners: the sighted ones and those with visual impairment. This is apparent in his statement that, "[h]e seems

to be aware that he teaches two different types of learners in the class. He ensures that he caters for our needs". Again this quote gives the impression that the teacher might have been using a differentiated instruction approach. There exists an extensive body of literature that regards differentiated instruction as one of the effective strategies, which can ensure that learners with diverse educational needs, including those with significant disabilities access an appropriate education in the mainstream classrooms (Lawrence-Brown, 2004; Levy, 2008). Phethahalo's acknowledgement that he was taught in a manner that made him understand the content, also implies that he felt that he is categorically valued as a learner. This was evidenced by the fact that he often volunteered to provide answers to the questions asked by his teacher during the observations. For example, he volunteered to answer the teacher's question that required him to give the reason why nine is not a prime number, as illustrated in the below dialogue:

Teacher:	Why is it not a prime number? Why are we saying it is not prime?
Phethahalo:	Sir we say prime factors are the factors that have two factors, one and itself. 9 has another factor besides one and itself.
Teacher:	Which is 3. This means 9 does not qualify, because it has three factors, but the prime numbers have got only two factors. That informs us that to present 18 as a product of its prime factors we are going to use only 2 and 3, because they are only factors, which are prime in the set of factors. […]

This dialogue suggests that Phethahalo was familiar with the concept being taught, as he was able to answer questions. The finding aligns with Gillies and Quijada's (2008) argument that learner engagement during instruction contributes positively towards improved self-confidence and interest in learning. These researchers are of the view that the quality of instruction is the determining factor of whether a learner can actively engage in a lesson or not. When comparing how mathematics is taught relative to other subjects, Phethahalo provided an explanation that serves as an indication that his mathematics teacher catered for his educational needs more than in other subjects as he stated that:

> In mathematics things are relatively smoother. This is because even where there are diagrams, our maths teacher draws things for us in Braille. When we don't understand, he makes us use a sense of touch to help us develop a better understanding. […] This could be a topic that involves drawing of shapes. He would bring them and make us touch them. We are also able to

> follow what has been displayed on the chalkboard, as we would be having them on [Brailled] paper.

This statement shows that the concepts that required learners to use diagrams were being taught in Phethahalo's class. While Adelakun (2020) argues that accessing diagrams in an inclusive classroom could be a challenge for learners with visual impairment, it appears that Phethahalo's teacher made an effort to provide tactile resources when teaching a topic on shapes. Phethahalo further clarified that:

> When we are doing classwork that involves drawing of shapes, he would request us to provide some descriptions only. We would only write down their properties. […] We would be required to mention things like [the] number of sides and edges of the given shapes. The sighted learners would be required to draw shapes.

What is implied by this statement is that the visually impaired learners were not required to draw diagrams, but they were expected to describe their properties. When responding to a question about whether he had any challenges when drawing diagrams, Phethahalo said, "I don't think it would challenge us that much, if we would be having the appropriate resources for drawing those shapes. I think it would be for our own good if we would draw such diagrams." From this statement, it might be inferred that if provided with essential equipment, it would not be difficult for Phethahalo to draw diagrams. His declaration also suggests that learners with visual impairment would benefit from drawing diagrams, as that might help them to develop a better understanding of the concept being dealt with during the lesson. Even though accessing diagrams in tactile format would be helpful for learners with visual impairment, Phethahalo is also of the view that drawing them would be more beneficial for him, as he would comprehend the concept being taught better. Brawand and Johnson (2016) argue that a thorough understanding of mathematics concepts by learners with visual impairment could enable them to thrive in today's society. This can be enhanced by giving them opportunity to learn skills at the same level as their colleagues with functional vision. However, the outstanding challenge is the abstract nature of mathematics concepts which mostly feature visual presentations which would not make it very easy for learners with visual impairment to acquire (Brawand & Johnson, 2016).

Phethahalo continued to share his experience by submitting that, “I am always comfortable during lessons […] even when I don’t understand something, I often ask questions.” When replying to a question on how his teacher reacted when he asked for help during lessons, he indicated, “He always tries to give us comprehensible responses whenever we pose questions. He seems to be taking good care of us.” Seemingly, this statement shows that Phethahalo felt appreciated by his mathematics teacher so much so that he was free to pose questions in the classroom. This coincides with Connor and Cavendish’s (2020) finding that among the qualities of an effective teacher, learners identified with it by giving them opportunity to ask questions and provide clear explanations, as well as giving easy-to-follow directions to approach specific concepts.

Conclusively, it could be understood from this discussion that homework is an important component of teaching mathematics in Phethahalo’s class. Emanating from its feedback, the teacher might decide to re-teach a concept. It is evident that Phethahalo also participated actively during the lessons, due to feeling appreciated by the teacher. Even though the lessons were dominated by the ‘chalk and talk’ teaching approach, the discussion also revealed that when teaching topics involving diagrams, the teacher ensured that visually impaired learners followed what was being taught by giving them diagrams drawn in Braille. This shows some elements of a differentiated teaching strategy.

4.3.2.2 Phethahalo’s reliance on the teacher and other sighted colleagues

When replying to a question regarding how the teacher assessed his work, Phethahalo had this to say, “For a wrong answer he puts a cross and a tick for correct answers.” Figure 4.5 below provides evidence of what Phethahalo was talking about.

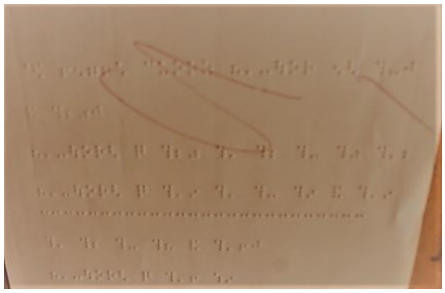


Figure 4. 5: Illustration of Phethahatso’s marking on the Brailled paper.

Asked whether he was able to see the marked ticks or crosses on his work, Phethahalo unreservedly answered: “No, he tells us here you have got a wrong answer.” The teacher also confirmed this when he said: “When I mark them, I keep telling them that this one is correct and this one is not. It informs them immediately that today I have them all correct or this one I made a mistake here and there.”

This conversation shows the extent to which a learner with visual impairment like Phethahalo relies on the teacher’s information in the classroom about his performance, as in whether his answers are correct or not. Phethahalo also confirmed this kind of interaction with the teacher when he marked the written classwork. However, in situations where the teacher is not around, especially when preparing for tests, he highlighted, “I usually come to other learners who are my classmates. They are the ones who help me by telling me whether I got a correct or a wrong answer to particular questions.”

This narrative again suggests that Phethahalo relies on his colleagues to tell him whether his answer is correct or not. It also gives the idea that the teacher may not be using alternative methods for assessing learners with visual impairment, which could perhaps be more appropriate for their condition, including those that entail a sense of touch. Phethahalo’s teacher also confirmed this by revealing, “So far, it is still difficult to mark them with something they can touch. Maybe we will have to have something like a puncher.” This assertion implies that the teacher acknowledged the shortcomings of how he assessed the work of learners with visual impairment. Hansen, Shute and Landau (2010: 275) argue that “assessments are often designed without taking accessibility into account from the beginning, resulting in a lost opportunity for students with disabilities to learn”.

4.3.2.3 Teacher’s consistent late arrival in mathematics lessons

Phethahalo also spoke of the issue of the teacher arriving late for mathematics lessons. When reporting about it, he asserted:

> I have realised that when we have a double period, our maths teacher enters the classroom in the second period. He is someone who teaches very

> quickly before the lesson could come to an end. Even when he comes in the second period, he still manages to perform what is expected of him.

The implication here is that the time for instruction may be reduced in the mathematics lessons, due to the teacher's consistent late-coming to class. Phethahalo's remark that his mathematics teacher is "someone who teaches quickly", implies that the teacher could be compelled to speed up a lesson, in order to cover the content within the remaining time. Despite Phethahalo not showing any concern about this issue, a wide body of academic research argue that visually impaired learners often face a challenge of coping with the pace of a lesson in inclusive classrooms (Bardin & Lewis, 2008; Papuda-Dolińska, 2017).

4.3.3 Insufficient provision of learning materials

This section presents data to explore the challenges that Phethahalo may have experienced, as a result of the unavailability of learning resources, such as textbooks, as well as the scarcity of assistive devices.

4.3.3.1 Lack of textbooks to support Phethahalo's learning

As a response to a question on whether he had a mathematics textbook, Phethahalo stated, "No, we don't have any textbooks." It appears that the issue of the lack of textbooks did not only affect him, as he clarified, "We really don't have textbooks. I am talking of us learners who are visually impaired. All of us have no textbooks at all." Again, his response demonstrates that he was not aware of the cause of that as he further mentioned, "We really don't have an idea about that. […] We were never told why that has been the case." In his next remark, Phethahalo confirmed that textbooks were given to sighted learners only, "The textbooks that we have access to are only those of our classmates when they read for us." This statement demonstrates that Phethahalo was not aware why the learners with visual impairment had no access to textbooks while their sighted counterparts have. This suggests that they relied heavily on their sighted colleagues whenever they needed to use textbooks.

Phethahalo's teacher confirmed that the learners with visual impairment have no access to textbooks. He said, "Like now with the Form As, they don't have books. I am

very busy typing learning materials for them for the topic we are doing." When asked to elucidate the reasons pertaining to this situation, the teacher explained, "They are not given books, but we have magnifiers. […] I am not sure why they are not given textbooks." Even though the visually impaired learners were not provided with textbooks, Phethahalo's teacher explained that he had taken up the responsibility to prepare complementary learning materials available for them. However, Phethahalo expressed his dissatisfaction with the prevailing situation of not having textbooks and this was evident in his statement below:

> Sometimes it is very challenging because we also need to use our own textbooks. So that we can have an opportunity to access and read whenever we want to do so. All this time I have to go to the girls' dormitories and seek help from them of reading for me. This issue doesn't sit well with me.

It looks as if the lack of reference materials could have negatively affected Phethahalo's learning of all subjects, including mathematics. It appears, from the issues mentioned above, that the lack of textbooks in an accessible format for learners with visual impairment, resulted in their over-reliance on the sighted learners. This resonates with a viewpoint of Burr (2015) who contends that learners with visual impairment tend to rely on the teacher and sighted learners to read for them, as a result of lack of appropriate resources that support their learning. Nonetheless, in this study, the teacher reportedly made an effort to develop learning materials in Braille format for learners with visual impairment with the intention of increasing their opportunities to learn.

4.3.3.2 Provision and use of assistive devices

It emerged that there were instances where Phethahalo found no one to read for him and in such situations, he tried using a magnifier as an alternative as he explained:

> I use it in situations where I ask someone to read for me and she tells me that she is busy with something like homework. Then I would ask her to lend me a textbook. When I get permission to access her book, it is then that I go and read it under a magnifier. […] A magnifier is quite helpful. When I am compelled to read a book, I won't be able to access information with my naked eyes. Now that a magnifier enlarges text, I am able to read with ease.

This assertion suggests that Phethahalo opted to use a magnifier as an alternative when his classmates were unable to read for him. However, it is noteworthy that such access to a textbook still depended on getting permission from his sighted classmate to use the textbook. This means that the presence of magnifiers even while useful, did not resolve the challenge of the dependence on his sighted peers for learning mathematics. Data further shows that the presence of the magnifiers at the school did not necessarily improve textbooks' accessibility for learners with visual impairment. Their availability in the school did not serve the intended purpose, because of inaccessibility of textbooks for learners with visual impairment. For that reason, they remained underutilised as Phethahalo confirmed in the following statement, "I have realised that nobody is using them anymore." While Equbal and Begum (2020) mention that assistive technology devices could have a significant effect on access to the content, in the case of Phethahalo, availability of magnifiers is worthless if visually impaired learners have no access to the textbooks.

There was yet another challenge at a school in terms of the scarcity of Perkins Braillers as Phethahalo observed, "We usually take them to class. However, there are not so many of them [here at school]. We are no longer able to take them to class anymore." Responding to a question about how he learned without using a Perkins Brailler, he claimed: "It is a challenge. Most of the time when one needs to write we often come here [to CATCH Centre] to look for them." It is gathered from his story that searching for a Perkins Brailler could be an exhausting exercise, as he elaborated:

> You would find that when you get here, the Perkins [Braillers] have been taken by other learners who have gone with them into their classrooms to do their work. When trying to search for them you don't find anything. When you get back to class you would find that a lesson of a certain subject comes to an end and then in the next lesson you are tasked with other work yet you don't have a Perkins [Brailler] to work with. That is the main issue that makes us suffer here at school.

Phethahalo's statement implies that he sometimes faced an impossible choice of whether to remain in class doing nothing or to go out and search for a device and thereby miss lessons. The inadequate supply of assistive devices may thus be a factor that negatively affect learning of learners with visual impairment in inclusive classrooms. Rosenblum and Herzberg (2015) also report that unavailability of

assistive materials make it very difficult for visually impaired learners to do their schoolwork, leading to late submission of assignments. Phethahalo also narrated how some of the senior learners with visual impairment take advantage of the Grade 8 learners in terms of preferential access to Perkins Braillers:

> There are those who regard themselves as seniors. Sometimes when you are looking for a Perkins, you would find that they have placed them in their cupboards. So when you are looking for it you don't find it where we were instructed to place them when we are done using them. Once you take it from the cupboard, someone would fiercely ask you as to why you took his Perkins.

This proves that there is an unhealthy competition between learners for these assistive devices, giving rise to a situation of 'survival of the fittest'. The situation of the scarcity of resources appears to create many challenges for most learners with visual impairment. The discussion revealed that at times learners with visual impairment are likely to miss out on the opportunity to be present for the entire duration of a lesson. Furthermore, leaving a class to fetch a Perkins Brailler seemingly did not guarantee its availability in the storage.

4.3.4 Cooperation between Phethahalo and his peers

Phethahalo addressed a question on how he collaborated with his sighted colleagues in this way, "Some of them are very cooperative, because they seem to understand that they have to help us. Whenever we need their help they usually cooperate." However, it emerged that there had been instances when Phethahalo's sighted colleagues were less willing or able to help:

> As it is well known that no human being is perfect, sometimes they refuse to read for us and create stories claiming that they are busy. […] I don't know how I can overcome such a challenge. Most of them don't want to read for us. It's only a few individuals who are willing to help us out. When they are engaged elsewhere we become stranded.

Judging by what he said, it seems that some of the sighted colleagues are always willing to assist, whereas the majority are either unwilling or unable to help. When asked why the majority of sighted learners seemed unwilling to read for the learners with visual impairment, Phethahalo asserted, "It seems they lack understanding." This

narrative underscores the challenges that Phethahalo faces in learning mathematics and/or even other subjects in school. Mitchell and Sutherland (2008) note that learners with special educational needs often experience rejection from colleagues in the Inclusive Education setting and that can be detrimental to their academic success. Alesech and Nayar (2020) contend that a positive attitude is important to facilitate a sense of acceptance and belonging among learners in the school. This implies that learners with visual impairment could get academic support from the sighted learners when the latter have developed a positive attitude towards them.

Another issue emerging from the data, as Phethahalo narrated, is that they were sometimes required to work in groups. He elaborated on the composition of these groups as follows, “When we form groups we always mix with sighted learners. They often write for the group. […] We don’t see what they are writing and that becomes a challenge.” When responding to a question on how he made his contributions to the group, he stated, “When she has written something down, I ask her what she has put down. That’s how we operate.” Continuing on the group work challenges, he recounted an instance when the sighted learners became less cooperative in a group setting:

> I often notice it when Madam or Sir gives us work and leaves the classroom. Immediately after the teacher left, those people would do nothing related to the given task, because they are so playful. Most of the time I would want us to continue with the task, since I am not the one who would be writing, they would just ignore my plea.

What emerges from Phethahalo’s assertion is that some members of the group may neither be serious nor committed when working on the tasks that were assigned to the group, more especially when the teacher is not present in the classroom. This kind of behaviour from his colleagues affects his learning, but he has very little control over it. This coincides with the claim that a visual impairment condition puts learners at a disadvantage of playing their role independently, but makes them to be at the mercy of the actions of others when learning (Jessup, Bundy, Broom & Hancock, 2018). In response to further probing about the consequences of such a lack of cooperation in the group, he stated, “When we have not done the work as a group, we all get beaten up as a punishment.” Evidently, Phethahalo did not always benefit much from the group work; instead it led to his punishment, together with his sighted colleagues.

Phethahalo also revealed that he has not had an opportunity to write a report for the group. Here is how he reported that inexperience, “This is because we use Perkins Braillers when we write […] they are not able to read Braille.” This statement suggests that because sighted learners are not conversant with Braille, thus Phethahalo is never assigned the task of compiling a group report. He responded to a question on whether he has ever taken time to teach the sighted learners the basics of Braille literacy as follows, “We only teach those who come to us and show some interest. Most of them seem not to be interested.” Most sighted learners do not appear interested to learn Braille even when Phethahalo and some of his visually impaired colleagues had volunteered to teach them the basics. Given this context, it is therefore unlikely that Phethahalo would ever be allowed to contribute by writing a group report when working with sighted learners. When answering a question regarding his preference in terms of group work as opposed to working individually, he pointed out, “I mostly prefer individual tasks, but I don’t mind the group work either.” He further articulated his reasons for this preference as follows:

> It is because when I am working alone I do exactly what I had been taught by the teacher, applying my individual effort. Sometimes when we are in groups, you would find that other group members expect me to be the main contributor, as they often argued that their responsibility is that of writing.

