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KWAZULU-NATAL**

**INYUVESI
YAKWAZULU-NATALI**

**TEACHERS' ESPOUSAL OF TEACHING CONVERSIONS AND
MEASUREMENT IN GRADES 10 AND 11 MATHEMATICAL LITERACY**

2024

By

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**A dissertation submitted in fulfilment of the academic requirements for the
degree of Master of Mathematics Education, School of Education, University
of KwaZulu-Natal.**

Supervised By

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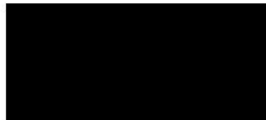
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Declaration

I, Krishnavani Govender declare that:

- i. The research reported in this dissertation, except otherwise indicated, is my original work.
- ii. This dissertation has not been submitted for a degree or examination at any other university.
- iii. This dissertation does not contain other people's data, pictures, or any other information unless acknowledged as being sourced from other researchers. Where other written sources have been quoted, then:
 - a). Their words have been re-written, but the general information attributed to them has been acknowledged, and:
 - b). Where exact words have been used, the writing has been placed within quotation marks and referenced.
- iv. The work described in this dissertation was carried out in the School of Education, University of KwaZulu-Natal, from February 2021 to November 2023 under the supervision of Professor Jayaluxmi Naidoo (supervisor).
- v. Ethical clearance No: HSSREC 0006323/2021 was granted before undertaking any field:

Signed:



Date: 24 May 2024

As the supervisor of the candidate, I, Professor Jayaluxmi Naidoo, agree to the submission of this dissertation.

Signed:



Date: 30 May 2024

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Dedication

This dissertation is humbly dedicated to my dear parents, Lutchmee Govender and Sivalingam Govender. Thank you for all the sacrifices you have made and for the invaluable guidance you have given me. I shall continue to draw from your teachings throughout my life.

Acronyms

ATP-Annual Teaching Plan

CAPS-Curriculum and Assessment Policy Statement

COVID-19- Coronavirus Disease

DBE-Department of Basic Education and Training

DoE- Department of Education

GET- General Education and Training Phase

HOD-Head of Department

FET- Further Education and Training Phase

LOLT- Language of Learning and Teaching

MKT- Mathematical Knowledge for Teaching

NSC- National Senior Certificate Examinations

SMT- School Management Team

STATS SA- Statistics South Africa

TIMMS- Trends in International Mathematica and Science Study

TKB- Teacher Knowledge Base

Glossary

Annual Teaching Plan-List of topics to be taught per term.

Content knowledge-Knowledge of syllabus and composition of work to be taught.

Curriculum-Content that is taught in a subject.

Quintiles- Schools ranked according to location and socio-economic needs of the communities.

Reflection-Thinking about something that has already happened.

Silent knowledge- Knowledge teachers gain from observing.

Teacher-specialised content knowledge- Knowledge needed specifically for teaching.

Teacher knowledge-Types of knowledge required for teaching

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Abstract

According to statistics in South Africa for the year 2021, 32,6 % of the population of youth were unemployed within the first quarter of the year. Research suggests that individuals with poor Mathematical knowledge and skills contribute to a downtrodden society. The research undertaken in this study was carried out in schools that were situated in multicultural settings. Each of the schools involved in the study comprised staff of different levels of experience in teaching Mathematical literacy. Learners who attended the schools chosen to be part of this study came from different socio-economic backgrounds. As a result, many learners who attended these schools hailed from homes that faced financial difficulty. Upon reflection of learners' performance in Mathematical literacy, and keeping in mind that Mathematical literacy is aimed at providing learners with basic Mathematical skills for daily life, this research study explored teachers' espousal of teaching conversions and measurement in Grades 10 and 11 Mathematical literacy. The study provides information based on the strategies, methods, resources, and challenges faced by Mathematical literacy teachers when teaching conversions and measurement. Conversions and measurement are basic skills needed for everyday tasks such as cooking or sewing, which could be used to earn an income if one cannot find employment. The Mathematical literacy curriculum uses topics that aim to equip learners with the Mathematical skills needed to perform daily tasks. One such topic is conversions and measurement. The data generated in this study was collected through the use of document analysis from lesson plans and interviews. The findings present the types of knowledge teachers use to teach conversions and measurement. The findings also present the challenges teachers face in teaching Mathematical literacy in state schools. Some of the challenges include language barriers and a shortage of resources. Further research is suggested based on the teaching of conversions and measurement, to be done on a national level. Recommendations have been made to the Department of Basic Education to provide teachers with adequate teaching resources and opportunities for teacher development, and to assist teachers in managing the many other challenges they experience when teaching Mathematical literacy. Recommendations have been made to school management teams to provide teachers with support in terms of practical teaching resources. The study is of importance to teachers, policymakers, and school management teams since teaching conversions and measurement in Mathematical literacy is dependent on the support and involvement of all relevant stakeholders.

Chapter 1: Introduction and background of the study

1.1. Introduction and background

From my experience as a teacher, it is noticeable that learners can be fearful of or overwhelmed by Mathematical literacy, leading them to adopt a noticeably negative attitude toward the subject. This is due to their experience of lessons in the classroom. It is therefore important that teachers plan, prepare, design, and present lessons using appropriate resources in a creative and stimulating manner. According to Taylor (2019b) addressing the knowledge of teachers presently in the education system will persist to be an urgent task for years to come and, until new teachers are suitably knowledgeable, skilled, and prepared to face the many challenges of teaching in South African schools, the problem will extend into the future. Teachers are expected to deliver well-planned and well-strategised lessons. However, it must be noted that to present creatively designed and well-planned lessons, teachers need to be provided with the necessary training, resources and means to do so. Unfortunately, there is relevant literature that proves that teachers, particularly Mathematics and Mathematical literacy teachers, are met with numerous challenges in this regard due to inequalities (Taylor, 2019a).