It is evident from his response that Phethahalo prefers to work individually, because he can take charge. It is also clear that he is not happy that his sighted colleagues expect most answers to come from him, because he is not involved in report writing. Even though the findings of a study conducted by Negash (2020) reveal that visually impaired learners often become passive when working in collaboration with the sighted classmates in groups as the latter dominates the discussions, data show that other group members expected Phethahalo to contribute more. This contradicts the expectation that learners with visual impairment mostly receive help in their studies from their sighted colleagues. However, Bond and Castagnera (2006) posit that learners with special education needs are also capable of providing help to their classmates. Phethahalo elaborated on his readiness to work in groups. The following excerpt describes a discussion group he formed with his peers:

> After school hours we gather. Amongst us, we have two sighted learners who read for us. We are about eight in number [in a group]. We all sit there

> and they read for us, then we answer questions of each other. We ensure that everyone understands what has been discussed.

This suggests that Phethahalo was able to work with his peers after normal school hours at the school boarding facility. The discussion group was beneficial to him and all those who participated in the group discussion. This seems to concur with Montgomery's (2015) view that collaboration can facilitate interactions that would allow learners to exchange ideas and to engage in arguments that would enable them to reflect upon the concepts they had learned in the classroom. In response to a question on the group dynamics, Phethahalo indicated, "I don't think they [members of the group] are very excited about it. They look as if they are satisfied, but their attendance proves otherwise." This statement suggests that the attendance of learners in the group discussion had not been satisfactory. When asked about regular absentees, he detailed as follows:

> The two sighted colleagues always attend discussions. It's us, the visually impaired learners, who don't attend regularly. Previously, the sighted colleagues had some issues but currently some learners with visual impairment don't cooperate especially those who can use large print. All of us who use Braille, we always attend discussions.

This quote suggests that some of the learners with visual impairment, especially those who can read large print, were less cooperative when it came to attending discussions. Despite the unsatisfactory attendance, it was evident that Phethahalo continued to attend the discussions and considered them useful. Evidently, opportunities to learn can be improved when learners work cooperatively in their studies.

4.3.5 Phethahalo's perceived competence in mathematics

This section reports on Phethahalo's perceived competence levels in mathematics. When asked about his performance in mathematics he said, "My performance in mathematics is satisfactory. […] I have been working exceptionally well ever since my arrival here."

When citing one of the tests that he wrote, Phethahalo proudly stated: "I don't think there is anything that I got wrong. I am saying this because of the way I was confident

when writing that test." Phethahalo seemed to be confident about his efforts. When his mathematics teacher responded to a question about the learners he had identified as the best in the Grade 8 cohort, he indicated, "It is Phethahalo [pseudonym]. He is very good. That is the only person I have identified. The rest of Grade 8 students are not that good." Evidently, Phethahalo was among the top achievers in his class. However, in the follow-up interview, Phethahalo disclosed:

> The challenge is that my performance seems to go down. This is because I obtained 90 [percent] in the first test. After that I got 80 something [percent]. This shows that my performance instead of going up, it goes down. […] In the latest test I obtained 60 something [percent].

The information gathered in the follow-up interview implies that Phethahalo's level of confidence in mathematics had declined, as he seemed to be concerned about his deteriorating performance in mathematics. When responding to a question which sought to determine reasons that might have led to these unfavourable outcomes, he said, "I think it is mainly because of a lack of adequate preparation."

4.3.6 Summary of Phethahalo's learning experiences of mathematics

Data presented show that Phethahalo's mathematics teacher appears to be in favour of verbal communication and chalkboard use when teaching. This kind of a teaching approach can be referred to as "chalk and talk". However, Phethahalo could not access information displayed on the chalkboard, even when positioned closer to it. His placement only benefitted him in paying attention to his teacher, who often stood in front of the class when teaching. Phethahalo reported that the teacher often provided hand-outs in an accessible format to the learners with visual impairment. The learners with visual impairment are not expected to draw any diagrams, but the teacher gave them the improvised tactile diagrams so that they can have an idea of what is being dealt with. During assessment, learners with visual impairment were only expected to describe the properties of shapes that were being taught. This also shows some elements of differentiated teaching in Phethahalo's class.

The teacher often marked learners' homework before the commencement of the lesson. It seemed as if the teacher used learners' feedback from homework to decide

on the lesson's activities. For example, on the basis of the learners' feedback, the teacher decided to conduct a remedial lesson. Phethahalo showed his satisfaction with the manner in which his teacher taught him. This could mean that his teacher catered for his educational needs, which might result in increased opportunities to learn.

On the basis of the data presented, there seems to be many challenges that affected how Phethahalo perceived and engaged with the teaching of mathematics in his class. For instance, Phethahalo indicated that he had no reference materials, such as textbooks in accessible formats. He mainly relied on his colleagues to read for him or he used a magnifier in situations where there was no one to read for him. However, magnifiers remained less utilised by visually impaired learners, because they lacked textbooks. Another issue that shows Phethahalo's dependence on his teacher and colleagues was that he expected them to tell him whether he had correct or incorrect answers, as his level of visual impairment did not allow him to access what the teacher had marked with a red pen.

The issue of the scarcity of assistive devices emerged from the presented data. The absence of any alternative when writing his schoolwork caused a serious challenge for Phethahalo. When given a task, he often went out of class to fetch a Perkins Brailler. This affected the time he spent during the lesson negatively. To exemplify, he missed out on some learning opportunities during mathematics lessons. Despite the prevailing challenges at his school, Phethahalo still managed to perform relatively well in mathematics. However, Phethahalo seemed to be concerned by his declining performance and this he blamed on his inadequate preparation for tests.

Teaching of mathematics in Phethahalo's class was also affected by the large learner population and the relatively small classroom size. This seemed to restrict the teacher's movement around the class when he tried to help individual learners. It is also notable that the learners with visual impairment were all occupying the front seats. The fact that the visually impaired learners were sitting next to each other in Phethahalo's class could be problematic, as it seemed to limit their interactions with their sighted peers.

4.4 Case study 3: The story of Ketsahalo: The beleaguered character

In this section, I present findings with respect to Ketsahalo's learning experiences of mathematics in a regular classroom. Firstly, I present a profile of Ketsahalo that is summarised in Table 4.4 below. Once more, it is considered very important to present this in order to better understand the issues that might have a substantial influence on his learning experiences.

Table 4. 3: A summary of Ketsahalo's personal and school backgrounds.

Personal information	Age	15	
	Sex	Male	
	Current condition of visual impairment	Partially sighted	
	Cause of visual impairment	Born visual impaired	
	Performance in mathematics at Grade 7	Proficient (second best symbol)	
Family Background	Number of siblings	2nd child out of 2	
	Next of kin	Grandmother (both parents are alive, but went missing)	
	Responsibility for payment of his educational needs	Guardian	
	Home	Village in the Eastern side of Maseru	
	Day scholar	Yes	
	Mode of transport from to school	Walks on foot	
School background	Current school	School A	
	Grade	8	
	Learner population in class	55	
	Learners with visual impairment in class	2	
	Teacher profile	Qualifications	Secondary teachers certificate (Science and Mathematics) B.Ed. (Geography and English Literature)
		Training special education	None
		Experience of teaching learners with visual impairment	Less than a year
		Teaching experience	32 years

At the time of the research, Ketsahalo was 15 years old and completing Grade 8. He was born not far from the Eastern side of Maseru town. Ketsahalo attended and completed his primary education in a regular school, which was not designated to cater for learners with special educational needs. He indicated that before enrolling in his

current school, he was unaware that it catered for the educational needs of visually impaired learners.

When talking about how he acquired visual impairment, Ketsahalo said, “I think I was born visually impaired. […] I never asked how I acquired this sight defect, but what I know is that I was born visually impaired.” Ketsahalo provided details of how the visual impairment condition affected his learning at lower grades, “I was not able to see clearly and used to look at things at close range. I was sitting in the front row when I was in Grade 1. I repeated Grade 2. After that, my parents explained to teachers that I am visually impaired.” Ketsahalo mentioned that his parents bought him a pair of spectacles soon thereafter:

> I started wearing spectacles when I was in Grade 3. I started using them when my parents realised that I could not see anymore. I was only able to access things when they are closer. […] After wearing spectacles I did not look at things at close range. In fact, when they were new I used to see properly like other sighted people. They made me see properly.

Reporting on whether his pair of spectacles was still able to help him, Ketsahalo indicated that, “Currently I have realised that they are no longer useful. I have returned back to my older ways of looking at things. […] I am not able to see properly.” Ketsahalo clarified that his pair of spectacles had exceeded their lifespan, as he said, “If my recollection serves me well, they must be renewed after three years. […] I started wearing them when I was in Grade 3 - then Grade 4, Grade 5 and I was supposed to have changed them while I was in Grade 6. It is way longer than three years now.” He provided the reason for not being able to replace his pair of spectacles by disclosing that, “It is because we don’t have enough funds to buy a new pair of spectacles.”

Ketsahalo further provided an account of how visual impairment affects his learning when he said: “I am very slow when writing. When I am writing notes, I am very slow and take too long to finish doing so. But I write pretty quick when I am able to see clearly.” This evidence shows that Ketsahalo’s level of visual impairment did not allow him to see properly without the aid of a pair of spectacles. It was evident that his pair of spectacles, that he was unable to replace due to lack of funds, did not help him to

see properly anymore. This double challenge of coming from an under-resourced background seemingly complicates the learner's access to learning opportunities. Some studies also note that visual impairment can be linked with poverty (Kasiram & Subrayen, 2013; Eide & Ingstad, 2013). These researchers argue that this can prevent provision of adequate support that ensures access to quality education for learners with visual impairment. Mason-Williams (2015: 257) arrives at the conclusion that "students with disabilities in high-poverty schools are not provided an equal opportunity to an equitable education, violating the equal opportunity standard."

4.4.1 Learner population and sitting arrangement in Ketsahalo's classroom

The total learner population in Ketsahalo's classroom was 45, including two learners with visual impairment. During the lessons I observed, the learners with visual impairment were identified occupying the front seats, where they sat together with the sighted learners. Ketsahalo pointed out that he is the one who chose his sitting position. His teacher confirmed this when she stated, "They [referring to learners with visual impairment] have just chosen where they want to sit." Ketsahalo clarified that he decided to sit in front so as to be closer to the chalkboard, to enable him better access to the information displayed without much difficulty. Despite sitting in front, it seems that Ketsahalo still encountered challenges with his vision. He narrated his experiences in the following manner:

> To tell you the truth, my sight gives me trouble especially when I look at the chalkboard. […] When I read from the chalkboard, sometimes it gets dark. I would then pause a while and stop writing when I cannot see. I usually rub my eyes so that I can look at the chalkboard. […] During the day when the door is open, I cannot see properly. I would realise that there are some words displayed on the chalkboard that do not come out clearly. I experience the same thing even when I change my sitting position.

Ketsahalo's narration suggests that sitting in front did not always help him. His visual impairment condition limited him from accessing information from the chalkboard, irrespective of his sitting position. Evidently, this might compromise his opportunities to learn, especially where mathematics teaching involves regular chalkboard use.

4.4.2 Lesson facilitation in Ketsahalo's classroom

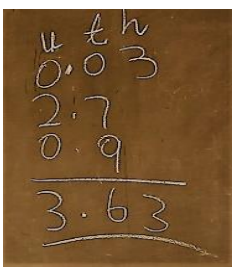
In this section, the discussion focuses on how mathematics was taught in Ketsahalo's class from his own perspective. The issues that emerged from data, with regard to teaching of mathematics, include the use of examples, chalkboard use and how writing pace can affect learning.

4.4.2.1 The use of examples to teach mathematics

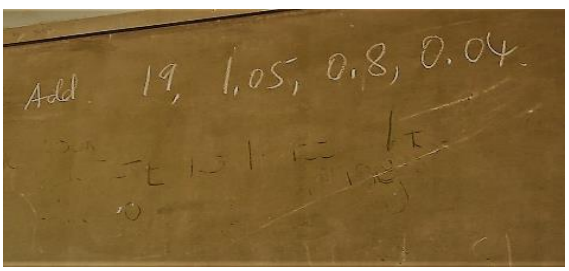
When talking about how his mathematics teacher conducted the lessons in his classroom, Ketsahalo stated that, "She starts by introducing a certain mathematics concept and then gives us classwork." Ketsahalo provided details of how this was done in the following way:

> Our mathematics teacher gives us an example first. That example makes us understand the concept. If you clearly understand how the example is done, you know exactly what to expect in the exercises from the textbook given as classwork.

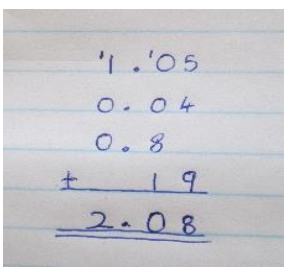
Data demonstrate that the teacher usually provided examples before giving classwork. Ketsahalo believes that the examples helped him to develop a better understanding of the concept being taught, since he refers to them as he works on the exercises that are assigned. The teaching approach used in Ketsahalo's class, can be likened to what Hodgen, Foster, Marks and Brown (2018) refer to as "explicit instruction". During my visit to the class, I observed that the teacher provided an example that learners were expected to follow. When examining Ketsahalo's answer, it became apparent that he tried to follow the example that was given by the teacher. This resulted in calculations that ultimately gave him an incorrect answer as shown in the third image of Figure 4.6 below.



Example



Question



Answer

Figure 4. 6: Illustration of an example of adding decimals and Ketsahalo's answer.

Ketsahalo shared his experience on how he tried to follow the example that his teacher provided when he worked out an exercise:

> I struggled with the number 19 without a decimal point. I put it at this side [he indicated a direction with his right hand], whereas I was expected to write it on this side [he indicated a direction with his left hand]. Since there is one number on the left hand side then the decimal point and two digits after it [referring to 1.05] and 19 was without a decimal point, I decided to put it on this side [on the right hand side] so that I could add them.

Evidently, the example that he followed did not help him to find the correct answer. In fact, the example that guided him dealt with digits in one and two decimal places and he seemed to perceive 19 as such, hence he placed the decimals as illustrated by the answer that he worked out. This shows that Ketsahalo misinterpreted the example given by his mathematics teacher and he could not figure out a different approach without another appropriate example procedure. In this case, it appears that Ketsahalo's visual impairment condition did not affect his understanding of what was being taught, but it might be that he lacked enough practice, as the concept was newly introduced in his class. Ellis, Denton & Bond (2014) submit that the use of explicit instruction requires learners to have enough practice for them to internalise the concept being taught.

4.4.2.2 Teaching of mathematics involving chalkboard use

In the two lessons I observed, the teacher seemed to prefer writing on the chalkboard when teaching mathematics in Ketsahalo's class. During one lesson, Ketsahalo seemed to encounter a difficulty of reading some words written on the chalkboard. He narrated his version of the story, regarding what transpired in that lesson, "When I was reading those words, I was not able to see clearly. Where it was written 'as' I was not sure whether it was 'as' because to me it appeared as 'are'." This assertion shows that Ketsahalo encountered difficulties when reading some sentences that were written on the chalkboard as shown in Figure 4.7 below.

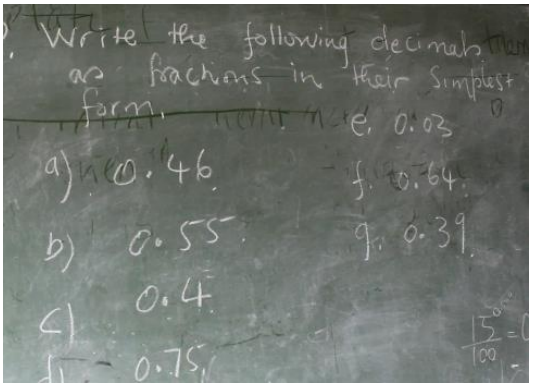


Figure 4. 7: Depiction of the question that Ketsahalo was struggling to read.

Ketsahalo pointed out that, “I should be taught using visible handwriting and small cursive writing should not be used. This is because I often don’t see what has been written.” The implication here is that Ketsahalo’s teacher wrote illegibly and that resulted in his difficulty in reading. The following extract illustrates the incident.

Teacher	I am asking this boy. [She points at Ketsahalo.] Can you read question two for us? What does it say?
Ketsahalo	Write the following decimal are … [He struggles to complete a sentence and he pauses for a moment] in the simple form.
Teacher:	In their …
Ketsahalo	In their simple form.
Teacher:	Read that word properly! In their …
Ketsahalo:	In their simplest form.
Teacher:	Hmm! What did you say here? [She points at the word “as”]
Ketsahalo	Are.
Teacher:	Are? Who can help him?
Sighted learner:	Write the following decimals as fractions in their simplest form.
Teacher:	Did you hear what she said? She said this word is? [She points at the word “as”]. As! [She says the word emphatically.]
Ketsahalo:	Write the following decimals as fractions in their simplest form.
Teacher:	Okay.

This extract demonstrates that Ketsahalo struggled to read correctly from the chalkboard, as instructed by the teacher. This gives the impression that Ketsahalo confused some of the words, because he was unable to access the information displayed on the chalkboard clearly. Recalling what happened during that lesson, his teacher pointed out that, “I said he should read what is written on the board. You realised that there was one word he couldn’t see. I can’t remember how he pronounced it. […] When he reads what is not written on the board, I ask another person to read for him”. This suggests that the teacher was aware that Ketsahalo had a difficulty in

reading information displayed on the chalkboard and she made an effort to help him out. While the teacher's attempt to ensure that Ketsahalo can read correctly what is on the chalkboard, the experience of misreading in front of the whole class could sometimes be counterproductive and embarrassing.

The teacher explained how she made sure that Ketsahalo got involved during the lesson, "I lately give him a little bit more attention than others to find out whether he sees properly on the chalkboard". This was manifested in the following conversation between the teacher and Ketsahalo during the lesson:

Teacher:	The fraction that is shaded is one over 100. [She writes on the board] So this $\frac{1}{100}$ is the fraction that is shaded. […] Can you see clearly? [She asks Ketsahalo]
Ketsahalo	Yes madam.

The teacher's question was referring to the first diagram illustrated in Figure 4.8 below.

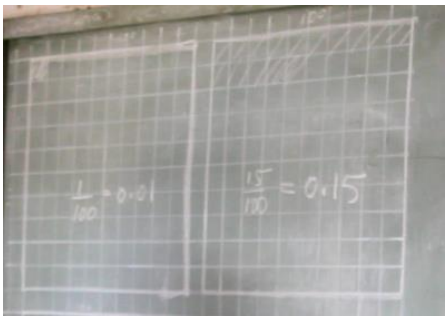


Figure 4. 8: Illustration of the teacher's use of diagrams to teach conversion of fractions to decimals.

It was evident that the teacher tried to ensure that Ketsahalo followed what was discussed as she asked him whether he could see clearly. Even though Ketsahalo said he could see the chalkboard clearly, he failed to count the number of shaded squares as per the teacher's instruction. The following extract captures what happened:

Teacher:	Can you count how many squares have I shaded? [The statement is directed to Ketsahalo and she refers to a second diagram in figure 4-8].
Ketsahalo:	Smaller squares?
Teacher:	Yes, smaller squares.
Ketsahalo:	100.
Teacher:	The ones I have just shaded. This ones [She points at the shaded squares].

Ketsahalo: [takes a little while to count the smaller squares and he seems to do so with difficulty.]
Teacher: How many are they?
Ketsahalo: 15.
Teacher: 15. Is that so?
Learners: Yes madam.

The shaded squares appeared too faint, as illustrated in Figure 4.8, possibly denying him a clear access to what was displayed. The data presented here show that Ketsahalo accessed information on the chalkboard with great difficulty. On one occasion, he was only able to read a sentence after being assisted by the teacher and a sighted learner. It was evident that Ketsahalo also needed more time to figure out the number of shaded squares of the diagram drawn on the chalkboard. Except for asking Ketsahalo whether he could read from the board, it was evident that the teacher continued to teach mathematics in what Gallagher, Bennett, Keen and Muspratt (2017) refer to as “traditional form of instruction”. Therefore, it is important to consider that teaching of mathematics to the visually impaired learner requires the teacher to use legible handwriting and brighter colours when drawing diagrams.

When asked whether he had ever consulted a teacher whenever he encountered problems with his work, Ketsahalo replied that, “I have never done that.” He explained that, “I have that problem of consulting a teacher. But when I encounter a challenge regarding the handwriting on the chalkboard, I usually tell the teacher that I am not able to see what has been written.”

The first part of his statement implies that he is hesitant to seek help from the teacher. This was evidenced by the fact that Ketsahalo neither posed a question to the teacher nor complained about not being able to see the information on the chalkboard even when the situation required him to do so. He explained his reluctance to consult the mathematics teacher as follows, “I have never been in the staffroom to ask the maths teacher questions. As I haven’t been there I don’t know exactly where I would find her as there are many rooms up there.” When asked whether he had ever considered approaching the teacher immediately after the lesson, he admitted that, “I am being honest here, I never thought of doing that.”

This information suggests that Ketsahalo was shy to consult the teacher during and after the lesson. He did not feel confident enough to approach the teacher with questions. This resonates with the findings by Bansilal, James and Naidoo (2010), which reveal that some learners are shy and not prepared to consult their mathematics teachers, because they avoid negative remarks that could diminish their confidence. In the same vein, Ketsahalo's reluctance to consult a teacher suggests that he might sometimes not get the help he needs at the appropriate time.

4.4.2.3 How Ketsahalo's pace of writing affected his learning

When talking about the normal procedure that the teacher used when marking classwork, Ketsahalo said, "Your book gets marked when you have got correct answers. When you have incorrect answers you are guided as to how you can approach the task. After that, I make some corrections and I resubmit." On the issue of whether his work on mathematics always gets marked, Ketsahalo stated that, "When I get incorrect answers, I make corrections. But sometimes we would be told that the time is up; as a result, I would not be able to resubmit in that case." This statement shows that there are instances when Ketsahalo fails to get his work assessed. In that case, it would be difficult for him to discern his level of understanding of the concept being taught. He talked about the time he normally takes to complete a task in mathematics, "I sometimes finish mathematics tasks on time. But, when we are given too much work, I am not able to complete it in the stipulated time."

This was evident in one of the lessons I observed. As the teacher moved around marking learners' work, she arrived at Ketsahalo's desk and realised that he had incorrectly copied a certain fraction from the book. She then requested Ketsahalo to properly copy what was written in the book and he complied. Ketsahalo confirmed this by saying:

> I sometimes get wrong answers, because I write incorrect things from the textbook. I am trying my best to copy properly from the textbook. […] Even when I write things from the textbook they come out to be wrong. Now I am trying my best to closely look at the book, in order to be able to copy them properly.

In light of this declaration, Ketsahalo's poor sight impacted on his copying information in the textbook accurately. As an attempt to 'copy properly', Ketsahalo was seen holding the textbook closer to his eyes to have a better view and that seemed to take him far too long. As Ketsahalo was still working out an answer to the exercise, another learner was sent to work it out on the chalkboard. Therefore, Ketsahalo had to abandon whatever he had been doing, in order to keep up with the pace of the class. Clearly, Ketsahalo could not finish the task within the stipulated time. Ultimately, his work on that task was not marked, meaning that he was excluded from participating in the task on the basis of being slow when writing. This suggests that Ketsahalo might require more time than other learners to finish the tasks given. Jessup, Bundy, Broom and Hancock (2017) mention this factor as one of the challenges that often prevent visually impaired learners to complete the school curriculum. These researchers emphasise that the value of time should be respected, as it is very important for the learning of the visually impaired learners to maintain academic parity with their sighted peers. Ketsahalo's teacher seemed to be aware of this challenge when it comes to completing the tasks on time, hence she said:

> This little one who wears spectacles is a bit slow and you need to push him. I try to check what he is writing, because he takes a long time to do something even when it is short, which other learners can take just a few minutes to complete. He takes such a long time. I am not sure as to whether it is because of the disability or what, but he is very slow.

The evidence reflects that Ketsahalo's level of vision made it difficult for him to copy accurately from the textbook and that led him to get unexpected answers. Evidently, Ketsahalo took too long to complete a task given by the teacher, and his slow pace made him fall behind with his schoolwork. This is consistent with scholarship that shows that a visually impaired learner can take longer than the stipulated time to complete a task (Bardin & Lewis, 2008). These researchers found out that even capable learners with visual impairment can also encounter a challenge of keeping up with the pace of the lesson. Even though the teacher was aware of the challenge that Ketsahalo encountered, she might have put him under a lot of pressure to complete a task within a short space of time, as she stated that, "you need to push him". She did not take into consideration that Ketsahalo might need more time than others to complete a task.

4.4.3 Scarcity of textbooks and assistive technology devices

This subsection explores how the limited provision of learning resources shaped Ketsahalo's learning experiences in the inclusive classroom. The discussion focuses on the limited number of textbooks in Ketsahalo's class and the assistive technology devices.

4.4.3.1 Challenges brought by the scarcity of textbooks

Ketsahalo confirmed that he had a mathematics textbook to use, which he often shared with classmates, "They [my classmates] also have textbooks, but they always leave them at home. So, I am now compelled to share my textbook when they have left theirs at home. When I take a textbook and place it next to me, they also suffer. They complain that they don't see what is written in the textbook." Ketsahalo was not entirely happy with the sharing of his textbooks with his classmates, as he stated that, "I really struggle a lot when I am sharing a mathematics textbook with them. Sharing the textbook disturbs me a lot. They leave their textbooks at home expecting to use ours." This statement expresses his dissatisfaction in sharing a textbook with his sighted classmates who deliberately leave theirs at home.

Moreover, it is also implied that Ketsahalo found the attitude of his classmates completely unreasonable when he told them about his discomfort, with respect to their conduct. He explained that, "They normally get offended when I tell them that. Honestly, I am not able to share a textbook, especially a maths textbook." Ketsahalo further indicated that, "I make sure that the maths textbook is always here. This is because we have maths lessons each and every day. There is no single day that we don't have a maths lesson."

Ketsahalo elaborated further that, "I usually sit at the far end of the desk and the textbook would be placed in the middle where everyone can access it." This kind of arrangement allegedly hindered Ketsahalo from properly seeing what is written in the textbook as he disclosed that, "When I am sharing a book with others, I am not able to write correct things."

It emerged later on that Ketsahalo no longer brought his textbooks to school on a regular basis. He said that, “I always ensure that I keep an eye on my textbook whenever I bring it. I make sure that it doesn’t go from one desk to another, because they would end up stealing it.” Ketsahalo clarified what led him to take that decision:

> I started leaving it at home simply because I realised that there was a high rate of theft at the school. Some textbooks of other learners were stolen. I then decided to leave mine at home, in order to avoid paying large amounts of money. […] I realised that someone has lost three books through theft.

However, Ketsahalo admitted that he suffered when his textbook is left at home. He explained how he managed to do classwork when he did not have his textbook with him, “If someone sitting next to me has a textbook, I look at all the questions in the textbook and then answer them.”

The issue of scarcity of the textbooks became clear in the lessons I observed, as the teacher gave learners some practice exercises. I observed that during that activity, the learners moved around trying to locate those who had brought their textbooks. The teacher also seemed to be aware that most learners did not have textbooks and she affirmed the challenges arising from this scarcity in the following manner:

> There are not enough textbooks. These learners did not get textbooks. You would find that half the class are not provided with textbooks, even though they have paid for them. So I think the best thing to do is that we can photocopy papers so that a few learners could share, avoiding the situation whereby 10 learners share one textbook. But now we don’t have access to that. We move very slowly.

This gives the impression that a limited number of textbooks in Ketsahalo’s classroom affected the pace of the lesson. The teacher stated the implication of this scarcity as follows, “It means we are not going to finish the syllabus if we are going to move at this pace. Yah, we are not going to finish. Because with some of the things we can write on the chalkboard, but there are those that you can’t write on the chalkboard, especially the diagrams.”

The exposition suggests that the teacher considered textbooks to be very essential in facilitating mathematics lessons, as they present certain information in diagrams that might be difficult to draw on the board. The teacher was also aware that the scarcity of textbooks could negatively affect syllabus coverage in Ketsahalo's classroom. Data show that despite this existing challenge, the teacher insisted on giving exercises from the textbook and this could imply that the content coverage would clearly be at risk.

4.4.3.2 Using the assistive technology devices

When addressing the issue of whether he was aware that the school had devices, which can help him read things written in smaller font, Ketsahalo claimed that, "I didn't know when I enrolled in this school that they have such kinds of equipment. I was only told that they are there, but I haven't seen them as yet. I haven't used them as yet." This statement gives the impression that Ketsahalo had not used the devices to his advantage, yet they were intended to support him, as well as other learners who have visual impairment.

Again, this implies that Ketsahalo was not prohibited from accessing the devices. He clarified that, "There is no one who said I shouldn't go and fetch that device. It's me who has decided not to do so. No one has ever stopped me from doing that. I was requested to go there and fetch the device, even though it wasn't specified that I should go there every day." This suggests that Ketsahalo had decided not to use assistive technology devices available at his school, despite having been requested to do so by his teachers.

His mathematics teacher confirmed this when talking about the conversation she had with a support teacher who looks after the welfare of the LSEN, she recounted that, "I asked her, 'do you know such and such a child [Ketsahalo], I learned that there are learners who are given some magnifying machines here, and did you attend to him?' Her reply was that, 'He doesn't want to come; I called him several times but he didn't come."

This implies that Ketsahalo was reluctant to use assistive devices even after several attempts were made by his teachers to persuade him to do so. Ketsahalo explains why he is not making effective use of assistive devices in this way:

> I only used that device once. But from there, I never went to fetch it again. This is because of the fact that most of the time I arrive late. I sometimes tend to feel disinclined to go there where the devices are placed. After late arrival, I get punished and thereafter I become hesitant to go there to fetch the device.

The data show that Ketsahalo had lost interest in using the assistive devices that his school provided for learners with visual impairment. In part because they put him in danger of being punished, especially when he arrived late. The implication here is that at times the available assistive technology device might be ineffectively used or abandoned permanently.

4.4.4 Ketsahalo's perceived competence in mathematics

Ketsahalo seems to perceive his performance in mathematics as taking a downward trend. Commenting on his performance in mathematics since he enrolled into his current school, he admitted that, "I was so surprised as I failed mathematics after […] arriving at this school." This shows that Ketsahalo seemed to be concerned about his declining performance since he arrived at his current school. He appeared to be sceptical about his competence in mathematics as he remarked that, "I like to pass mathematics. I know it a little bit and it sometimes gives me problems." Ketsahalo's self-confidence seemed to be at a low level since he declared that, "Truth be told, I now doubt myself whether I am competent enough in mathematics any longer. I can build my confidence if I work extremely hard, so that my performance improves."

At first, Ketsahalo seemed to be unaware of the reasons that might have led to his worsening performance scores in mathematics, as it can be read from his response, "I really don't know." Later on, Ketsahalo had excuses to account for his poor performance in mathematics, which he revealed in the follow-up interview where he was reporting about his performance in the mid-term examinations. He said that, "You know I didn't perform well in the winter exams. This is because I found some of the

questions very challenging." He clarified that, "I can say I obtained a mark less than a half. This is because a question paper that we were using gave me some trouble. I didn't understand most of the questions that were asked in the mathematics question paper. Some of the concepts had been taught, while others were not."

This gives the impression that Ketsahalo's unsatisfactory performance resulted from his lack of understanding of the concepts that were assessed, as some of them were allegedly not yet taught. Describing the possibility of being assessed on what was not taught, Ketsahalo talked about the existence of common papers at his school in the following details, "Sometimes question papers are similar, such that those of A_1 are the same as those of A_2. There are instances when they are exactly the same. This happened when we were taught the same things. But you would find that in most cases some teachers are ahead of others."

Ketsahalo also admitted that his level of preparedness for writing the mathematics paper was not up to standard. He shared his experience about this in the following manner, "I think what contributed to this was that my exercise book got missing a few days before we wrote the maths paper. In that book I was writing classwork. If it was there, I could have used it for revising." He seemed to be sure that the book got lost at school, as the issue of stealing books appeared to be a common practice. He further indicated that, "Teachers advised us to always carry our schoolbags wherever we go." This gives the impression that thorough preparation could be an essential element considered to be a missed opportunity in Ketsahalo's case.

However, his teacher on the other hand, seemed to believe that sight defects might be the reason for Ketsahalo's poor performance in mathematics as she said that, "I think it is because he doesn't see, not the matter of incompetence. This is because in his book you would find that he writes answers properly when attempting some of the questions."

The above discussion suggests that Ketsahalo's self-esteem happened to be very low as a result of a downward trend in his performance in mathematics. Ketsahalo attributed his unsatisfactory academic performance to inadequate preparation for tests, as well as a lack of understanding of certain concepts that were not covered in

class. However, his teacher believed visual impairment might have contributed to this unfavourable outcome. It has been widely reported in the previous studies that learners with visual impairment tend to perform at a lower level in mathematics (Beal & Shaw, 2008; Ukeli & Akem, 2013), which may be the case in this instance.

4.4.5 Summary of Ketsahalo's learning experiences of mathematics

The data presented show that Ketsahalo's mathematics lessons were dominated by the teacher's verbal communication and chalkboard use. The teacher taught mathematics concepts by demonstrating examples that learners were expected to follow when working on the exercises. However, Ketsahalo misinterpreted the example that the teacher displayed on the chalkboard and that resulted in incorrect answers. On occasions when learners were given classwork, the teacher was seen going around marking their work or helping some individuals where necessary. At times, Ketsahalo's work was not marked as he was supposedly very slow when writing; therefore, he seemed to struggle to keep up with the pace of the lesson.

There were situations that affected how Ketsahalo engaged with the teaching of mathematics in his class. For instance, the scarcity of textbooks was evident during the observed lessons. Despite this, the teacher kept giving classwork from the textbook. Again, Ketsahalo had a mathematics textbook, which he always shared with his colleagues sitting next to him. However, sharing the textbook had been detrimental to Ketsahalo, as he complained that he was not able to access information from it as he was often distracted. This negatively affected his level of engagement in lesson activities. In this case, having a textbook seemed not to guarantee increased opportunities for him to learn. Ketsahalo later indicated that he no longer brings the textbook to school and that compromised his learning experiences.