In this chapter, the background of the study and the purpose and motivation for the study is discussed. This chapter also includes a discussion on the research gap and the significance of the study. The research questions are then stated, which have been answered through the research development process. There are also details of the research design, limitations, and findings of the study. Researchers have focused on many aspects of teaching; however, very little attention has been paid to, how teachers understand the subjects that they teach (Ball et al., 2008). Teachers are faced with limited time allocations and a fast-paced work schedule provided by the DBE. These documents have allocated specific time frames that teachers need to adhere to, in terms of curriculum coverage. As a practising teacher myself, I have often heard teachers complaining about undue stress levels, due to limited time allocated to teaching concepts, and this seems to be the consensus observed when being receptive to the conversations of teachers. Through my own experiences in teaching over 16 years, I have engaged with requirements issued by the Department of Basic Education and Training (DBE), which are set out in the work schedule and these stipulations make it difficult for teachers to use innovative methods and strategies when teaching since much preparation and time go into delivering lessons, setting and marking of tasks.

Mathematical literacy teaching and learning are driven by policy documents. The primary policy used for teaching and learning is the Curriculum and Assessment Policy (CAPS). This policy is a national policy that consists of guidelines for teachers about what content should be taught in subjects. The CAPS policy not only stipulates what teachers should teach but also how teachers should assess their learners in every grade. The CAPS policy is aimed at striving to ensure that all learners across the country are being uniformly taught the content. Stemming from the CAPS policy is an Annual Teaching Plan (ATP). The ATP specifies areas teachers ought to focus on, however, the ATP does not provide teachers with teaching strategies that could be of assistance to them. Annual Teaching Plans are documents that stipulate what topics should be covered in each term. These documents break down topics into subcategories but do not state specifically which contexts teachers should explore.

The open nature of the interpretation of the document would mean that different teachers would touch on different contexts, yet all Mathematical literacy learners are essentially being prepared to write the same examination papers. Mshengu (2019), advocated that teachers were proven to develop their skills when the policies adopted by the DBE are discussed by teachers in professional bodies. Teaching and conducting this research simultaneously have presented me the opportunity to reflect critically on teaching strategies and types of teaching knowledge that are required to facilitate successful lessons, particularly in Mathematical literacy involving calculations of conversions and measurement. With much emphasis being placed on the education sector; it remains a challenge for most of the youth who complete their schooling career to find ways to make a living due to the scarcity of jobs in the country.

According to the statistics of Statistics South Africa (STATSSA) (2021), many of the unemployed youth, as a last resort, have turned to entrepreneurship to earn an income. Some of the avenues used to generate income include home industries, where food items and other products are manufactured and sold informally. However, according to Hadebe (2010), the skills required to successfully navigate such avenues depend a great deal on a variety of aspects, with educational skills from formal schooling being the core of those aspects. There are a variety of calculations and conversions, as well as background knowledge that one needs, to be able to effectively

perform, to turn such business ventures into a success (Hadebe, 2010). Cooking or baking is a typical example of how conversions and measurement can be a skill that proves to be useful to learners in life, since the correct measuring, estimating, and purchasing of ingredients has a significant effect on one's finances. Recommendations have been made by Chen et al. (2021), to reduce the gap between learning and practices in the hospitality industry.

Apart from using Mathematical skills to earn a living, numerous other situations require learners to efficiently and confidently use Mathematical skills acquired in conversions and measurement. Such skills would be of importance should learners choose to go abroad or venture into different career paths not specifically limited to academics. One needs to be able to effectively convert between currencies of different countries to budget and take control of one's livelihood. Another basic example of daily activities where conversions play a vital role is temperature. According to the resources and content specified in the Mathematical literacy ATP, learners are exposed to situations where vacations and emigration require individuals to convert between different systems of temperature to plan effectively for a trip.

To keep up with the demands of modern society, one is expected to use skills and competencies gained through schooling and experiences from daily life, which is known as Mathematisation. Mathematisation enables an individual to assess, interpret, and reflect on problems before determining a plan to arrive at solutions. (Rizki & Priatna, 2019). Everyday activities namely, baking, cooking, shopping, and time management employ skills based on conversions and measurement. The bulk of the content taught in Mathematical literacy is largely dependent on the understanding of conversions and measurement usually being one of the initial lessons in the year since the skills acquired will be used in almost every other section explored within the South African Mathematical literacy curriculum. This is stated in the Mathematical literacy ATP which calls for conversions in calculating solutions. Furthermore, according to the ATP, learners are required to perform calculations that involve converting between units of measurement and to convert between different systems of measurement namely (imperial and metric), which can be frequently seen when the study material and content in Mathematical literacy is examined.

The basic skills used every day are expected to be acquired by learners through the teaching of conversions and measurement. These skills include temperature conversions, how to read thermometers, how to successfully use kitchen utensils, and how to read maps to calculate speed, distance, and time, as well as currency conversions. By developing a solid grasp of conversions and measurement, learners are equipped with the necessary tools to approach complex mathematical scenarios with confidence.

Regarding the ATP, other aspects of Mathematical literacy affected by conversions and measurement include:

- The calculation of cost applicable to products and services, municipal and cell phone tariffs, where it is imperative to successfully convert between Rands and Cents to arrive at correct solutions.
- Calculating area, perimeter, and volume, particularly when the dimensions of the objects have different units of measurement.
- Calculation of dosages required in medicine according to body mass index.
- Use of scale (line, strip, or numerical) used in mapwork.

As a teacher who is critical of my lessons, it is my view that: in response to the economic crisis that South Africa is currently facing, what is needed is an economic and socially responsive Mathematical literacy curriculum that equips learners with basic Mathematical skills that will enable them to perform daily activities with confidence as well as prepare learners for the world of employment. The Mathematical literacy results of particular schools participating in this study were thoroughly analysed and it was evident from the marking of tasks and observation, that conversions and measurement seemed to be areas of weakness for the learners in those schools. Hence, the purpose of this research was to analyse the different strategies used by teachers of Mathematical literacy during lessons conducted involving conversions and measurement.

1.2. Significance of the study

The significance of the study was to explore teachers' espousal of teaching conversions and measurement in Grades 10 and 11 Mathematical literacy. The study also draws attention to whether teachers are aware of the different types of teacher knowledge that exist and whether teachers use these types of knowledge in their lessons. As a researcher and educator, myself, I have had the

chance to blend teaching and research, allowing me to critically reflect on the teaching strategies and types of knowledge required to enable effective lessons, particularly in the field of Mathematical literacy, involving conversions and measurement calculations. As the education segment continues to place substantial importance on preparing learners with the necessary skills and knowledge, there remains a persistent challenge for most of the youth who complete their education to find suitable employment due to the scarcity of jobs in South Africa.

Additionally, this study also explores the challenges teachers face when teaching conversions and measurement, to recognise how to best equip learners with fundamental Mathematical skills needed in everyday life. The findings of this study are important since they will be of assistance to teachers when teaching conversions and measurement and more so, will provide teachers with useful data on which strategies to employ or not when they are teaching conversions and measurement and other sections linked to it.

1.3. Purpose and motivation for the study

The researcher who undertook this study is currently teaching in a multicultural and socially diverse school which, according to the frequent analysis of results, revealed that learners struggled to break down questions. It was identified that frequently learners from that school arrived at incorrect solutions due to incorrect calculations. This observation made by the teacher is a result of the learners' lack of understanding when engaging with work on conversions and measurement. The researcher, out of curiosity, had decided to consult with her colleagues at the school and found that her colleagues had in fact, also made the same observation. However, her peers expressed that they could not spend much time teaching conversions and measurement because it was one of the first topics covered in the syllabus. Teachers explained that they were pressured into moving on with the syllabus due to a taxing scope of work to be covered in very little time.

Despite teachers taking note of their learners not performing well in conversions and measurement, they were ultimately teaching toward meeting the requirements of upcoming moderation. Moderation in schools is a process whereby teachers must be accountable for ensuring that all topics are taught timeously according to the ATP. Moderation involves a great deal of paperwork including the inspection of how tasks are graded, if marks are captured and converted correctly, as

well as if teaching targets are met. Once the moderation aspect is over, the subject advisor then discusses the results of learners. Unfortunately, in that particular school, learners performed dismally in both Mathematics and Mathematical literacy. This poor performance leaves teachers perplexed and embarrassed, as they are interrogated about the poor performance of learners at moderation meetings. This is aligned with research focusing on underperforming public schools, generally, learners at these schools perform poorly in Mathematics, Accounting, and Physical Sciences (Msomi, 2018; Msomi, Mabusela, & Ntshangase, 2023). In retrospect, the researcher then discussed with her colleagues, the need for their learners to properly understand how conversion factors and calculations with conversions and measurement are of utmost importance in improving Mathematical literacy results. The other teachers had not realised that basic conversion and measurement calculations are part of almost every topic that would be explored later in the year. Without understanding how Cents are converted to Rands, learners would not be able to solve questions based on electricity and water tariffs in the forthcoming terms. If learners face difficulty in converting between units of measurement concerning mass, volume, or length, then those learners would be disadvantaged when they explore topics such as budgeting, cost price, and selling price of goods.

Another major topic explored in Mathematical literacy is mapwork, which requires learners to use ratios and convert units of length and distance to find actual distances between places on a map. Mapwork becomes even more intricate after the distances are calculated. The next step would require learners to calculate the cost of fuel for a journey or calculate either the time, distance, or speed of a journey. Such questions often contribute to almost 30% of marks in common assessment tasks. Common assessment tasks are tasks that are designed and distributed by the provincial examiners of Mathematical literacy. Therefore, the researcher explained to her peers that every effort should be made to ensure learners would not be disadvantaged by simply moving on with the syllabus and ignoring the topic conversions and measurement, since rectifying errors and misunderstandings that learners face based on the topic would drastically improve the results of the learners. An analysis of results (diagnostic analysis) which is compiled by each teacher and then combined at the school level, is required by the DBE after each assessment task is administered and marked by teachers. One of the participants from a school participating in the research revealed that learners were encountering challenges when working with areas like

municipal tariffs, particularly because electricity tariffs are calculated in Cents and not Rands. After thoroughly examining the diagnostic analysis of Mathematical literacy learners in grades 10 and 11, it was evident that there was a need for intervention.

Thus, this study critically explores teachers' espousal of teaching conversions and measurement in grade 10 and 11 Mathematical literacy. The study also investigates teaching strategies adopted by teachers, when teaching this section in particular. Important data arose from the study, which the researcher did not purposely seek. It was discovered that teachers of Mathematical literacy are burdened with many challenges in their jobs. What is concerning is that teachers expressed their dissatisfaction since voicing their opinions and concerns fell on deaf ears of the DBE. Given the current economic crisis in South Africa, it is essential to have a responsive Mathematical literacy curriculum that equips learners with basic Mathematical skills. The Mathematical literacy skills learners gain will assist learners in daily life activities, regardless of what their choice of vocation is (Ahmad, 2019). This will enable them to confidently engage in daily activities and prepare them for future employment.

Many learners with whom the researcher interacted while engaging in her teaching practice, confided that their households are faced with financial difficulty. The challenges of not having stationery or money for transport and meals are a reality for many learners in public schools. The schools that participated in this study are public schools which are also referred to as government schools in South Africa (Mestry, 2017). Other learners informed the teacher that they simply lived too far away from the school and therefore could not manage to attend school before the school gates were closed. For a teacher to efficiently teach, there must be constant reflection on lessons, the performance of learners, and resources used in lessons to improve the understanding of learners. Once reflection takes place, the teacher would then have a better idea of how to take the necessary steps that will allow learners to improve their performance. Consequently, as a passionate practicing Mathematics and Mathematical literacy teacher, I was motivated to explore whether teachers are aware of the different types of knowledge that are required to ensure that successful teaching takes place, particularly based on the topic of conversions and measurement. The interest in this study stemmed from sixteen years of teaching Mathematical literacy and observing that learners seem to have a sense of disconnection from the concepts of measurement

and conversion and how these concepts can impact their daily lives as well as results at the end of their school year.

1.4. The problem statement

Teachers of Mathematical literacy face many difficulties in teaching conversions and measurement in grades ten and eleven, due to a lack of resources and barriers to learning. While teacher content knowledge is significant to the enhancement of teaching and learning, the amount of attention given to the development and study of types of teachers' knowledge has not been sufficient. Ball, et al. (2008), stated that although there is great emphasis specifically on what content a teacher needs to know, further studies on how teachers comprehend the subjects that they teach need to be done. After critically analysing the documents provided by the Department of Basic Education, which governs Mathematics and Mathematical literacy teaching and learning, the researcher noted that very little teaching involving the calculations or language associated with conversions and measurement was done when learners were in primary school.