Data further reveal that the school that Ketsahalo attended, provided assistive technology devices for learners with visual impairment. It emerged that Ketsahalo never took advantage of this, even after his teachers advised him to make use of such devices. This gives the impression that the availability of assistive technology devices can only maximise opportunities to learn if they are used efficiently.

In the same vein, Ketsahalo admitted that his performance had been consistently declining. His teacher was of the view that visual impairment contributed immensely to Ketsahalo's declining performance in mathematics. Contrarily, Ketsahalo did not mention this as the main factor, but he seemed to be adamant that he did not understand some of the questions asked in the assessment tests, as some concepts had not been taught before. On the basis of the presented data, it can be inferred that Ketsahalo's self-confidence in mathematics was at a very low level.

It emerged from the findings that Ketsahalo always sits in the front row, with the purpose of easily accessing information displayed on the board. On the contrary, sitting in the front row seems not to help him much, because his condition of visual impairment does not allow him to access information written in cursive handwriting on the board. Data also show that Ketsahalo had difficulty in accessing information from the textbook. This seemed to affect his level of engagement in the activities of a lesson. His pair of old spectacles, which he could not afford to replace, due to financial constraints, did not help him read the information displayed on the chalkboard as well as in the textbook. This kind of situation minimised Ketsahalo's opportunities to learn.

Chapter Five

5. Cross-case analysis and discussion of the findings

5.1 Introduction

In this chapter comparisons are largely made in terms of the themes emerging from the presented data. These themes serve to guide the presentation of a cross-case analysis. I begin by comparing the different personal backgrounds of the three learners, followed by the outline of their classroom setting and learning experiences in the mathematics classrooms. Thereafter, I compare how each of the three cases perceived and engaged with the teaching of mathematics.

5.2 Learner backgrounds

Table 5.1 below shows that all three cases were of male learners with a partial sighted condition. This should not create the impression that there were no females with visual impairment in the targeted classrooms. Actually, these cases were selected, using purposive sampling techniques, guided primarily by the learners' willingness to share their experiences, as well as the richness of data they provided. However, I was able to notice that the boys with visual impairment were a bit dominant in the targeted classrooms.

Table 5. 1: A summary of personal background of three learners with visual impairment.

School	**Learner**	**Gender**	**Age**	**Visual impairment condition**	**Grade**	**Size of class**	**Number of visually impaired learners**	**Teacher's experience of teaching learners with visual impairment**
School A	Ketsahalo	Male	15	Partial sightedness	8	45	2	Less than a year
School B	Pheello	Male	17	Partial sightedness	9	31	5	9 years
	Phethahalo	Male	19	Severe partial sightedness	8	55	8	

Data show that Phethahalo had difficulty accessing information displayed on the chalkboard, because of his visual impairment condition. Thus, he relied much more on

his sense of hearing when learning. He mostly accessed information from the teacher's verbal communication in the classroom. For the third case, Ketsahalo's level of visual impairment did not allow him to see properly without the aid of a pair of spectacles. His pair of old spectacles, that he was unable to replace, due to lack of funds, however did not help him see properly either. This suggests that his under-resourced background might have contributed towards the worsening of his disability condition. Kasiram and Subrayen (2013) report that there is a strong connection between disability and poverty. Similarly, data show that Pheello's sight deteriorated along the way, due to lack of resources and this made his vision less and less effective when participating in classroom activities, especially those activities that required a sense of vision. Pheello, therefore also had a challenge when reading small font or reading from a chalkboard, hence his pace of writing was affected negatively.

5.3 Classroom settings

In this section I explored whether the classroom environment was conducive for effective teaching of mathematics for learners with visual impairment. Among the issues I examined include the physical space, learner population and the sitting arrangement. I observed that the classrooms of Pheello and Ketsahalo were relatively spacious, allowing their teachers to move around and help individual learners. I observed that teachers often exploited that opportunity by making rounds, especially when marking learners' classwork. Phethahalo's classroom was rather congested, due to the large learner population and relatively small classrooms. I observed that this situation affected lesson facilitation as it might restrict the teacher's movement around the class. The teacher also complained that it is quite difficult to try-out different combinations of grouping learners in the congested class. These aligns with the findings of other studies, which indicate that learner population affect implementation of Inclusive Education in mainstream classrooms, particularly in the context of developing countries. In reporting about the situation in Kenya, Odongo and Davidson (2016: 227) found that "it is very difficult for the regular education teachers to include students with special needs and to individualize instruction especially with big classrooms sizes". Ali (2018) found that in Egypt, one of the challenges that hinder individualised instruction in the inclusive setting is large classes. Several studies conducted in Botswana also point to a similar challenge, for instance, according to

Mukhopadhyay, Nenty and Abosi (2012: 6), “large class sizes also were thought to diminish the adaptation of learning materials, use of differentiated instructions, and peer-assisted learning.” Mangope, Otukile-Mongwaketse, Dinama and Kuyini (2018) conclude that large class size is not a conducive learning environment for learners with diverse educational needs. Phillimon and Chabaya (2016: 75) argue that “teachers find it difficult to give individualised educational instruction to [learners] with visual impairment” in inclusive schools with high teacher-pupil ratio.

The marked contrast between the situations in these two schools is the relatively substantial number of learners with visual impairment in the classroom. The high number of visually impaired learners in the classrooms of both Phethahalo and Pheello posed a challenge when it comes to providing adequate support during mathematics lessons for each individual learner with visual impairment. This would imply that the low number of learners with visual impairment in Ketsahalo’s classroom could be the ideal situation for the teacher to have a manageable number of visually impaired learners to work with. However, the fact that the total number of learners in this regular classroom was on average 45 does not make it easy for the teacher to interact with individual learners and facilitate effective instruction during the mathematics lessons. This means that the learners with visual impairment may be on the losing end when placed in the environment that is not conducive for learning. Cawthon *et al.* (2012) submit that placement of the learners with special educational needs in the “least restrictive environment” could facilitate high levels of OTL. In their study, Zhu, Li and Hsieh (2019) observe that teachers preferred scaling down the number of learners with special educational needs in the inclusive classroom as one way of dealing with limited resources and time, as well as a heavy workload that negatively affect teachers’ preparations for lessons.

The presented data show that the sitting position of all visually impaired learners in the targeted classrooms was in front. Ketsahalo had the liberty to choose his sitting position and he preferred to sit in front with the intention of accessing the information displayed on the board with ease. Even though Ketsahalo occupied the desk located in the middle column of the desks, I observed that sitting in front for him did not guarantee him perfect view of the chalkboard. His severe condition of visual impairment makes it almost impossible for him to access information displayed on the

chalkboard, even from an ideal sitting position. I noticed this further when he made several attempts to read a sentence written on the board, but failed to read it properly. Again, data demonstrate that it was compulsory for the learners with visual impairment to sit in front in the classrooms of both Pheello and Phethahalo. However, the data show that their mathematics teacher had a minimum role to play in adjusting the classroom arrangement. In their classrooms, the visually impaired learners were sitting side by side, because of their significant number. Sitting at the same desk certainly minimised their interactions with their sighted peers. Consequently, learning from each other by sharing ideas was in reality a far-fetched concept. For them, sitting in front served a purpose of convenience in terms of movement in and out of the classroom.

The findings of this study seem to be consistent with existing literature, which suggests that learners with visual impairment often sit in front. Habulezi and Phasha (2012) state that the advantage of occupying front seats by learners with visual impairment, is getting closer to the teacher and also for maximising access to the chalkboard. Negiloni, Ramani and Sudhir (2019) show that sitting in the middle of the front row is a favourable position for increased visual acuity, and it was evident that this was unhelpful for Ketsahalo, owing to his visual impairment condition. Akomolafe and Adesua (2015: 21) expect teachers to have full control of the classroom organisation as they argue, “teachers should adjust the classroom environment to students’ preferences. [...] By making it more comfortable and functional for learning to take place, so that students can learn and perform better academically.” Similarly, Maemba, Maina and Ogola (2016) also emphasise the importance of classroom arrangement by suggesting that it should be kept the same way for learners with visual impairment to be familiar with the classroom setting. Mboshi (2018) argues that learning of the learners with visual impairment can be improved in an Inclusive Educational setting by organising classrooms in a way that allows easy movement and social interactions. The purpose of inclusion, as argued by Tuggar (2014) is to promote positive interactions between learners with diverse educational needs in the classroom. This was perhaps a missing element in the classrooms of Pheello and Phethahalo.

5.4 Teaching of mathematics in the targeted classrooms

This section explores how mathematics lessons were facilitated in the targeted classrooms of the three cases studied here. It enables me to address the first sub-research question in this study: How is mathematics taught in classrooms with visually impaired learners?

Based on the data presented, across all cases, learners with visual impairment were taught the same mathematics curriculum alongside the sighted learners. The mathematics lessons were largely facilitated by verbal communication and chalkboard use across the three cases. The fact that Pheello and Phethahalo were taught by the same mathematics teacher could mean that they were exposed to similar conditions with respect to how mathematics was being taught. The only difference was that Phethahalo relied only on the teacher's verbal expression during mathematics lessons, due to the severity of his visual impairment condition. Pheello commended his mathematics teacher for talking and writing simultaneously when teaching. He also stated that his teacher's handwriting could be read easily on the chalkboard. This implies that Pheello still had an opportunity to use his residual vision to access information displayed on the board. This is evidenced by the teacher who occasionally gives notes to learners. However, Pheello did not take full advantage of this opportunity as he said, "He thinks we are taking them [notes], but I never take them." I find it rather surprising that Pheello only preferred listening attentively and selectively memorising what the teacher said. This shows that even when opportunities to learn are made available, learners with visual impairment have their own preferences in terms of how they want to learn. It is noteworthy that Pheello seems to be a unique case, which demonstrates that a visually impaired learner has a full control over opportunities that he can benefit from, in order to learn.

Both Pheello and Phethahalo seemed to depend more on a sense of hearing and memorisation. However, Pheello had options in terms of accessing information. He decided to rely on memorisation and he clarified that he only concentrated on those mathematics concepts that could help him to answer specific questions. Phethahalo's visual impairment condition would not allow him to access what was written on the chalkboard and that required him to "listen attentively to what the teacher said".

Phethahalo also reported that the teacher often provided him with hand-outs in an accessible format as a form of intervention to aid his learning.

Similarly, Phethahalo expressed satisfaction with the manner in which his teacher taught him. Phethahalo proudly demonstrated that his teacher always made provisions that enabled him to participate in lesson tasks. He mentioned that his teacher gave him exercises in Braille format. The teacher also gave learners with visual impairment the improvised tactile diagrams so that they could have an idea of what was being dealt with in the mathematics lesson. This could mean that the teacher catered for his educational needs, which might result in increased opportunities to learn. It seemed that the teacher operated differently in Phethahalo's class, as compared to how he approached lessons in Pheello's class. When closely examining what might have been the cause of this difference, I realised that in Pheello's classroom the kind of visual impairment that learners had was low vision, whereas Phethahalo's classroom accommodated some learners who had severe conditions of visual impairment, including totally blind learners. Apparently, the teacher had an understanding that some learners in Phethahalo's classroom would have limited options of being exposed to a lesson task if he would ask them to use textbooks. This suggests that their mathematics teacher was familiar with these learners' individual learning needs; in both classes that he taught. This shows that a teacher who teaches learners with visual impairment in inclusive classrooms has a responsibility to establish ways of supporting learners of diverse educational needs.

The findings of this study show that instruction dominated by chalkboard use and verbal communication can be advantageous for some learners with visual impairment. However, the existing literature is highly critical of this teaching approach. Gallo-Toong (2020: 1) argues that "an overdependence of the chalk-and-talk method has resulted in unsatisfactory performance and poor attitude towards school mathematics for many students." Bouck, Weng and Satsangi (2016: 50) indicate that,

> Although reliance on audio for students who are blind and audio and visual for students with low vision is potentially concerning, […] [s]upport exists for the oral reading of mathematics assessments as an accommodation for students

with learning disabilities, indicating that an understanding of mathematics through listening is possible.

Lamichhane (2017) mentions that learners with visual impairment often encounter the difficulty to learn mathematics in the regular class, due to excessive use of a chalkboard. Altaf, Kawish and Anwar (2017) emphasise that the role of teachers is an essential aspect for achieving inclusive practices, such as teaching strategies and attitude towards learners of differing abilities. Whitburn (2014) reveals some effective strategies of inclusive pedagogy as appropriate communication modes and also availing accessible resources to learners with visual impairment. Similarly, Leo *et al*. (2017) argue that the provision of tactile diagrams would enable learners with visual impairment to have an idea of what was being dealt with in a lesson. Elliot *et al.* (2017) conclude that learners with special educational needs might need more opportunities to learn than their colleagues without impairments, in order for them to realise optimum academic achievement. These researchers found in their study that learners with special educational needs performed far below their classmates without impairments, despite being given equal opportunities to learn.

Data show that Ketsahalo was taught by the teacher who often demonstrated examples that learners were expected to follow when working on the exercises. Ketsahalo also told me that examples make him understand the concept being taught. He further elaborated that, “If you clearly understand how the example is done, you know exactly what to expect in the exercises”. However, I observed that Ketsahalo followed the example on the board without a clear understanding of the concept of place value, hence his written answer turned out to be incorrect. In this case, his visual impairment condition did not affect how he comprehended the example given. This should not create the impression that a visual impairment condition had no effect in Ketsahalo’s learning experiences in mathematics class. In fact, data show that there were instances that he had a difficulty when reading the information displayed on the chalkboard. He was only able to read the sentence properly after getting help from his classmate and the guidance of his teacher. Ketsahalo reasoned that the chalkboard was not properly cleaned and the cursive handwriting that his teacher had used, made it very difficult for him to read the sentence. He told me how he preferred to be taught, “I should be taught using visible handwriting and small cursive writing should not be

used. […] I often don't see what has been written." The data reveal that the teacher was also aware of Ketsahalo's challenge as she explained that, "I lately give him a little bit more attention than others to find out whether he sees properly on the board". The teacher perceived asking Ketsahalo whether he could see properly on the chalkboard, as giving him more attention. Except for this, the teacher continued to use a traditional form of instruction. Again, the severity of Ketsahalo's visual impairment affected him negatively to the extent that he incorrectly copied the exercises from the textbook. He narrated to me that, "I sometimes get wrong answers, because I write incorrect things from the textbook."

The existing scholarship laments the use of traditional forms of instruction in mathematics class. Gallagher *et al.* (2017) argue that the traditional form of instruction can be detrimental to the learning of learners with special educational needs, as they might require a different approach, which would cater for their diverse needs and learning styles. Similarly, Tan and Kastberg (2017: 25) observed that "opportunities that support development of mathematical reasoning and understanding of mathematics as a human endeavour often do not exist for mathematics learners identified in schools as having dis/ability." Hodgen *et al.* (2018) talk about the teacher-led strategies with specific focus on explicit instruction. They indicate that in this approach the teacher usually begins by sharing ideas and techniques in the form of worked examples and then provides detailed explanations. Afterwards, learners are engaged in extensive practice of routine exercises. However, according to Ellis *et al.* (2014), imitating the example without a clear understanding might result in rote learning, which cannot help a learner deal with a slightly different exercise. Hodgen *et al.* (2018: 8) also share similar sentiments by arguing that, "it is unlikely that explicit instruction is effective for all students across all mathematics topics at all times." In agreement of this, Abrahamson, Flood, Miele and Siu (2019: 293) conclude that "[m]athematics learning […] that assumes and requires vision as a prerequisite for participation will always underserve [learners with visual impairment]".

I also observed that the teacher made rounds to monitor learners' progress in Ketsahalo's class and also helped learners who might need guidance. The data presented reveal that Ketsahalo hardly consulted a teacher whenever he encountered problems with his work, as shown in this remark, "I have never done that. […] I have

that problem of consulting a teacher." Clearly, by not consulting the teacher, Ketsahalo might end up compromising his opportunities to learn. Bansilal *et al.* (2010) show that a shy learner might not feel confident to approach the teacher and sometimes can get scared when it is necessary to ask questions. Buli-Holmberg and Jeyaprathaban (2016) point out that learners build positive interaction with the teacher in their learning process when they get assistance in the one-to-one support practice.

The significance of homework in the teaching of mathematics

Data show that homework was very significant in the learning of mathematics for both Pheello and Phethahalo, as their teacher preferred giving it on a regular basis. For instance, Phethahalo explained how his mathematics teacher conducts lessons, "We often don't have written classwork in maths lessons. […] We all know that we are going to be given an assignment every day." Their mathematics teacher often marked learners' homework before the commencement of each lesson and used learners' feedback from homework to decide on whether he should conduct a remedial lesson or continue with a different topic. Remedial teaching was undertaken once the teacher realised that a considerable number of learners did not understand the concept being worked on. The teacher made a decision to reteach some concepts in Phethahalo's classroom as a way of helping most learners who apparently lacked a good foundation in mathematics. This could be one of the strategies that was used to ensure that learners get adequate opportunities to learn.

However, this strategy did not work to Pheello's advantage, as he was often not able to do his homework as expected. He could only do homework during the morning study period while he was at school, as he left all his files there when going home. This made it difficult for him to do homework or to read his notes at home. Pheello explained to me that, "Sometimes when I get here at school in the morning, I really don't have enough time for doing such homework." It can be deduced from Pheello's case that the strategy of assigning homework to learners on regular basis by the teacher might not always benefit some visually impaired learners, especially those who are day scholars. One can arrive at a conclusion that what works for one learner does not mean it can automatically be suitable for another. What might be considered as an

opportunity to learn for one learner might unintentionally create a barrier to learning for another learner.