The amount of work that needs to be taught in primary school is determined by the CAPS policy for the General Education and Training phase (GET). Upon reflection on the CAPS document and ATP, it is evident that more work needs to be done in Mathematics at the primary school level, that prepares learners for Mathematical literacy at the secondary school level (Machaba, 2017). More work is needed to prepare learners for the complexity of Mathematical literacy in grade 10 so that learners do not feel overwhelmed when exploring topics in Mathematical literacy in secondary school. To identify problematic areas or aspects in teaching and learning, a teacher must reflect and think beyond the confines of the classroom. Such introspection requires more than just content knowledge. Therefore, the reason why this study is needed is that it seeks to uncover if Mathematical literacy teachers are aware of the variety of types of teacher knowledge that exist and, whether the teachers involved in the study apply a combination of knowledge types when teaching. Thus, this study focuses on teachers' espousal of teaching conversions and measurement in Grades 10 and 11 Mathematical literacy.

1.5. Location and context of the study

According to Shulman (1987), effective teaching is often determined by the teacher's management of a teacher's classroom. Shulman's intensive study involved observing the content knowledge and pedagogical knowledge of student teachers to monitor the teacher knowledge growth of the teachers in terms of development. Therefore, the participants involved in this study were purposefully chosen. Gatekeeper letters were obtained from principals of schools granting permission for the study to commence. This research was conducted at two secondary schools in KwaZulu-Natal, South Africa. The schools are situated in Durban and are in suburban locations. Learners who attend the schools involved in the study are largely IsiZulu-speaking learners. The schools involved in the study face many challenges in terms of resources.

The research was conducted involving a total of eight participants (three participated in the pilot and five participated in the main study) who teach at differentially ranked schools by the Department of Basic Education in terms of quintiles. Quintiles are groups, in which schools are ranked according to location and socio-economic needs of the communities. (van Dyk & White, 2019). The more affluent the community where the school is situated, the less funding the Department of Education will provide to that school. The schools involved in the study belong to quintile three. Each of the participants, being Mathematics teachers, is employed in schools that consist of learners from multi-diverse cultural and socio-economic backgrounds. It is unfortunate that both schools in which the research was undertaken, lack resources that would be of great assistance in teaching Mathematical literacy efficiently. All the participants reported that the schools are not equipped with proper resources and have very few computers for learners to access. Thus, the participants used traditional teaching strategies which are generally teacher-focused and do not allow for much learner interaction (Tularam, 2018). More information based on the lack of resources is provided in chapter four of this study. The researcher is currently teaching grade 10, grade 11, and grade 12 Mathematical literacy learners and has been doing so for several years. The participants involved were from different ethnic groups and many of them have taught at numerous schools where there were also learners from mixed social backgrounds. The participants consisted of level one teachers and one member of school management (level 2) (Okeke & Mtyuda, 2017). Some of the teachers were appointed as markers and senior markers of Mathematical literacy in the National Senior Certificate examinations (NSC). Teachers who are appointed as markers or

senior markers are considered to be more seasoned teachers since the marking of the NSC exam further provides suitably qualified teachers with intensive training before the marking process begins (Nyam, 2024). Such teachers who participated in this study provided valuable insight into their teaching strategies used when teaching conversions and measurement.

The research idea was sparked by an interest when colleagues were discussing topics that Mathematical literacy learners performed poorly in. Some of the topics mentioned included measurement, taxation, tariffs, and mapwork. Upon reflection on teaching these topics, the researcher realised that conversions and measurement were components in almost all of these topics since learners have to understand the difference between units of measurement to provide solutions to questions correctly. Therefore, as a teacher of Mathematical literacy for the past 7 years, I began to critically think about how conversions and measurement are taught, and what strategies, resources, and types of knowledge are used in the teaching of conversions and measurement. By understanding why conversions and measurement are taught in the way that teachers teach, this research study sought to explore teachers' espousal of teaching conversions and measurement in Grades 10 and 11 Mathematical literacy.

1.6. Research Objectives

The objectives of this study were aimed at addressing the following points:

- To identify what strategies Mathematical literacy teachers use, when teaching conversions and measurement in grades 10 and 11.
- To determine the types of knowledge, methods, and resources Mathematical literacy teachers use when teaching conversions and measurement in grades 10 and 11.
- To determine why grade 10 and 11 Mathematical literacy teachers teach conversions and measurements in the way that they do.

1.7. Research Questions

1.7.1. What strategies do teachers use to teach conversions and measurement in Grade 10 and 11 Mathematical literacy?

1.7.2. How do teachers teach conversions and measurement in Grade 10 and 11 Mathematical literacy?

1.7.3. Why do teachers teach conversions and measurement in Grades 10 and 11 Mathematical literacy in the way that they do?

1.8. Prior knowledge required for teachers

Teachers who possess a deep understanding of their learners' prior knowledge play a critical role in fostering effective learning experiences. This notion is particularly relevant in the realm of Mathematical literacy, as emphasised by a comprehensive study conducted by Mbonambi and Bansilal (2014), on learners' competency in temperature conversion problems. The findings of this research indicate that most learners do not possess the necessary skills required to appropriately and correctly apply formulae in calculating temperature conversions. The researchers advocate for early exposure to conversion exercises to be done, particularly involving the manipulation of formulae such as those encountered by learners in temperature conversions. Similarly, Long, Bansilal, et al. (2014), argue that Mathematical literacy, being a complex and abstract subject, demands a solid foundation in algebraic skills. The study concluded that teachers faced a challenge in maintaining a variance between the classroom environment and assessment requirements.

Paradoxically, the current Mathematics curriculum in the GET phase fails to allocate a significant amount of attention to conversions, presenting a challenge for teachers attempting to introduce this concept to learners who have already progressed further in their schooling. So, the immediate comprehension of conversion and measurement concepts becomes arduous for learners. Hence, there exists an urgent need for teachers to integrate conversion-based activities into the curriculum from an early stage, enabling learners to develop a more profound understanding of this fundamental aspect of Mathematical literacy.