Güven and Akçay (2019) state that homework is a common instructional practice and further mentioned some of its benefits that include providing an opportunity for learners to revisit mathematics concepts that had been taught during the lesson with a purpose of improving their understanding. This was also identified in the study conducted by Johnstone, Avagyan and Marutyan (2018) who found that it was difficult for learners with visual impairment to do the homework. Their findings reveal that some learners with visual impairment had no access to the same assistive technology devices at home as they did at school and that compelled them to stay longer after school or come early in the morning to finish homework.

Time allocation and the pace of a lesson

The data presented show that Ketsahalo was often unable to cope with the pace of a lesson. His teacher was also aware of this, as she mentioned that, “This little one who wears spectacles is a bit slow and you need to push him. […] He takes a long time to do something even when it is short, which other learners can take just a few minutes to complete.” Taking this into consideration, the teacher should have figured out that she should give Ketsahalo more time to complete a task, but that was not the case. I also realised during the observations that at times Ketsahalo’s work was not marked, as he had to abandon it to catch up with the rest of class. When the teacher gave assessment tasks, she ignored the fact that Ketsahalo takes a long time to complete a task, hence he struggled to keep up with the pace of a lesson. When closely studying Ketsahalo’s situation, he had the most unpleasant experience as he accordingly strived to participate in the classroom activities. If this continued, Ketsahalo would not stand a good chance of learning mathematics and he could end up losing interest in fully engaging in the classroom activities, since his efforts were often left unrecognised by his teacher. However, the teacher prioritises content coverage over learners’ understanding of the taught concepts, as she told me during the interview, “it means we are not going to finish the syllabus if we are going to move at this pace.”

Both Pheello and Phethahalo reported that the teacher often arrived late for mathematics lessons. Pheello had cast the blame for his own late arrival to class on his teacher. He specifically indicated that he always estimated the actual time that the teacher would get to class, knowing very well that he would definitely come late. Phethahalo also reiterated this and went further to say, “I have realised that when we have a double period, our maths teacher enters the classroom in the second period. He is someone who teaches very quickly before the lesson could come to an end.” This seems to demonstrate that the teacher taught in a rush, due to his consistent late arrival for lessons. When doing this, the teacher minimised the possible time for instruction, which might have compelled him to speed up the pace of a lesson to cover the content. However, considering that “[n]ot all [learners] learn at the same pace and in the same way” (Tichá, Abery, McMaster, Avagyan, Karapetyan & Paylozyan, 2018: 107), that could destabilise the possibility of achieving what Roos (2019) refers to as mathematical engagement and teaching for maximising opportunities to learn. Ramos and Gaviria (2012: 90) argue that effective use of time for instruction can “provide more exposure and opportunities for skills development among students.”

Studies show that a learner with special educational needs, specifically the visually impaired, may take longer time to complete a task when compared to their classmates with full functioning vision in an inclusive classroom (Connor & Cavendish, 2020; Maarof & Jalaludin, 2019). Lahav and Babai (2018: 296) point out that additional time is needed for learners with visual impairment “to access graphical information tactilely compared to visually. [A]t least five times more time is needed for [blind learners] to accomplish the task compared to those with sight.” Connor and Cavendish (2020: 10) report that learners with visual impairment described one of characteristics of the effective teacher as being someone who considers, “The importance of gauging a teaching pace compatible with student learning”. Asamoah, Ofori-Dua, Cudjoe, Abdullah and Nyarko (2018: 6) found that some teachers did not support Inclusive Education and their reason was that “[learners with visual impairment] could not keep up with the pace of normal classroom work.” Citing Florian (2017), Maarof and Jalaludin (2019) argue that “teachers should bear in mind that when teaching inclusively, some pupils would need more time, more practice and more instructions during the teaching phase”. Nagro, Hooks, Fraser and Cornelius (2016) argue that by increasing learners’ opportunities to respond, whether in written form or oral, a teacher

would certainly get the information that could be used in monitoring their progress and also inform instruction.

Appropriate assessment for a learner with visual impairment

It should also be pointed out that Phethahalo and other learners with visual impairment were not expected to draw any diagrams, rather the teacher gave them improvised tactile diagrams. Phethahalo unequivocally explained that, “Where there are diagrams, our maths teacher draws things for us in Braille. […] [H]e makes us use a sense of touch to help us develop a better understanding. […] When we are doing classwork that involves drawing of shapes, he would request us to provide some descriptions only.” He clarified that, unlike their sighted classmates, they were not required to draw diagrams such as shapes, but they were instead expected to describe the properties of the shapes.

Data further show that the teacher tended to mark learners’ work in the same way, irrespective of whether they were visually impaired or not. Actually, it was observed that the teacher used a red pen to mark learners’ work. Phethahalo indicated that the teacher “puts a cross [for a wrong answer] and a tick for correct answers”. This by itself was highly problematic for a visually impaired learner to be able to get the message, more especially when the marked ticks or crosses were on a Brailled paper. Phethahalo demonstrated his dependence on his teacher by stating that, “He tells us here you have got a wrong answer.” In confirmation of this, the teacher asserted that, “When I mark them, I keep telling them that this one is correct and this one is not. It informs them immediately that […] I have them all correct or this one I made a mistake here and there.” The teacher also used verbal feedback to compliment the tick and cross that he marked on the paper with a red pen.

However, in situations where the teacher would not be there, especially when preparing for the coming tests, Phethahalo relied on his sighted classmates to assist him. He explained that, “I usually come to other learners who are my classmates. They are the ones who help me by telling me whether I got a correct or a wrong answer to particular questions”. As someone with a relatively severe condition of sight defects, he could not access what is written on the paper. Data reflect that the teacher did not

use other alternative methods for assessing learners with visual impairment, which might be appropriate for their condition, including those that entail a sense of touch.

Studies interested in assessment within both the Mathematics Education and Inclusive Education fraternity, converge with the same argument that formative assessment could enhance effective learning and ultimately help learners realise improved academic achievement (Lisenbee & Tan, 2019; Tan & Kastberg, 2017). Florian and Beaton (2018: 871) advocate for self-assessment in inclusive classrooms. They argue that self-assessment creates opportunities for learners "to recognise that they have responsibilities in the learning process" and also "to develop a clear sense of their progress as they compare their current work to the previous work". Results of a study undertaken by Luque, Brandão, Kira and Brandão (2018) reveal that the majority of educators involved learners with visual impairment in group work and assessed them differently. Where graphical representations were involved, learners with visual impairment mentioned that they were tested on conceptual understanding and for others assessment was either conducted orally or by use of tactile drawings. On the other hand, for some learners there were no assessment tasks regarding topics that contain graphs. Formative assessment can provide evidence, which could be used for taking instructional decisions in terms of the accommodations needed that would help to facilitate the active involvement of learners with special educational needs, more especially in inclusive settings (McLeskey, Maheady, Billingsley, Brownell & Lewis, 2019).

5.5 Learner engagement with the teaching of mathematics

This section addresses the second sub-research question: How do visually impaired learners perceive and engage with the teaching of mathematics in selected classrooms of Lesotho? Of interest in this section is how each of the three cases perceived their competence in mathematics and how the provision of textbooks and the use of assistive devices in the different schools had affected the learning experiences of each of the three cases during mathematics lessons.

5.5.1 Perceived learner competence in mathematics

Pheello's performance in mathematics had been inconsistent, but then it was relatively satisfactory. He revealed his usual performance scores in mathematics as follows, "What I know is that I used to get 70's and 80's. My performance was fluctuating. At times it improved and in other instances it seemed to decline." Pheello believed that his performance in mathematics can improve if he can put more effort from the outset. He showed concern about his inconsistency in terms of academic performance, when he remarked that, "You would find that in some tests, I become playful whereas in some I show some commitment." Pheello connected getting lower marks to being playful and high marks as showing some determination. He expressed one of the reasons for his declining performance in this way, "I don't really have adequate time for my studies." As a day scholar, Pheello was unable to engage in his studies after normal school hours, as all his learning materials were left at school when he went home and that affected the amount of time he devoted to his studies.

Phethahalo was pleased about the efforts he had made that had possibly contributed to his improved performance in mathematics. He explained, "I have been working exceptionally well ever since my arrival here [at his current school]." However, Phethahalo was worried that his performance was declining instead of showing improvement. He identified one of the factors that resulted in his declining performance as "a lack of adequate preparation."

Ketsahalo's perception about his performance in mathematics contrasts with the cases that have been described above. Ketsahalo perceived his performance in mathematics as taking a downward trend. He conceded that he had consistently failed in the mathematics tests given, since he had enrolled in his current school. This outcome frustrated him as he was unaware of how these unfavourable results came about. This consistently low performance weakened his self-confidence, as he explicitly said that, "Truth be told, I am now doubting myself whether I am competent enough in mathematics any longer." However, his mathematics teacher was of the view that Ketsahalo's low performance could possibly be attributed to his visual impairment condition rather than any incompetence.

The existing literature show that the teacher quality is very significant in determining the academic achievement of learners. Suleymanov (2015) posits that the teacher quality is the main contributing factor to learner achievement in an inclusive classroom, compared to other issues such as the classroom context. According to this researcher, the level of achievements of learners with special educational needs depends on, amongst others, the teaching approaches that teachers use. Lahav and Babai (2018) suggest ways that teachers can use to create opportunities for effective learning that include selecting appropriate learning and instruction methods for the learners with visual impairment. Maarof and Jalaludin (2019) raise an argument that a teacher can address the educational needs of learners by applying a wide range of teaching strategies that would provide equal education opportunities for all learners, including those with special educational needs. Gallagher *et al.* (2017) advance an argument that teachers can create an enabling environment that could contribute to learners' improved academic achievement in inclusive classrooms. These researchers maintain that Inclusive Education can be achieved when teachers ensure that they plan lessons, while taking into consideration the needs of individual learners. This element was missing in the practices of all the participating teachers in this study. According to Korir and Kipkemboi (2014), learners under the guidance of a teacher considered to be ineffective, are likely to experience unsatisfactory progress, despite their individual academic potential.

5.5.2 Scarcity of textbooks

It was evident across all the cases that most of the tasks that their mathematics teachers gave the learners, were from the textbook. Pheello and Phethahalo both indicated that all learners with visual impairment in their school had no reference materials, such as textbooks in accessible formats. Data show that lack of textbooks affected how they engaged with assessment activities, such as homework. A lack of textbooks in their classrooms proved to be the major hindrance that prevented their active engagement during lessons. It was also observed that Pheello could not take part in doing classwork when given exercises from the textbook. In the case of Pheello and Phethahalo, there were absolutely no reference materials allocated for them in their school. They were mainly reliant on their sighted classmates when they needed to do the work from the textbook. When commenting on why these learners were not

given textbooks, their teacher made the following remark, “The low vision students are also not given books; but I don’t know why that might be the case. Maybe we have a perception that they are all blind.” This demonstrates that the selective provision of textbooks to only the sighted learners could minimise opportunities to learn for the learners with visual impairment. Under these conditions, it would be a challenge to successfully achieve inclusion.

It is rather surprising that those learners with visual impairment had no access to textbooks, despite efforts made by the Government of Lesotho (GoL) in introducing a programme of the textbook rental scheme (TRS) at the secondary level in all public schools (Lekhetho, 2013), including the two schools attended by the cases involved in this study. The main purpose of this scheme was to ensure a high retention rate of learners through reduced cost, while at the same time ensuring that they get access to quality teaching and learning materials (UNESCO, 2007).

Ketsahalo was the beneficiary of this programme, as he had textbooks. I noticed that there was a general scarcity of textbooks in Ketsahalo’s class when learners were engaged in classwork. I also observed that a number of learners had no textbooks and that compelled a large group of learners to share one textbook. For a visually impaired learner like Ketsahalo, it would be very difficult in such circumstances to access information from the textbook. However, the teacher kept giving classwork from the textbooks, despite their recognisable scarcity in class. Ketsahalo had a mathematics textbook that he always shared with his classmates sitting next to him. Data presented here show that sharing the textbook had been detrimental to Ketsahalo, as he complained that he was not able to access much information from it, as he was often distracted. In fact, it was also not easy for him to have a good view of the textbook due to his visual impairment condition. Clearly, this affected his level of engagement in lesson activities negatively. In this case, having a textbook seemed not to guarantee increased opportunities for him to learn. Ketsahalo later indicated that he no longer brings the textbook to school and that further disadvantaged his learning experiences. Even though being in possession of a textbook can be linked to high OTL by research (Cawthon *et al.,* 2012), Ketsahalo’s situation proves otherwise.

The findings of most studies on Inclusive Education, point to a lack of resources as the notable barrier to successful implementation inclusion. McCarthy and Shevlin (2017: 1021) identify as one of the issues that might hinder learners with visual impairment to effectively engage with the mathematics curriculum in the inclusive setting as “inappropriate and inadequate provision of mathematics books and materials in accessible formats.” Burr (2015) reveals that visually impaired learners were not often provided with the appropriate resources written in Braille and this promotes the issue of dependence on the teacher and sighted peers.

Meda (2016) states that learners with visual impairment may struggle to access textbooks written in small font. This researcher argues that lack of textbooks compatible for learners with visual impairment, could lead to undesirable performance, as it would make it difficult for them to prepare adequately for assessments. Dakwa (2014) also asserts that realisation of inclusion might not be possible when adequate resources, such as reading materials are unavailable for learners with visual impairment.

5.5.3 Inadequate supply of assistive devices

The schools attended by these three cases were in possession of digital magnifiers. Initially, Phethahalo indicated that he made good use of the magnifier. He explained its usefulness as follows, “A magnifier is quite helpful. When I am compelled to read a book, I won’t be able to access information with my naked eyes. Now that a magnifier enlarges text, I am able to read with ease.” Nevertheless, he provided an explanation that he only used it whenever his sighted colleagues could not read for him. Clearly, he was still dependent on his colleagues reading for him and the magnifier was merely used as an alternative means. Besides that, Phethahalo would still need to be granted permission to use the textbook of his sighted colleagues, in order to use the magnifier.

The presence of magnifiers did not resolve the issue of Phethahalo’s dependence on his sighted peers, as the challenge that stood out was the lack of textbooks for learners with visual impairment. The availability of the magnifiers in the school did not necessarily mean they would be useful for learners with visual impairment, but they would remain underutilised and Phethahalo confirmed this by saying that, “I have

realised that there is nobody using them anymore." In this case, abandoning of the magnifiers by learners with visual impairment might have been instigated by lack of textbooks, which is the issue beyond the learners' control.

Even though Ketsahalo's situation was not similar to the case discussed above, he was also at liberty to use digital magnifiers and a specialised tablet at the beginning of the 2018 academic year. The presented data showed that Ketsahalo rarely used the assistive devices, yet he was cognisant of their availability in his school. He explicitly told me that, "I haven't used them as yet. […] There is no one who said I shouldn't go and fetch that device. It's me who has decided not to do so." The mathematics teacher confirmed that Ketsahalo was reluctant to use the available devices, even after being persuaded to do so by the teacher responsible for the welfare of learners with special educational needs.

The placement of the magnifier in the office meant that he would only be able to use it while in the office. As writing schoolwork would require intense concentration from the learner, the office was not a conducive learning environment, as it could sometimes get noisy, because it serves many people including parents. He explained his situation in the following manner, "Most of the time I arrive late. I sometimes tend to feel disinclined to go there where the devices are placed. After late arrival, I get punished and thereafter I become hesitant to go there to fetch the device." Arriving late to school made him a culprit eligible for punishment, hence he ultimately decided to permanently abandon their use. Data show that abandoning assistive technology devices was not because they are less resourceful, but as a result of circumstantial challenges of a visually impaired learner.

The previous studies report about the importance of assistive technology devices in promoting effective instructional practice for visually impaired learners. Erdem (2017: 128) posits that the use of assistive technologies generally has a positive effect on the learners with special education. Silman *et al.* (2017) found that the use of the assistance of technology can motivate the end-users. Beal and Rosenblum (2018) share similar sentiments as they report that learners got more accurate answers in mathematics when using appropriate assistive technology and as a result they got

motivated. Tuwaym and Berry (2018: 8) view assistive technology devises as resourceful tools that can,

> Assist teachers in helping students with VI [visual impairment] reach their full potential. [...] Appropriate technology ensures that individuals with disabilities, such as VI, can fully participate in their learning environment and engage in a number of activities where, previously, they would not have been able. Moreover, considering that VI students may be highly motivated and enthusiastic to use and learn from the technology, the use of an AT [assistive technology] device may be credited with making learning and teaching more fun.

Watson *et al.* (2010) are of the view that the use of assistive technology devices can lead to improved learner performance. Sah (2013: 2271) indicates that "a large array of technologies have been developed to aid individuals with visual impairment with their ability to access information, travel independently, and take part in meaningful experiences." Other literature points to the ineffective use of the assistive technology devices that later led to their discontinued use. Riemer-Ross and Wacker (2000) argue that one of the factors that might lead to the discontinued use of assistive devices could be the lack of involvement of the end users. Coleman (2011) reports that a range of factors caused discontinued use of assistive devices among the visually impaired learners, including not being conversant with how to manipulate the devices. Hemmingsson, Lidström and Nygård (2009) contend that a visually impaired learner might sometimes perceive the use of assistive devices as a clear sign that can expose the kind of disability that one has. In this case, a learner might feel embarrassed when getting unwarranted attention or in extreme cases get subjected to ridicule when noticed by everyone in the school.