1.9. Limited teaching time

With the ever-growing demand for more content and topics to be covered during the school year, there is a mounting challenge for teachers to equip learners with a well-rounded education within the limited teaching time specified in the relevant policy documents. The pressure to meet curriculum standards and the increasing expectations for better test and examination results have put a remarkable strain on Mathematical literacy teachers to cover more content within a shorter space of time. The situation becomes further complicated when factoring in the necessity to

provide differentiated instruction to meet the needs of all learners. Differentiated instruction is used to reach all learners by teaching according to their pace and proficiency in language. Teaching time is further limited by the need for teachers to include integration and hands-on activities that enhance the learning process. The challenge is to find ways to effectively utilise the limited teaching time available while still meeting the needs of all learners. Teachers are required to be imaginative and think outside of the box to ensure that learners are receiving the best education possible. Many unforeseen circumstances can arise, which could affect the school year. One such occurrence took place in 2019, which saw a global pandemic that altered the academic functioning of schools across the world. The South African Department of Education does not readily have contingency plans to continue with its functioning should such unfortunate situations arise. However, the Department of Education adjusts the syllabus to cater to such situations after they occur. The detriment of this is that because of so many channels in the education sector, the changes are implemented too late since teachers and learners are last to be included.

To add to the pressure that teachers face, an enormous amount of teaching time and contact with learners was reduced due to social distancing during the COVID-19 period. Moreover, many parents had been reluctant to allow their children to attend school even when learners were eventually allowed to return. According to Duraku and Hoxha (2020), the COVID-19 pandemic has created a negative impact on teaching and learning and many of the lessons had to be taught in the fastest and simplest ways possible to comply with the Mathematical literacy CAPS. Most teachers and learners in public schools simply could not continue with proper teaching and learning during the pandemic, since there were issues regarding communication between teachers and learners. Teachers resorted to using their private cellphones to continue with work and reach their learners. This placed undue financial strain on teachers since they had to pay for data and were not compensated for the cost, despite the data being used to do work. The efforts of teachers going beyond the classroom were sometimes in vain since not all learners have access to cellphones and data either.

Another aspect that adds to the challenge of teaching time is the issue of language. Due to the diverse multicultural nature of schools, learners from different races and cultures attend public schools with the same purpose: to be given a fair and equal opportunity to learn. However, as ideal

as it sounds, having learners with such different levels of language proficiency, leaves teachers in a very questionable position as to whether they can communicate effectively with all learners. Mzimela (2012), stated that the Curriculum and Assessment Policy Statement (CAPS) demands that learners be taught in their home language for the first two years of schooling. Thereafter, another language is introduced to learners which will become the medium of instruction at any given school. These different situations in primary schools share a common meeting point when learners enroll in secondary schools. Learners are then faced with a situation where they are taught in a language, they are probably not proficient in, and they must grasp new concepts, possibly without understanding the vocabulary involved in those concepts. Such a situation would then present a multitude of challenges for teaching and learning since learners would have been taught in a different language when they were building the foundation of their education in primary school.

1.10. The impact of teachers' strategies used in teaching, on learners

Teachers are undeniably the foundation of any fruitful education system and the strategies they choose for teaching are extremely important in providing learners with the best education possible. A teacher's strategies can range from communicating effectively with learners to using technology to enhance learning. Teachers are responsible for providing their learners with the skills, information, and inspiration they need to be successful in their lives. The strategies that teachers implement in their lessons to engage their learners can have a long-term impact on the learners' academic experience. However, it must be noted that the strategies that teachers choose are based on the availability of resources among other factors, such as the number of learners in a class. Teachers being able to build relationships with their learners is essential for effective teaching. This would hold for teachers who are involved in more challenging subjects, such as Mathematics. When learners are comfortable, they are likely to become engaged and driven to learn. According to Moodley (2007), the beliefs and behaviour of teachers influence the learning of Mathematics. Moodley (2007), further stated that the environment of learning has a huge impact on the learning process and that the attitude of the learners is influenced by the experiences learners encounter in the Mathematics classroom. The results of the study revealed that learners who had high self-efficacy beliefs performed remarkably better than the learners with poor confidence in their Mathematical skills. It is, therefore, the duty of Mathematics teachers to create teaching strategies

that would enable learners to feel motivated and comfortable, to enhance their learning. Since these were the findings of Moodley (2007), this research is similar as the study seeks to uncover if teachers are aware that their values, attitudes, beliefs, and strategies create an impact on the learning of their learners, especially in the field of Mathematics. This study also aims to explore what types of knowledge are used to teach conversions and measurement in Mathematical literacy. Further literature reviews based on the impact of strategies used by teachers and the impact of those strategies on learners are discussed in depth in chapter two of this study.

1.11. Limitations of the study

The participants were able to allocate very little time for participation in the research process since many of the teachers involved in the study are teaching grade 12 learners. Participants indicated that they were very busy with teaching and administrative duties. Some of the administrative duties include marking attendance registers, composing worksheets for lessons, and completing work forecasts. Forecasts are a document that teachers fill in daily to track what content has been covered with each class. Some of the participants who were originally approached to be a part of the study were hesitant to share their lesson plans and information about their teaching practices and strategies. The teachers felt more comfortable participating once they were assured that all communication and involvement would be on an anonymous basis. As much as there has been adequate research done in the field of Mathematical literacy in South Africa, there was very limited research available based on the teaching of conversions and measurement itself. Several topics explored in Mathematical literacy, including taxation, inflation, and percentages, have been extensively researched. However, no research has been solely dedicated to calculations entailing conversions and measurement, leaving very little literature available to discuss conversions and measurement.

1.12. Findings

The participants who were involved in this research indicated that very little to no assistance was offered to them by the Department of Basic Education in terms of teaching resources and support material. From the data gathered in this study, it is quite evident that not only are teachers in South African classrooms facing challenges in teaching Mathematical literacy, but learners are also facing challenges in learning and fully understanding concepts taught in Mathematical literacy,

due to challenges in language proficiency. Learners 'poor understanding of the concept of conversions and measurement is due to language barriers and a lack of prior knowledge as a prerequisite for learning about conversions. Consequently, a recap of prior knowledge supports learner understanding and interaction in the classroom (Stavnezer & Lom, 2019).

There were numerous other challenges faced by Mathematical literacy teachers that were discovered in this study. These challenges were not initially what the study sought to discover. Socio-economic challenges played an important role in the poor performance of learners in conversions and measurement as well as other sections that are integrated with conversions, since learners were not provided with adequate resources, learning materials, and calculators. In response to the research questions asked in this study and the theoretical framework adopted by this research, the findings suggest that the participants did use different types of knowledge when teaching conversions and measurement, however not all types of teacher knowledge have been used by the participants who were involved in the research. Teachers had to improvise with very few resources being available to them when teaching conversions and measurement.

Recommendations were made to do more work in lower grades based on conversions and measurement in junior grades to familiarise learners with the vocabulary and change of contexts in questions in senior grades. Research (Machaba, 2016) supports the view that vocabulary is important in enhancing learner performance in activities involving area, perimeter, and other mathematical concepts. Moreover, repeating key terms or vocabulary helps learners to memorise and remember, this is an important memory strategy for teachers to use (Johnson, Ginsberg, & Wilks-Smith, 2020). The participants vocalised the need for the Department of Basic Education to provide efficient and adequate written and practical resources. More opportunities are required for teachers to enroll in teacher training workshops throughout the year. Through reflecting on interviews with the participants, it would be fair to say that learners also face numerous social and economic challenges in public schools. These challenges impact their educational journey and overall well-being. The findings of this study highlight the importance of addressing these challenges and providing support to ensure equitable educational opportunities for all learners in KwaZulu-Natal schools. There is room for further research to be done on this topic throughout South Africa, to develop improved teaching strategies.

1.13. Overview of the chapters

In this study, the background, the location, and the purpose of the research are outlined in chapter one. The first chapter provides details that enable the reader to gain an understanding of the context in which the research was conducted. Chapter two provides a comprehensive literature review focusing on the challenges that teachers face in teaching Mathematics and Mathematical literacy in public schools. This literature review serves as a foundation for the subsequent chapters in the study. Chapter three then delves into the theoretical framework used in this study, exploring the different types of teacher knowledge that are essential for successful teaching. Here, the reader will gain an insight into the conceptual underpinnings of the study. Chapter four illuminates the details of the research design, including the instruments used in the study, the number of participants that were involved in sampling, and the approach to data analysis that was applied. Additionally, the paradigm in which the research was undertaken is also discussed. Chapter five presents the data presentation and data analysis, providing a thorough examination of the gathered information. Finally, chapter six concludes the study with a detailed discussion of the findings, recommendations, and overall conclusion of the research. This chapter serves as the culmination of the study, consolidating the results and shedding light on the implications for teaching practices in Mathematical literacy.

1.14. Summary

This chapter serves as a foundational piece, providing the reader with valuable insight into the background, location, and context of the study. It delves into various aspects, such as the socio-economic status of the learners who attended the schools where the participants taught. The limitations of this study were identified and acknowledged, as well as the purpose or objective of the study. The research methodology employed to achieve the research goals was discussed. By clarifying these key elements, this chapter sets the stage for a comprehensive understanding of the study and its context. Building upon this, the following chapter will delve deeper into the existing literature that is directly relevant to the chosen topic, establishing connections and highlighting the relevant research findings from prior studies done on Mathematical literacy and teacher knowledge. The literature review will provide the necessary foundation and contextual framework to support the subsequent analysis and interpretation of the study's findings.

Chapter 2: Literature Review

2.1. Introduction

According to Naheem (2020), September 1999 marked a month that left NASA scientists, engineers, and ordinary global citizens devastated. NASA engineers had previously successfully implemented almost ten months of travel to Mars and were eager to gather fascinating data about the climatic state of Mars when one of their rockets, the Mars Climate Orbiter exploded and was reduced to smithereens. What was the cause of the failure of this particular launch, one may ask? Even after years of academic grooming in analytical theory, subjects, and content, experience in technical design, and exposure to the production of rockets, the engineers had made a fundamental mistake! The error that had caused the loss of millions of Dollars, an invaluable amount of time, and strenuous efforts made by many specialists in the field of rocket science were made by professionals who, sadly, failed to identify an error and apply the correct units of measurement, namely, the metric system. Naheem (2020). If the inappropriate units of measurement had filtered through so many departments without the error being noticed, it can be concluded that none of the employees involved stopped to evaluate how realistic the numbers in the calculations were, whether in Metric or Imperial units. We must wonder how deep the understanding of conversions and measurements the engineers were, or if they simply overlooked the error due to not being diligent.

Further case studies were done by Ashraf (2015), on instances where conversion errors resulted in catastrophic situations that threatened the lives of many people. In January 2004, an axle on a train at Tokyo Disneyland's Space Mountain broke down during the ride, due to employees ordering an incorrect-sized part that was expressed in English (imperial) units rather than Metric units. An axle is a beam which has wheels on either end. Axles enable power to be transferred from the gearbox to the wheels, allowing the train, in this case, to be propelled. Imperial units are based on pounds, ounces, feet, yards, and so on. The metric system is based on kilograms, litres, metres, and so on. Another instance where conversions played a crucial role in the lives of people, occurred in July of the year 1983. An Air Canada aircraft had run out of fuel during the flight, which was halfway into the journey, due to the miscalculation of fuel needed. The miscalculation was a result of a misunderstanding based on the Metric system of units.

By reflecting on the unfortunate circumstances that occurred, namely the Climate Orbiter explosion and Tokyo Disneyland's Space Mountain breakdown, the need for a study based on conversions and measurement is deemed necessary, particularly within the South African context, since Mathematical literacy is a subject chosen by the majority of learners. This chapter of the research will now describe the results of the literature that has already been written about Mathematical literacy in South Africa as well as some of the difficulties that teachers encountered when trying to teach the subject, especially in public schools. Given that one of the key ideas in this chapter relates to the difficulties teachers have in teaching Mathematical literacy, the literature review for this study first begins by defining Mathematical literacy and outlining the rationale behind its introduction, before continuing to describe some of the challenges teachers have faced in the past and present. This chapter also explains several sociological and political challenges that teachers encounter while educating learners in Mathematical literacy. Literature on the education of teachers of Mathematical literacy in South Africa is also included in this chapter.