Challenges caused by the scarcity of Perkins Braillers

Data presented reflect that Phethahalo and Pheello encountered a challenge of Perkins Braillers that were in short supply and many of them were malfunctioning. The inadequate number of Perkins Braillers negatively affected the learning experiences of Phethahalo, Pheello and all the other learners with visual impairment in their school. During mathematics lessons, Pheello had to go out of class to search for a Perkins

Brailler and that only happened after the teacher had given them the classwork. He often took a long time to get one, as most of his time was spent carrying out a repeated process of trial and error until such a time when he finally came across a functional Perkins Brailler. It was highly likely that he would miss out on important information imparted while he was out of the classroom. Pheello was accustomed to working out the mathematics exercises on a sheet of paper with a pen before he would transcribe the answer obtained into Braille.

Phethahalo always used a Perkins Brailler when writing classwork and assignments. In all the observed mathematics lessons, he was seen in possession of this assistive device. He, however, reiterated similar challenges that Pheello alluded to, as regards to the scarcity of Perkins Braillers. He also pointed out that going out in search of the device would often make him lose out, as the lesson's proceedings would not stop for his sake. Over and above the hardships that his colleague alleged to have endured, Phethahalo seemed to have suffered blatant discrimination instigated by the senior learners. They denied him and fellow classmates access to Perkins Braillers by hiding those in a good condition in the cupboards.

This scenario shows that the inadequate supply of Perkins Braillers posed a serious challenge for these two cases. Actually, they faced a difficultly of making a choice of proceeding with the activities during the lesson without assistive devices and that was unlikely to benefit them, or to continue with the process of searching for the devices, which also evidently compromised the valuable time for instruction. Literature shows that inadequate provision of assistive resources for learners with visual impairment, can affect their academic achievement negatively. Dakwa's (2014) findings of a study conducted in the context of under-resourced inclusive schools, revealed that learners with visual impairment often encounter a challenge of inadequate assistive devices to support their inclusion, due to a deficiency of resources that repair them. Phillimon and Chabaya (2016: 74) remark that an inadequate supply of resources might imply that "[learners] with visual impairments' eagerness to academically benefit from Inclusive Education settings cannot be stimulated." Their findings also reveal that a lack of appropriate resources affected academic performance of learners with visual impairment in examinations (Phillimon & Chabaya, 2016). Ramos and Gaviria (2012:

90) consider provision of better resources as one of “OTL standards that would guarantee equity and opportunities for all”.

5.5.4 Level of cooperation among peers

The presented data show that at times learners with visual impairment were provided the support by their sighted colleagues. For instance, Phethahalo often got help from his sighted classmates. He remarked that, “Some of them […] seem to understand that they have to help us. Whenever we need their help, they usually cooperate.” However, the findings presented here show that there had been some instances when Phethahalo’s sighted classmates became less cooperative. He explained how that happened, “Sometimes they refuse to read for us and create stories, claiming that they are busy.” Phethahalo told me that, “It’s only a few individuals who are willing to help us out. When they are engaged elsewhere we become stranded.” Clearly, learners with visual impairment were to a large extent reliant on their colleagues with functional vision. As a result, their learning was affected negatively when they could not get help.

Phethahalo revealed that he never benefitted from working as a group in class. In fact, he reported that his classmates in the group expected more of a contribution from his side, because he was the most knowledgeable among all the members. In light of the presented data, Phethahalo might have not been aware that giving answers to the group might, at the same time, help in promoting his thinking capacity. What can be learned from this case is that visually impaired learners might not always be dependent on their sighted colleagues, when involved in discussion groups. The learner dependence should not only be perceived as being one-dimensional as the presented data revealed that sighted learners can also get help from their visually impaired colleagues.

If these reports are considered to be accurate, it would require the sighted learners to be conversant with Braille, so that they would not solely rely on their visually impaired colleague’s verbal expression. Apart from this, Phethahalo and other visually impaired learners could perhaps get the opportunity to write for the group, which was almost impossible in their current situation. In spite of this, the prevailing challenge that would hold back the achievement of this was that sighted learners showed no interest in

learning Braille. This happened despite the fact that Phethahalo and some of his visually impaired friends allegedly volunteered to help them with basics.

It was revealed that Phethahalo was a member of discussion group which they formed without their teachers' assistance. He clarified that in their discussion group, they incorporated two sighted classmates whose responsibility was reading for the learners with visual impairment when this was deemed necessary. Phethahalo also pointed out that he continued to benefit from the discussions. Contrary to his expectation, it became apparent that the meetings of the discussion group were poorly attended. Surprisingly, the regular absentees were all partially sighted learners, whereas those who always showed up in the meetings were the two sighted learners, together with the totally blind classmates. It might not be expected that learners with visual impairment might also lack cooperation amongst themselves, because of their similar learning experiences and challenges. However, the findings demonstrate that the learners with low vision often become uncooperative when they habitually failed to attend the set meetings. It might then be expected that the sighted learners who showed cooperation might also lose interest of extending a helping hand to learners with visual impairment, because of the wrong message sent by the partially sighted learners. The kind of behaviour exhibited gives the impression that the partially sighted learners perceived themselves as having an advantage over their colleagues, because they tended to have alternative means of accessing information.

Bond and Castagnera's (2006) study found that peer support is one of a variety of ways that can be used to achieve effective inclusion of learners with special educational needs. Huber and Huber's (2008) findings suggest that cooperative learning can benefit all learners by building their thinking capacity and enhancing their learning. Huber and Huber (2008: 239) citing Gillies and Ashman (1998), argue that "[learners] who cooperate show increased participation in group discussions [and] engage in more useful help-giving behaviours [...] than [learners] who do not cooperate with their peers". Similarly, Montgomery (2015) argues that working in a discussion group creates opportunities for learners to exchange ideas and also to engage in arguments that would enable them to reflect upon the concepts they had learned in the classroom. Mitchell and Sutherland (2008) also note that learners with special educational needs often experience rejection from colleagues in the Inclusive

Education setting and that can be detrimental to their academic success. Jessup *et al.* (2018) argue that visual impairment conditions may put learners at a disadvantage of playing their role independently, but makes them to be at the mercy of the actions of the learners with functional vision when learning.

5.6 Summary of the chapter

The data revealed a number of intriguing findings. The narratives of the participants showed that the presence of learners with visually impairment in the classroom might not influence the teacher's normal instructional practices, including the teaching style and the pace of a lesson. The teachers largely used traditional forms of instruction in mathematics lessons where the visually impaired learners were involved. The findings show that even when opportunities to learn are made available to the learners with visual impairment, they still have a full control over a selection of opportunities that they consider helpful to them.

It was rather surprising that the teacher expected Ketsahalo to write fast in order to keep up with the pace of a lesson. It was observed that as a visually impaired learner, Ketsahalo needed more time to complete a given task, but he was not allowed to learn at his own pace. Likewise, the teacher of Pheello and Phethahalo arrived late for lessons and he consequently taught in a rush to cover the content within the remaining time. It was also surprising that the pace of the lessons did not take into consideration that learners with visual impairment might need longer time to learn effectively.

The presented data showed that textbooks were very important resources for teaching mathematics in the targeted classes. However, the general scarcity of textbooks can negatively affect learners with visual impairment when they engage in lesson activities even if the individual is in possession of the textbook. For example, Ketsahalo had to share his textbook with his classmates and that hindered him from correctly copying exercises. Being visually impaired, regardless of its severity, could deprive a learner access to textbooks in the school attended by Pheello and Phethahalo. This might be because of the perception that "they are all blind". It was a challenge for learners with visual impairment to participate in classwork, as most of exercises were given from the textbooks.

It was intriguing that learners would not afford to remain in class throughout the entire lesson, due to an inadequate supply of functioning assistive devices. Using trial and error to find the functional device made learners with a visual impairment take a longer time outside class and this resulted in the loss of opportunities to learn. Another finding that emerged is that there was reciprocity in terms of sharing ideas between learners with visual impairment and their sighted classmates. This is against the idea that visually impaired learners often depend on their colleagues for learning. The next chapter concludes the study. It draws conclusions and makes recommendations, based on the major findings of the study.

Chapter Six

6. Key findings, discussion, conclusions and recommendations

6.1 Introduction

This chapter presents key findings, discussions, conclusions and recommendations. Firstly, a brief description of the study is provided. After that, I give a broad outline of the major findings, including their significance and implications. Thereafter, conclusions are drawn and logically sound arguments are constructed as to how visually impaired learners' experiences of mathematics teaching in Lesotho can be understood. Explanations are made based on the conceptual framework underpinning the study, as well as the supporting literature. An attempt is also made to outline recommendations in terms of policy issues, on how the teaching of mathematics to learners who are visually impaired can be improved and areas worthy of consideration in future studies, are presented.

6.2 Summary of the study

In this study, I investigate the experiences of the three visually impaired learners of learning mathematics in inclusive classes. Opportunities to learn (OTL) is the theoretical resource through which learners' experiences are construed. I found this conceptual framework appropriate for interpreting teaching and learning practices at classroom level (Goos, 2004; Cawthon *et al.,* 2012). This conceptual framework assessed the manner in which learners access mathematics content (Watson, 2003). In fact, OTL is also considered very resourceful for understanding and explaining the learning experiences of learners with visual impairment, in terms of participation and engagement during lessons.

The literature reviewed in this study shows different perspectives of mathematics education. Some scholars are of the view that the quality of teaching depends on the teacher's knowledge of the subject matter (Ball *et al.*, 2001). Elçi's (2017) study revealed that teachers' content knowledge is important for assisting them as it enables them to use a diverse representation of mathematical knowledge and give appropriate

examples. Giving different examples can help learners develop a better understanding of the mathematical concepts that they did not understand initially. Learners showed satisfaction with this approach and this made them like mathematics a lot more.

Other scholars argue that teachers' instructional practices of mathematics are to a large extent affected by their beliefs, which are based on an individual's philosophical view on mathematics and mathematics teaching/learning process in correlation with contextual factors (Briede, 2016). Another perspective is that learners play an important role in mathematics teaching and learning process. Some educational challenges hindering the effective acquisition of mathematics concepts can be associated with learners and these include: mathematics anxiety, lack of interest in mathematics and an apparent deficiency in basic arithmetic skills affecting some of the learners (Genc and Erbas, 2020).

Apart from individual learner's cognitive skills, mathematical self is significant for developing mathematical literacy. Briede (2016) unpacks this concept by indicating that it entails learner's perception of mathematics, a mathematics teacher and attitude towards these. This suggests that learners engage with the teaching of mathematics depending on their perception towards the subject and the teacher responsible to teach it. In the same way, the study conducted by Mazana *et al.* (2019) revealed that learners' performance in mathematics depends on whether they enjoy the subject or not, as well as their attitude towards it. Another factor considered to influence learners' liking or disliking of mathematics is their aptitude linked with their motivation and prior achievements. These can help learners to take more responsibility in their learning of mathematics (Mazana *et al.*, 2019).

The literature on Mathematics Education that also examines experiences of learners with visual impairment was also reviewed. Some studies suggest that visually impaired learners show relatively low academic achievement in mathematics, compared to their performance in other academic subjects (Beal & Shaw, 2008). Ukeli and Akem (2013) share similar sentiments when reporting about the existence of an achievement gap in mathematics between visually impaired learners and their sighted peers. Drawing from the above discussion, undoubtedly learners with visual impairment are

intellectually capable of performing well in school. However, their performance in mathematics is, at present, apparently far below average.

This study uses the case study approach. Gustafsson (2017) highlights the importance of using a case study as allowing an in-depth exploration of research questions and can result in eliciting rich evidence. In the context of this study, each of the visually impaired learners in the targeted classrooms was considered as a distinct case, as it was believed that even if the same teacher had taught them, their experiences might differ in terms of how they perceived and engaged with the teaching of mathematics.

This study mainly considered the voices of learners with visual impairment by gathering their stories. Teacher interviews as well as lesson observations were used as additional data sources to triangulate the narratives of learners. The narrative interviews are appropriate for this study as Riessman (2001) argues that they can help to gather more comprehensive data about concrete situations, whereas Murray (2009: 47) points out that "narrative inquiry can yield practical pedagogical information," namely the experiences of the individual cases being studied. Murray contends that narratives can provide valuable information about learners' identities for understanding issues such as motivation, learning styles and a choice of learning strategies. When reporting the results in this study, I gave an account based on the themes emerging from the stories of the three cases and the arguments raised were supported by quoting the exact assertions of each individual learner.

6.3 The major findings of the study and their implications

The data gathered in the form of narratives of learners with visual impairment, teachers' interviews and lesson observations were used to answer the main research question: What are the visually impaired learners' experiences of learning mathematics in Lesotho regular schools? The three sub-questions were explored in an attempt to address the main research question and guide the presentation of the key findings. These sub-questions are:

1) How is mathematics taught in classrooms with visually impaired learners?

2) How do visually impaired learners perceive and engage with the teaching of mathematics in selected classrooms of Lesotho?
3) How can the experiences of mathematics teaching for visually impaired learners in Lesotho be understood and explained?

6.3.1 Teaching of mathematics in regular classrooms

The key finding in this study shows that the mathematics lessons were predominantly facilitated through verbal communication and chalkboard use across the three cases. The three cases had differing experiences when it came to the dominance of "chalk-and-talk" in mathematics lessons. Pheello considered his teacher highly competent in teaching mathematics when talking and writing on the chalkboard at the same time (**Sub-section 4.1.2.1**). Phethahalo relied on his sense of hearing for accessing what the teacher said, because his severe visual impairment condition made it very difficult for him to see the chalkboard (**Section 4.2**). Ketsahalo complained that he had difficulty in accessing what is written on the chalkboard especially when cursive handwriting was used by his mathematics teacher (**Sub-section 4.3.2.2**).

The experience of Ketsahalo differs with the other cases, as it coincides with the current literature. Lamichhane (2017) submits that learners with visual impairment often encounter difficulty to learn mathematics in a regular class because of the teaching style, dominated by chalkboard use. Gallagher *et al.* (2017) share similar sentiments and argue that the traditional form of instruction can be detrimental to learning of learners with special educational needs, as they might require a different approach, which would cater for their diverse needs and learning styles. Gallo-Toong (2020) is highly critical of the 'chalk and talk' teaching method, as it is associated with unsatisfactory learner performance and might result in a negative attitude towards mathematics for some learners. Heckman and Weissglass (1994) lament the fact that traditional teaching strategies in mathematics do not essentially benefit learners as they fail to stimulate interest in the learning of mathematics. They argue that teaching mathematics this way serves to limit the learning opportunities of some learners. Lawrence-Brown (2004: 34) regards differentiated instruction as a form of support "students ranging from gifted to those with significant disabilities can receive an appropriate education in general education classrooms." Levy (2008: 161) argues that

the use of differentiated instruction strategies can ensure that “educators can meet the needs of all students and help them meet and exceed the established standards”.

In Pheello’s case, the legible handwriting used by the teacher, created opportunities for him to learn in his mathematics class. He preferred listening attentively to the teacher and selectively memorising what he considered helpful. The dependence on his memory did not help him deal with challenging topics (**Section 4.1.2.1**). Similarly, memorisation also played an important role in Phethahalo’s learning of mathematics concepts. Phethahalo’s teacher ensured that he always provided exercises in Braille format. Where necessary, he gave them improvised tactile diagrams so that they could have an idea of what was being dealt with. There was also differentiation in assessment strategies, whereby it was not a requirement for learners with visual impairment to draw any diagrams, but instead they were expected to describe their properties, unlike sighted classmates (**sub-section 4.2.1.1**). Ketsahalo received more attention from his teacher during lessons, as he was regularly asked whether he could access information on the chalkboard (**Section 5.3**).

Genc and Erbas (2020) indicate that mathematics instructional practice often involves strict memorization and rote learning. They infer that mathematics lessons characterised by rote-learning and expository teaching might be influenced by teachers’ orientation. In other words, what teachers do align with how they grew up in a rote education system dominated by drill and computation, often without conceptual understanding. Van den Heuvel-Panhuizen (2020) advocates for a shift from didactic teaching methods towards the approach called Realistic Mathematics Education. RME can promote learners’ independence and empowerment as it considers learners’ mathematical experiences as one that should be meaningful, relevant and accessible (Van den Heuvel-Panhuizen, 2020).

Homework was very important in the teaching of mathematics in the classes of both Pheello and Phethahalo. The teacher used learners’ feedback from homework to decide whether he could conduct a remedial lesson or continue with something else. Remedial teaching was undertaken once the teacher had realised that a considerable number of learners did not understand the concept being worked on. However, Pheello was not able to do his homework as expected, as he was only able to write it while he

was at school where he had access to Perkins Braillers and all his files. Being a day scholar made it difficult for him to do homework or to read his notes at home. He could only do homework during the morning study period.

Homework is another form of assessment that can be used to facilitate classroom instruction on a continuous basis (Suurtamm *et al.,* 2016). The view held by these researchers is that assessment provides evidence of learners' progress in learning and also informs teachers about how to plan for their future instruction. Güven and Akçay (2019) state that homework provides, among others, an opportunity for learners to revisit mathematics concepts that had been taught during the lesson, with a purpose of improving their understanding. Johnstone *et al.* (2018) revealed that some learners with visual impairment had no access to the same assistive technology devices at home as they did at school and that compelled them to stay longer after school or come early in the morning to finish homework.

The presence of learners with visual impairment in the classroom might not influence the teacher's normal instructional practices, including the teaching style and pace of a lesson. The teacher expected learners with visual impairment to write quickly as it was the case with Ketsahalo's class and as a result he lagged behind and his work was often not assessed. Both Pheello and Phethahalo indicated that their teacher often arrived late for a lesson and taught in a rush to cover the content.

According to De Verdier and Ek (2018), when things happen fast in class, some learners might miss out on the taught information and that could result in confusion and insecurity. Bardin and Lewis (2008: 474) contend that, "Even students with visual impairments whose knowledge of concepts is strong would have difficulty keeping pace with this rate of instruction". Papuda-Dolińska (2017: 122) found that, "teachers see the specific problems of visually impaired students' working pace and way of acquiring information as difficulties that affect their work."

The teacher tended to mark learners' work in the same way, irrespective of whether they were visually impaired or not. Actually, it was observed that the teacher used a red pen to mark learners' work. This in itself was highly problematic for a visually impaired learner to be able to get the message, more especially when the marked

ticks or crosses were on a Braille paper. Phethahalo stated that he relied on his teacher to tell him whether his answer was correct or not. This suggests that the teacher also used verbal feed
back to compliment the tick and cross that he marked on the paper with a red pen.

Suurtamm *et al.* (2016) argue that it is necessary to use a range of assessment strategies that can create more opportunities for learners to demonstrate their learning and learners should also get feedback on a timely and regular basis so as to use this feedback to improve their learning of mathematics. For learners with visual impairment, this can be realised when feedback is provided in accessible format. Brownell *et al.* (2010) argue that general education teachers trained in special education would likely be in a better position of teaching mathematics to LSEN effectively, in terms of designing helpful assessment strategies, as well as providing appropriate interventions.

6.3.2 Learner perception and engagement on the teaching of mathematics

The presented data showed challenges that learners with visual impairment experienced, as they were taught mathematics. These challenges appear to shape how learners perceive and engage with the teaching of mathematics in the selected classrooms of Lesotho. The challenges are categorised as limited opportunities provided by classroom setting, scarcity of learning materials and lack of cooperation among peers.

6.3.2.1 Limited opportunities provided by classroom setting

The findings show that the learning environment has a significant impact on shaping visually impaired learners' experiences of learning mathematics. The high learner population in regular classrooms did not make it very easy for teachers to facilitate effective instruction during mathematics lessons. This also posed a challenge when it came to giving the requisite support to each individual learner with visual impairment during a mathematics lesson (**Section 5.2**). Apart from this, the teachers did not have clear strategies for helping each one of the visually impaired learners learn mathematics concepts effectively. A high population of learners with visual impairment

within one classroom posed a challenge, because of the inadequate provision of functional assistive devices to serve the entire population.

Genc and Erbas (2020) identify high teacher-pupil ratio as posing challenges for teachers as they organise their classroom arrangement. This condition can make it very difficult for teachers to monitor and assess learners' work and as a result the provision of appropriate learning opportunities in such classes might not be realised. Ali (2018: 173) highlighted a number of challenges hindering effective learning, which include "heavy workload and difficulty to individualise instruction in large classes." Odongo and Davidson (2016) found large class sizes to be one of the contributing factors identified as slowing down the progress of other learners. Hence their study suggests that "one way of making inclusion work more successfully in [...] classrooms is by limiting the number of children with special needs" (Odongo & Davidson, 2016: 226) in one classroom. Ramos and Gaviria (2012: 90) identified aspects of opportunities to learn as entailing "teacher-student ratio that would allow more teacher-student interaction and closer attention to individual student needs and difficulties [as well as] improved physical conditions of schools and classrooms." Cawthon *et al.* (2012) are of the view that high OTL could be associated with the placement of the LSEN in the least restrictive environment.

The findings show that visually impaired learners were sitting in the front row. In classrooms that had a significant number of learners with visual impairment, they were often located sitting side by side. This resulted in their isolation, which restricted their interactions with their sighted peers. Therefore, learning in diversity by sharing ideas with each other was a far-fetched concept in such cases. The findings demonstrate that sitting in the front row was not always advantageous for some learners with visual impairment. For someone, like in the cases of Phethahalo and Ketsahalo, with a severe condition of visual impairment, it was almost impossible to access information displayed on the chalkboard, even from an ideal sitting position. Studies show that learners with sight defects are often allocated front seats (Akomolafe & Adesua, 2015; Negiloni *et al.*, 2019). Habulezi and Phasha (2012: 1558) posit that "learners with visual impairment sat in the front row closer to the teacher so as to maximize reception or utilize some of the residual sight". Trevisan *et al*. (2020) bring up the issue of

generating learning opportunities by using the classroom as a professional teaching and learning environment more efficiently, in a way that can promote learners' active involvement in discussions. This can be difficult to achieve in a crowded setting and in a situation where learners are allocated permanent seats.

6.3.2.2 Scarcity of learning materials

The findings show that textbooks were very important resources for teaching mathematics across the three cases, especially during assessment (**Section 5.4.2**). In the school attended by Pheello and Phethahalo, the learners with visual impairment were excluded when textbooks were distributed to all the sighted learners, through the programme called, 'textbook rental scheme'. Considering that some learners like Pheello were partially sighted, it would be expected that they might be able to read textbooks with the aid of digital magnifiers. This illustrates that there was a perception in the school that put all learners with visual impairment in the same bracket of being blind, regardless of each individual's level of visual impairment condition. However, having no textbooks resulted in ineffective participation and engagement of learners with visual impairment in mathematics lessons. Apart from this, the learners with visual impairment relied on the textbooks of their sighted colleagues, who would read for them upon request. One can conclusively argue that a lack of support in terms of the provision of learning materials to the learners with visual impairment in the school might promote overdependence on their sighted counterparts.

In the school attended by Ketsahalo, the issue of textbook scarcity forced him to share it with his classmates (**Section 4.3.3.1**). Obviously, this made it difficult for him to easily access the information displayed in the textbook. He then resolved to leave his textbooks at home and this decision, however, jeopardised his full participation and effective engagement during mathematics lessons. Hence his opportunities to learn were at stake, whether he leaves his textbooks at home or brings them along. He ended up relying on his colleagues who brought their textbooks to school. This discussion shows that assessment strategies were also employed without a careful selection designed to accommodate all the learners.

Teaching of mathematics at secondary schools requires, among others, provision of material resources such as textbooks (Adler, 2012 cited by Venkat & Graven, 2017). Elliot *et al.* (2017) argue that learners with special educational needs might need more opportunities to learn to realise optimum academic achievement, than their colleagues without impairments. Whitburn (2014) submits that some essential elements of inclusive pedagogy entail appropriate communication modes and also avail accessible resources to learners with visual impairment. Leo *et al.* (2017) echo that the provision of tactile diagrams would enable learners with visual impairment to have an idea of what was being dealt with in a lesson.

Dakwa (2014) argues that visually impaired learners might be disadvantaged in inclusive schools, due to a lack of reading and writing resources. Meda (2016: 48) argues that "without textbooks, it is very hard for a [learner with visual impairment] to prepare for an assessment." Burr (2015: 599) found that "the effects of lack of resources and the inevitability of large class management [...] meant that the visually impaired children were reliant on the teacher and other students to read information off the board for them."

<u>The ineffective use of available assistive technology devices</u>

The findings reflect that the majority of learners with visual impairment in the school attended by Pheello and Phethahalo discontinued the utilisation of digital magnifiers. Clearly, the issue of lack of textbooks resulted in the underutilisation of digital magnifiers. Similarly, Ketsahalo ended up abandoning assistive technology devices, earmarked for visually impaired learners, but for a different reason. Arriving late to school made Ketsahalo a culprit eligible for punishment, hence he ultimately decided to permanently abandon their use (**Section 5.4.3**).

Wairimu *et al.* (2018) argue that the government has full responsibility to ensure the provision of assistive technology devices to the visually impaired, in order to increase their opportunities to pursue careers in mathematics and science-related programmes. In agreement of this, Equbal and Begum (2020: 1513) emphasise the importance of these devices by saying,

> Assistive technology is supportive in nature; provide better opportunities to the special need students to facilitate their learning. It plays a very vital role to those students to participate in academic activities, as well as social activities of the learning. These technologies also provide the conditions to the students for the active participation in classroom learning and encourage those students to promote a learning environment. The use of assistive technology makes for simple access to educational contents and materials for special needs students.

According to Sah (2013), it is very important to consider integrating the training of assistive technology devices to the learners with visual impairment, because these devices might help them to perform functions, which would enable them to realise their full potential. Coleman (2011: 6) posits that discontinued use of assistive devices among the visually impaired learners was caused by a lack of training and further argues that teachers should undergo training that can equip them with skills "so they know how to operate and implement AT devices in their classrooms; how to teach their students to use AT devices and follow up with on-going data to ensure the devices are effectively meeting their students' needs". Bouck *et al.* (2016: 50) argue that the discontinued use of assistive technology devices might result from, "the amount of training time provided or the overall quality of training [that could be] insufficient for students' sustained use of technology or their preferences for doing so." These researchers are of the view that "It is important that the educators select technology that students will actually use, which helps to decrease assistive technology abandonment" (Bouck *et al.*, 2016: 49-50).

Inadequate provision of functional Perkins Braillers

Both Pheello and Phethahalo encountered a challenge of an inadequate supply of the Perkins Braillers in their school. This often compelled visually impaired learners not to remain in class for the entire lesson, as they left class to fetch functioning Perkins Braillers. Searching for this device was strenuous, as it involved repeated trial and error exercises that caused learners with visual impairment to take a longer time outside of class. During that process, they would miss out on important information

imparted while they were out of the classroom and this resulted in the loss of opportunities to learn (**Section 5.4.3**).

Dakwa's (2014) findings revealed that learners with visual impairment often encounter a challenge of inadequate assistive devices to support their learning in inclusive classes, due to a deficiency of resources that repair them. In the same vain, Phillimon and Chabaya (2016: 73) found that "lack of resources [...] impact negatively on the quality of education provided to students with visual impairment in inclusive education." Meda (2016: 49-50) laments the unavailability of learning resources for the learners with visual impairment as follows,

> In a situation where a partially sighted student is not afforded large font in reading materials and is deprived of the use of braille and assistive technology, it is tantamount to failing to provide teaching and learning resources to students without disabilities and expecting them to pass. When students fail in such a situation, it would not be because of their inability to prepare for tests and examinations, but the institution's incapacity to provide resources and the necessary support needed.

Rosenblum and Herzberg (2015) found that the unavailability of materials make it very difficult for visually impaired learners to do their school work on time, leading to late submission of assignments.

6.3.2.3 Importance of peer support for learning

The findings show that learners with visual impairments often receive support from their sighted colleagues (**Section 5.4.4**). For instance, Phethahalo often received help from his sighted classmates who were generally cooperative when he needed them to read for him. However, there had been some instances when sighted learners became less cooperative as they demonstrated a reluctance to read for their counterparts with visual impairment. This illustrates that learners with visual impairment were to a large extent reliant on their colleagues with functional vision and their learning was affected negatively when they could not get help. The findings show that learners can organise themselves without teacher involvement to form discussion groups. For example,

Phethahalo collaborated with his classmates to form a group in which they assisted one another with their studies after school (**Section 4.2.4**). Even though he continued benefiting from the discussion, he was however concerned about the poor attendance of meetings, as learners with low vision habitually failed to attend the set meetings.

Jessup *et al.* (2018: 271) postulate that "the nature of visual impairment means that visually impaired students have even less autonomy and choice in the classroom than do their sighted peers: they are more dependent on the actions of others to access the curriculum." Bond and Castagnera's (2006) study found that peer support is one of a variety of ways that can be used to achieve effective inclusion of learners with special educational needs. Brock, Biggs, Carter, Cattey and Raley (2016: 209) established that "students participating in peer support arrangements experienced increased interactions with peers, increased academic engagement, more progress on individualized social goals, increased social participation, and a greater number of new friendships." Huber and Huber's (2008) findings suggest that cooperative learning can benefit all learners by building their thinking capacity and enhancing their learning. Gillies (2016: 39) describes cooperative learning as,

> [A] pedagogical practice that promotes socialization and learning among students from pre-school through to tertiary level and across different subject domains. It involves students working together to achieve common goals or complete group tasks – goals and tasks that they would be unable to complete by themselves.

Similarly, Montgomery (2015) argues that working in a discussion group creates opportunities for learners to exchange ideas and also to engage in arguments that would enable them to reflect upon the concepts they had learned in the classroom.

6.4 Conclusions and theoretical implications

This section presents the conclusions and theoretical implications, based on the findings summarised above. In fact, it addresses the research objective, which explores how the experiences of mathematics teaching for the visually impaired in Lesotho can be understood and explained. The conceptual framework of opportunities to learn helps us understand the factors that seem to have influenced the experiences of learners with visual impairment, in terms of mathematics teaching in the targeted classrooms. The conceptual framework justifies a conclusive remark that challenges related to mathematics teaching and learning may be translated as limiting opportunities to learn. These challenges may hinder the effective development of mathematical literacy among learners (Genc & Erbas, 2020).

Attard (2011) realises that there are a limited number of studies that feature learners' views about mathematics teaching and learning. Likewise, there is very limited literature that covers the voices of learners with visual impairment who are learning mathematics at school. This implies that little is known about the dynamics of mathematics classroom practices, involving learners with visual impairment. Out of the identified gaps gleaned from the reviewed empirical studies, the present study tried to build its methodological approach. The findings showed that the opportunities to learn for learners with visual impairment in Lesotho remain their sole responsibility in the face of a lack of resources and a lack of teacher preparedness. In view of the challenges that these learners face in the mainstream classroom, their opportunities to learn fall through the cracks. Based on the findings, it can be concluded that the visually impaired learners in Lesotho have limited opportunities to learn mathematics in regular classrooms.

The findings showed that mathematics textbooks were very important tools used for the teaching of mathematics and their unavailability and scarcity directly affected learner engagement, especially when given assessment tasks. For example, Pheello and Phethahalo were more reliant on the textbooks of their sighted colleagues, when engaging in their schoolwork, as learners with visual impairment were not provided with any reference materials in their school. The availability of digital magnifiers in their school served no purpose when the learners with visual impairment had no access to

textbooks, and that resulted in their discontinued use. Therefore, the lack of learning materials in regular classrooms put visually impaired learners at a disadvantage and it consequently resulted in inadequate participation and lack of effective engagement during mathematics lessons.

Ketsahalo had textbooks, because his school provided them to all learners including those who are visually impaired. Even though being in possession of a mathematics textbook for this case can be regarded as having opportunities to learn, it however, existed at the level of only being in possession of the textbook. The findings show that he had to share his textbook with his classmates and as a result he had a difficulty of accessing information from it. This negatively affected the manner in which he engaged with his schoolwork, culminating in the loss of opportunities to learn. Nyabanyaba (2014: 27) laments,

> while education spending appears to have increased and this in favour of the poor, the efficiency rates as indicated by progression and completion rates have remained quite low. Overall, it can be deduced that the poor and the disabled would be the most vulnerable in the face of these high inefficiency rates.

This shows that even when resources are available, the circumstantial challenges that are beyond control of learners with visual impairment can contribute towards compromising their opportunities to learn.

It can be understood from the findings that the status of opportunities to learn was not optimal for learners with visual impairment in Lesotho inclusive schools. The teaching strategies used and the manner in which learners engaged with the teaching of mathematics, contributed towards loss of opportunities to learn. A closer scrutiny of the findings makes us conclude that it is not only the classroom practices that can lead to diminishing opportunities to learn, but lack of the appropriate resources also contributes to this.

Previous research on opportunities to learn used the classroom as their unit of analysis. Chabongora and Jita (2013: 173) argue that “a better understanding of the OTL mathematics lies in the examination of what goes on during the teaching and

learning of mathematics in the classroom." Taub, McCord and Ryndak (2017: 129) are of the view that there exists OTL aligned to learners with special educational needs and that entails:

> [A]ccess to the intended, enacted, and assessed curricula through the planned curriculum that includes purposefully designed practices in classrooms and schools that utilize a combination of (a) universal design for learning (UDL) principles, (b) ecologically identified individualized content embedded within the elements of OTL, and (c) supports and materials that enable students to fully and actively participate and make progress in the intended curriculum across the school day. Without these variables, schools merely provide a presentation of content for students with ESN [extensive support needs], without actual opportunities for them to learn.

Kohanová (2010: 8) also shows the importance of the use of technology for the learners with visual impairment to learn mathematics in regular classrooms and further argues that:

> The information technologies might be very helpful for visually impaired students who are studying mathematics, since they have largely improved the educational opportunities. [...] The most important requirement for secondary school students is to handle mathematical expressions quickly and efficiently in the same way as their sighted classmates.