Some of the points mentioned concerning the training of Mathematical literacy teachers include language barriers to learning, prerequisites for teaching and learning, and the lack of professional support groups available to Mathematical literacy teachers. Furthermore, this chapter provides details about the curriculum policy in Mathematics and Mathematical literacy, as well as how political factors influence the curriculum policy and its delivery in South Africa. Additionally, the literature reviewed in this chapter illustrates how the training; attitudes, and beliefs of Mathematics and Mathematical literacy teachers; their experiences, and multicultural diverse school settings impact the teaching of conversions and measurement in grade 10 and grade 11 Mathematical literacy.

2.2. The focus of the research

This research details what is required by learners to fully grasp concepts in Mathematical literacy. Therefore, the study was aimed at exploring teachers' espousal of teaching conversions and measurement in Grades 10 and 11 Mathematical literacy. There is information on the South African curriculum policy in the Mathematical literacy provided, which will be explored in this chapter of the study. The information used by teachers following the Annual Teaching Plan (ATP) and the work schedules issued by the KwaZulu-Natal Department of Education are also discussed

in this section. An informed discussion based on the contributions of leading researchers in the field of teaching Mathematical literacy will be provided.

2.3. Exploring the nature of Mathematical literacy

Although Mathematical literacy is a relatively new subject in South Africa, there research has been done that characterizes Mathematical literacy in different ways. According to research done by Buytenhuys et al. (2007), Mathematical literacy has the following properties: it is driven by life-related applications of Mathematics and allows learners to develop the capability and confidence to think numerically and spatially, to interpret and critically analyse everyday situations and solve problems and involves a lot of comprehension skills and deductive reasoning. The researchers claim that they found learners are Mathematically discouraged since so many of the learners have only experienced negative encounters with Mathematics in the classroom. To change the perceptions that learners had about Mathematics, the participant who implemented the lesson being a teacher of Mathematics, had realised that she had to make a connection with each learner for him/her to reach his/her ability to learn Mathematics. According to the DBE (2018), South Africa has a larger number of Mathematical literacy learners than Mathematics learners, since Mathematical literacy was supposedly deemed easier.

North (2015), stated that Mathematical literacy is a subject that requires engaging Mathematics with everyday life experiences. North (2015), further explained Mathematical literacy can be characterised as having four areas of practice: everyday knowledge, Mathematical competency, modelling knowledge and practices, and reasoning and reflection. The researcher claimed that more learners are leaning towards choosing Mathematical literacy as a subject of choice rather than Mathematics in schools, due to the perception of Mathematical literacy being an easier subject. However, the researcher concluded that the language used in Mathematical literacy, particularly in examinations, requires amendment. It was also stated that in choosing so, the learners would be compromised in finding job opportunities and living a better quality of life.

Even though Mathematical literacy was introduced to provide support to learners who were weak in core Mathematical concepts, the study done by North (2015), concludes that the syllabus that is taught in Mathematical literacy disadvantages learners rather than empowering them since the concepts taught in Mathematical literacy do not prepare learners for analytical careers.

Consequently, the researcher stated that the Mathematical literacy syllabus taught to learners would result in dire economic consequences for the country. This study based on conversions and measurement, is therefore necessary as it seeks to explore teachers' espousal of teaching conversions and measurement in Grades 10 and 11 Mathematical literacy. The skills and concepts involved in conversions and measurement are essential to perform everyday tasks such as budgeting, and preparing meals and more importantly, it can be used to facilitate self-employment should learners not find employment after completing their academic journey.

Implementing the introduction of Mathematical literacy in South African schools was met with many learners who hail from impoverished backgrounds and many of whom enrolled in a school participating in this study were unable to attend school daily. A study conducted by Moremedi (2007), explicitly articulated that teaching learners who reside in homes where parents or guardians are unable to provide learners with the financial support needed for academic purposes, plays a largely negative role in education. These findings correlate with the findings of Nortje (2017), who indicated that many learners cannot attend school since their parents or guardians cannot afford school fees, stationary or transport costs. The study also concluded that many Mathematics learners drop out of school and have failed at some point in their schooling career. Learners who fail more than once end up being progressed into the next grade, due to the policy of the Department of Basic Education and the instruction of school circuit managers. Mogale and Modipane (2021), indicated that the progression policy was introduced in secondary schools in 2013 to reduce the number of learners who could become school dropouts. According to the progression policy, learners who have been retained in a phase for more than 4 years, would be progressed to the next grade. The Education Department claims that the reason for this is that learners are allowed to exit the school system due to their age since several learners who attend public schools are already over eighteen years old (Makoelle, 2014).

Adebayo et al. (2020) stated that the South African government claims to spend a very substantial amount on education in terms of resources each year. The researcher mentioned that although the government spends a large sum on educational resources for public schools to level the performance between learners from private schools and public schools, it was found that more affluent schools had learners who produced better results. The researcher stated that learners whose

parents are educated at the secondary school level have a more favourable chance of performing well in their studies as opposed to learners whose parents only have a primary school level of education.

2.4. Challenges experienced in teaching Mathematical literacy

To understand why teachers teach conversions and measurement in the way they do; this section provides details about challenges with which Mathematics and Mathematical literacy teachers are faced. Issues such as socio-economic crises; shortcomings that teachers face working with the DBE; curriculum and school-related challenges and barriers to learning are discussed. There are details about how professional development bodies and workshops impact the teaching of Mathematics. The literature on curriculum challenges discussed in this chapter is covered under sub-headings and is based on research done mostly by South African teachers.