However, Taub *et al.* (2017: 127) show that "students with ESN are not consistently or regularly provided appropriate and accessible OTL standards-aligned content." Similarly, Abed (2018: 15) also found that "in the mainstream environment, teaching has not always been modified in line with the needs of student". The evidence points to the fact that mathematics teaching in the classrooms of the three cases followed in this study was also not aligned with the needs of learners with visual impairment.

This study devoted special attention to the in-depth narratives of learners with visual impairment in Lesotho context. The data revealed that Pheello seems to regulate OTL in his learning of mathematics. On the basis of this, a conclusion that can be drawn is

that learners with visual impairment are aware of ways of leveraging their learning and that also appears to influence their opportunities to learn in the mainstream mathematics classroom. OTL is currently viewed as a teacher-dependent variable, which mainly focuses on instructional practice. This study further extends this knowledge by showing that OTL is also learner-dependent in the case of learners with visual impairment in Lesotho.

What the literature defines as opportunities to learn does not always translate into effective use by learners. The findings of this study show that learners may chose opportunities to learn out of a pool presented, depending on their usefulness when learning mathematics. The chosen OTL can be referred to as “actual opportunities to learn (AOTL)” because they support mathematics learning and they may differ according to individual learner’s needs. This resonates with Van den Heuvel-Panhuizen’s (2020) argument that learner’s individual conceptions and experiences have to be respected and taken into consideration for teaching and learning of mathematics. Suurtamm *et al.* (2016) share similar sentiments and propound that learners can develop an understanding of mathematics that is important to learn and mathematics that is valued.

This view is echoed by Hill *et al.* (2020), whose study considers understanding learner well-being in mathematics education as an important aspect that can lead to an improvement of learners’ experiences in terms of how they perceive and engage in mathematics instructional practices. Learners’ mathematics well-being is interrelated with valuing the importance of learning meaningful mathematics that can be useful to learners in their daily lives. Hill *et al*. (2020) submit that the factors valued by learners when learning mathematics are the same factors that promote their mathematics well-being and these are important in our understanding of how OTL mathematics are constructed, especially in the context of inclusive classrooms of Lesotho as argued in this study.

6.5 Limitations of the study

One of the limitations of this study is that the sample selection only covers one district. However, the main reason for this selection is that these schools are the only ones in the country with the responsibility to offer access to visually impaired learners, including those who are totally blind. This also poses a challenge on keeping the identity of the schools anonymous. Another aspect, which is a limitation of the study, is the time that was taken for observing lessons. The two consecutive lessons might not be enough to observe how mathematics was taught in classrooms accommodating learners with visual impairment. It would be ideal to observe mathematics lessons for a longer duration than was possible in the present study. Usually seven periods are allocated for mathematics lessons. Producing their transcripts would require more time and resources. That would only be possible if I deployed research assistants to these schools. However, the nature of the study required me to be present in all classroom observations for the reconstruction of mutual trust with the participants. As an exploratory study on this otherwise less explored area of mathematics education and inclusive education, the present study has thus opened a path that other researchers can traverse in conducting similar and/or related research.

The other aspect, which is a limitation of this study, is considering targeted participants as distinct case studies. The challenge of using case studies is the use of different research instruments during data capturing. This produced the large amounts of data and reconciling these pieces of information, required a great deal of effort. There was also a chance that I would end up with large amounts of data that were not helpful, if I had not been careful enough. This means resources and time used for data collection would have been fruitless and I would be required to go through the same process all over again. Baxter and Jack (2008: 550) indicate that “the evidence created from this type of study is considered robust and reliable, but it can also be extremely time consuming and expensive to conduct.” However, to address these challenges, the selected participants attended schools at close proximity and this minimised travelling costs, as well as time taken to cover distance between the places.

The participants in this study were a group of vulnerable members of society. The major challenge, which was likely to emerge, would be the reluctance of participants to divulge precise information. For example, if ever they had experienced discrimination before, there would be a little apprehension about the kind of treatment they would get after disclosing some evidence. As this study is interested in finding out visually impaired learners' experiences of learning mathematics, a possible challenge associated with this includes the fact that the participants would feel that I intruded into their private space, which they might regard as exposing their weaknesses, especially when this was related to their performance levels. Cohen *et al.* (2007) highlight that some issues in educational research might be sensitive and the researcher should always be cautious when dealing with them. I am confident that I was able to be reflexive enough as a researcher to represent the experiences of the learners in a balanced manner that did not seek to cause embarrassment or even to unnecessarily embellish them in any way.

6.6 Recommendations for policy, practice and future research

This section outlines the recommendations of this study based on the findings. These are categorised in terms of three areas that the results of this study focuses on: (a) recommendations for practice, (b) recommendations for policy and (c) recommendations for future research.

6.6.1 Recommendations for practice

Teachers tended to employ strategies that treated all learners as if they are sighted. This might be due to their lack of capacity and exposure in terms of teaching learners with visual impairment in inclusive classrooms. Based on this, there is a need to empower teachers with the relevant skills for teaching mathematics to learners with diverse learning needs. Actually, for them to efficiently perform their mandate as expected, an intensive in-service programme can be conducted to capacitate them with the requisite skills. This study also recommends that it is essential for teacher training institutions (TTIs) to review their pre-service programmes, in order to enable the student teachers to gain the appropriate skills that would help them to meet the

demands of teaching mathematics to learners with visual impairment in inclusive settings.

Owing to the consideration that a number of learners discontinued the use of assistive technology devices, due to various reasons, the study provides a few recommendations intended to address this challenge. Firstly, the study finds it important to place assistive technology devices in a strictly regulated conducive learning environment where learners with visual impairment can easily access them, even after school hours. The use of audio recorders can be useful where learners rely on memorisation of concepts during mathematics teaching.

Secondly, there is a need to introduce these devices as early as possible and it is imperative to give the learners with visual impairment rigorous training in their use. This can help them appreciate their usefulness. Equally important is that all teachers of visually impaired learners receive a similar kind of training so that they can better understand how the devices are intended to be used. This would help them figure out ways of accommodating their usage during their lessons. Where there might be a wide range of assistive technology devices, each of these learners might need to be allowed to choose the type of device that best suits the individual learner's condition of visual impairment.

Finally, the study recommends that there is a need for all the learners attending the schools that accommodate learners with visual impairment, to learn the basics of Braille literacy. The viewpoint advanced in this study is that there should be compulsory lessons in Braille literacy for all the sighted learners in the schools that give access to learners with visual impairment, especially those who depend predominantly on accessing information written in Braille format. This will not only contribute to the improvement of social interactions among the learners, but will also promote the active involvement of learners with visual impairment in terms of participation and engagement, when given tasks that require a collaborative effort in lessons of mathematics, as well as in any other subject taught.

6.6.2 Recommendations for policy

The study recommends that it might be necessary for schools to consider revising their policies, which seem to promote a tendency of overreliance on sighted colleagues by the learners with visual impairment. For example, the provision of learning materials in accessible formats, such as Braille or electronic books to learners with visual impairment can promote their independent learning without inhibiting coexistence with their sighted counterparts. In fact, ordinary textbooks can serve learners who are partially sighted as well, because they can use magnifiers to read information displayed in them.

Another recommendation is that there is a need for the Ministry of Education and Training to develop adaptive curriculum, guiding teachers on effective strategies to teach mathematics to learners with educational needs, especially those with visual impairment. It is essential for the Ministry to consider providing learning materials in accessible formats to learners with visual impairment so that they can learn independently.

6.6.3 Recommendations for future research

As the scope of the study was on understanding the learning experiences of learners with visual impairment, future studies may extend this research by increasing the sample size so as to find out teachers' perspectives of teaching mathematics to learners with special educational needs in under-resourced inclusive schools. It might also cover issues of their preparedness in terms of professional development and the support they get from the relevant stakeholders, including the head of department, school principals, the Ministry of Education and Training, as well as the private sector, also including development partners, both locally and internationally. Future studies may explore approaches to teaching mathematics that are aligned to the needs of learners.

6.7 My personal experience as a researcher

This study helped me to witness and gather first-hand information about the teaching and learning of mathematics to learners with visual impairment in regular classrooms. This experience has in so many ways been an eye-opener for me as a curriculum developer in Lesotho. I was able to figure out what learners with visual impairment go through as their teachers implement the general curriculum in their inclusive classrooms. The experience of researching this topic aided my growth not only as a mathematics curriculum developer, but as a researcher in the field of Mathematics Education.

My academic journey, whilst researching this subject, pushed me beyond my comfort zone, as I only have a background in the field of Mathematics Education. I found this to be most interesting and challenging at the same time. What made it even more exciting was when I tapped into the unfamiliar avenue of the Inclusive Education field. I had the opportunity to navigate through this subject by engaging in a lot of reading of scholarly literature on Inclusive Education as well as Mathematics Education. This helped me to gain more understanding on what are considered the factors influencing the education of learners with special educational needs.

However, there were many challenges encountered along the way. After collecting massive data and having started the preliminary analysis my laptop and other belongings were stolen. Unfortunately, I did not have a backup. Honestly, the situation left me in a state of disarray, but I had no alternative except to soldier on. In fact, I had no choice but to go back and collect further data. I took this as the window of opportunity to improve the quality of the data that would assist me in addressing the research questions in the best possible manner. Going back did not even guarantee that I would access the same research participants. Even though I could not access some participants because of a change of school or working place, I was able to collect data once again. The rapport I had built with the research participants helped a great deal.

I was really humbled by the participants who were willing to share their experiences openly with me. I really felt privileged to interact and make friends with visually

impaired learners and their teachers. It was not difficult for me to build a rapport with this group of people as the Special Education Unit (SEU) and the school principals had made prior arrangements that facilitated our meetings. Frequenting the schools expanded my network with the majority of the school community. This made things much easier for me and enabled me to conduct this study.

Throughout this study I realised that teaching mathematics to learners with visual impairment is not an easy task. As someone who lacked exposure to the teaching of learners with visual impairment, the study enlightened me with many issues that intrigued me. I learned that learners with visual impairment are as academically capable of studying subjects like mathematics as any other learner. I was overwhelmed to learn that at times they can become the top achievers in their classes.

Listening to the views of learners with visual impairment about their learning experiences helped me to understand the circumstances surrounding mathematics teaching in an inclusive environment. I also learned from this study that teachers were using outmoded didactic approaches regardless of the presence of learners with visual impairment in their mathematics classes. Such an approach proved to disadvantage the learners, particularly those with visual impairment. Despite this and the inadequate support they get in terms of the provision of learning resources such as textbooks in accessible formats, the learners still persevered and engaged with the learning of mathematics. Some of them even managed to perform satisfactorily in mathematics. This suggests that, if given adequate support, their academic achievement could improve.

The theoretical lens of ‘opportunities to learn’ helped me to understand what shaped the experiences of learners with visual impairment and the challenges associated with the teaching and learning of mathematics. I was also able to explore the limitations of this theory as other scholars have conceived it.

After carrying out this study I am now convinced that ‘opportunities to learn’ is learner dependent in the context of mathematics teaching and learning for learners with visual impairment. It is worth noting that whilst the provision of ‘opportunities to learn’ is indispensable, individual learners have differing preferences in terms of what they can

find helpful to support their learning of mathematics. Hence I am of the view that learner involvement is an essential element for ensuring the provision of ‘opportunities to learn’ targeted towards addressing their educational needs. Otherwise, what can be considered as ‘opportunities to learn’ would just remain unutilised. This study has brought a new perspective on issues that can be attributed to low learner performance in mathematics. The opportunities provided might not be those that learners need for learning mathematics and this could result in affecting their academic achievement negatively.

This study has been a life changing experience for me. I would also like to make a further contribution to scholarly work by extracting articles from this study. I have a perception that such articles will offer fresh insights into how teachers can improve their mathematics teaching strategies for the benefit of learners and not only for those who are visually impaired. I maintain that there is a glimmer of hope for learners with visual impairment who have been in despair about their experiences of teaching and learning mathematics in inclusive classrooms. Even though my study reports about the Lesotho context, in my opinion it adds to the global body of knowledge in the field of Mathematics Education. I hope to get an opportunity to expand this study to other disability groups and contribute more to the existing Mathematics Education literature.

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Appendix 1: Narrative interviews

What can you tell me about your visual impairment?

What do you have a hard time seeing?

How long have you been visually impaired?

What do some teachers do that make learning mathematics easier?

What strategies help you to learn mathematics better?

Have you been prescribed low vision devices?

Do you use them?

Are you able to see your textbooks? If not, what do you have a difficult time seeing?

Are you able to see your handouts? If not, have you found anything to help you see them better?

Are you able to see information presented on the board? If not, what strategies do you use to access the information?

I want to ask you to tell me how the story of your life occurred in relation to teaching and learning of mathematics in the regular school(s). The best way to do this would be for you to start from the earliest years of schooling and then tell all the things that happened one after the other until today. You can take your time in doing this, and also give details, because for me everything is of interest that is important for you.

Appendix 2: Observation checklist

Yes/No
Evidence

1. Has the teacher identified appropriate and differentiated learning objectives for all learners?
2. Is there use of multi-sensory teaching approaches visual, verbal, and kinaesthetic?
3. Is there use of interactive strategies?
4. Is there use of visual and tangible aids?
5. Does the teacher find ways of making abstract concepts concrete?
6. Does the teacher vary methods of assessment in terms of level of difficulty?
7. Are tasks made more open or more closed according to pupils' needs?
8. Over time, does the teacher employ a variety of learner groupings so that learners are able to draw on each other's strengths and skills?
9. Can all learners access the teacher and any resources in use (e.g. background noise avoided where possible, light source in front of teacher not behind, pupils' seating carefully planned)?
10. Does the teacher check for understanding of instructions?
11. Is the contribution of all learners valued?
12. Does the teacher give time and support before responses are required?
13. Does the teacher work directly with visually impaired learners as well as with sighted learners?
14. Are pupils provided with, and regularly reminded of, resources to help them be independent?
15. Is scaffolding used (e.g. problem-solving grids, talk and writing frames, clue cards) to support learners?
16. Has the teacher made arrangements where necessary to ensure that all children can access written text or instructions?
17. Has the teacher planned alternatives to paper-and-pencil tasks, where appropriate?
18. Are all learners involved in setting their own targets and monitoring their own progress?

Appendix 3: Teacher's interview questions

What are the visually impaired learners' strengths in your class?

How are the visually impaired learners progressing in your class in terms of learning mathematics?

How does disability affect the visually impaired learners' educational performance in mathematics your class?

What are the accommodations that are allowing the visually impaired learners to have access to the general mathematics curriculum that you think should continue, if any?

What are the usual performance grades of visually impaired learners in mathematics in your class? Please include what might be causing learners to earn such grade.

How are visually impaired learners doing socially/emotionally in your class?

Appendix 4: Approval letter from the Ministry of Education and Training

THE KINGDOM OF LESOTHO
MINISTRY OF EDUCATION AND TRAINING
MASERU DISTRICT EDUCATION OFFICE
P.O. BOX 47. MASERU 100.
22 313 709 / 22 322 755

26/06/2017

The Principal

_____
Maseru 100

Dear Sir/Madam

RE: RESEARCH

Learning Mathematics in inclusive schools : Case studies of visually impaired learners in Lesotho

Mr. Setseetso Matobako is a student who is conducting a research on the above stated topic. He therefore wishes to carry out a research at your school.

You are kindly requested to provide him with the information that he may require.

Thanking you in advance for your usual support.

MASERU DISTRICT EDUCATION OFFICE
26 JUN 2017
P.O. BOX 47, MASERU - LESOTHO
TEL.: 22322756/22313709

Yours Faithfully

Lalbakha

LEPEKOLA RALIBAKHA (MR)
SENIOR EDUCATION OFFICER - MASERU

Appendix 5: Ethical clearance letter

UFS·UV

Faculty of Education

21-Aug-2017

Dear Mr Setseetso Matobako

Ethics Clearance: **Learning mathematics in inclusive schools: case studies of visually impaired learners in Lesotho**

Principal Investigator: **Mr Setseetso Matobako**

Department: **School of Education Studies (Bloemfontein Campus)**

APPLICATION APPROVED

With reference to you application for ethical clearance with the Faculty of Education, I am pleased to inform you on behalf of the Ethics Board of the faculty that you have been granted ethical clearance for your research.

Your ethical clearance number, to be used in all correspondence is: **UFS-HSD2017/1002**

This ethical clearance number is valid for research conducted for one year from issuance. Should you require more time to complete this research, please apply for an extension.

We request that any changes that may take place during the course of your research project be submitted to the ethics office to ensure we are kept up to date with your progress and any ethical implications that may arise.

Thank you for submitting this proposal for ethical clearance and we wish you every success with your research.

Yours faithfully

Prof. MM Mokhele
Chairperson: Ethics Committee

Education Ethics Committee
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Appendix 6: Turnitin Report

1/10/2021 Turnitin

Turnitin Originality Report

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Thesis January By Setseetso Matobako

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6%	Internet Sources: 5% Publications: [illegible] Student Papers: [illegible]

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Appendix 7: Proof of Language Editing Letter

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13 January 2021

Professor Loyiso Jita
PO Box 339
Bloemfontein 9300
Republic of South Africa

RE: Language Review of Mr Setseetso Matobako's Thesis titled: Learning mathematics in inclusive classrooms: cases of the visually impaired in Lesotho secondary schools

Dear Professor Jita,

This is a letter to confirm that the current version of Setseetso's thesis (13/1/21) has had the language edited.

Kind regards
Derek Gripper