2.4.1. Challenges in implementing the Mathematical literacy curriculum policy

In teaching Mathematical literacy, teachers are faced with implementing a subject that does not have established aims, understandings, and practices associated with it (Venkat, 2007). This statement holds since one of the participants of this study indicated that the Annual Teaching Plan simply stated which topics to cover but it did not provide much information on what the objectives of those topics would be. She further stated that even though topics were divided into subtopics, not every context of the content was provided in the Annual Teaching Plan. This leaves teachers with different options as to what to teach about context. It would then be fair to say that not every Mathematical literacy teacher would cover every type of context within a particular topic, leaving Mathematical literacy learners at different levels of preparedness for tasks and examinations. According to Moremedi (2007), there are many challenges teachers experience implementing the Mathematics curriculum policy. Some of the challenges mentioned in the study include lack of resources, unqualified teachers, large class sizes, and learners being pushed into higher grades without meeting the basic requirements of the grade they are in. In addition, high work-loads, large class sizes lack of support from educational stakeholders contribute to challenges teachers face in delivering the curriculum (Genc & Erbas, 2020).

The KwaZulu-Natal Department of Basic Education learner-educator ratio (LER) is 35:1 for secondary schools and 40:1 for primary (Makhoba, 2018). The number of learners per class at most public schools is not aligned with the Learner-Educator Ratio (LER) and the norm of the current Post Provisioning Norms (PPN) as set out by the Department of Basic Education (Buthelezi & Makhoba, 2020). Since educating a child is dependent on many factors and the influence and decisions made by various stakeholders, every stakeholder is equally responsible for the progress of learners in education. Recommendations were made to include relevant Mathematical organisations such as the Association for Mathematics Education in South Africa (AMESA) and the South African Mathematical Society in Mathematics (SAMS) teacher training. Regular teacher training will allow teachers to explore different strategies, methods, and ultimately different types of knowledge that result in effective teaching. Further challenges in teaching Mathematical literacy will be addressed in the paragraphs to follow.

2.4.2. Language as a barrier to teaching and learning Mathematical literacy

The National Benchmark Test results discussed by Frith (2011), stated that investigations based on performance on some aspects of learning in Mathematical literacy discovered that learners experience difficulty using quantitative language. According to Vale et al. (2012), much of the work done in conversions is based on quantitative language, of which grade 10 learners may not have full knowledge. Vale et al. (2012), touched on the notion that Mathematical literacy can be a biased subject. This statement is fair since the researchers advocated that some learners would have a linguistic advantage over other learners since some learners are first-language speakers of English. This statement describes the ongoing challenge that Mathematical literacy teachers are faced with since most learners in South African schools are not native English speakers.

Multilingual classrooms would be an advantage for those learners who are seeking to learn different languages. However, in South Africa, multilingual classrooms are proving to be more of a disadvantage to many learners, particularly when learning Mathematics. A study carried out by Ball et al. (2005), indicated that teachers needed to possess fluency in Mathematical language, amongst other skills, so that proper explanations and analogies are given. The researchers also emphasised that there is very little known about the connection between the preparedness of Mathematics teachers and their learners' performance. The researchers further stated that more

research needs to be done to determine whether specialised knowledge is required for teaching Mathematics, rather than just Mathematical knowledge. More needs to be done to ensure that pre-service teachers can efficiently read, write and understand a variety of mathematical texts (Colwella & Enderson, 2016).

According to the findings from a study undertaken by Hlatshwayo (2013), teachers are experiencing challenges in multi-diverse and multilingual classrooms. The findings suggested that though teachers are aware of the demands of teaching in multi-lingual classrooms, they are not empowered to cope with these demands and therefore do not have a way of mitigating the challenge of teaching in a multi-diverse classroom. The fact that there are many learners in South African classrooms, each with their different levels of understanding language, means that is indeed difficult for teachers to effectively communicate instructions and explain concepts in a way that meets the needs of every single learner. Figure 2.1. provides insight into the effect of language on Mathematics teaching and learning.

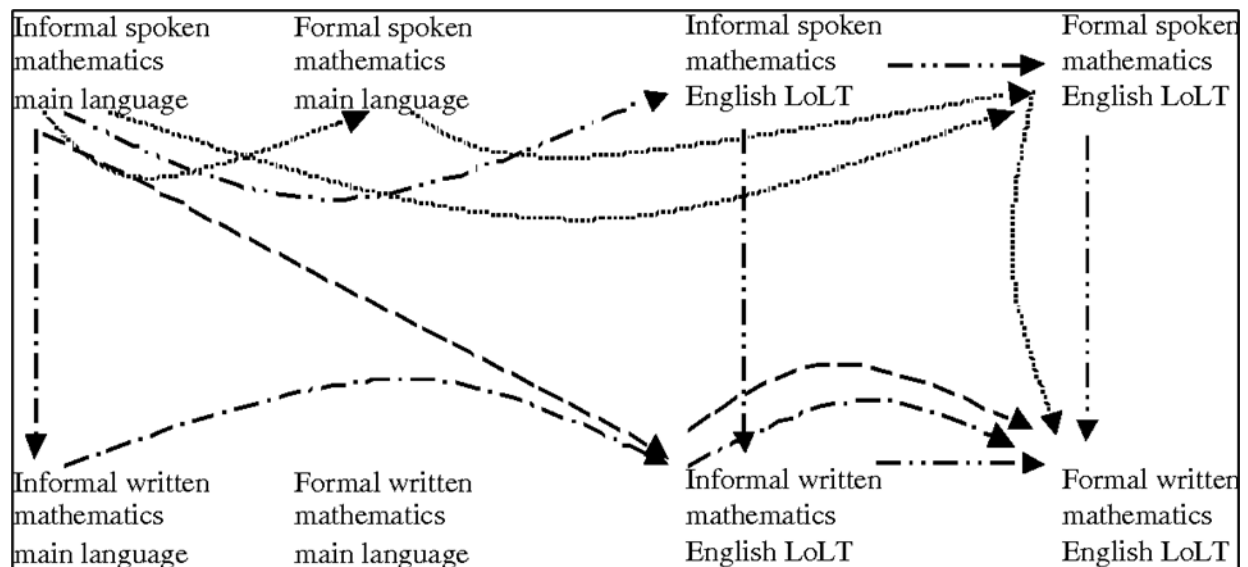


Figure 2.1: Alternative routes from informal spoken (in the main language) to formal written (In English) Mathematics language.: Adapted from Setati (2002, p. 11).

According to Figure 2.1 and the literature discussed in this chapter regarding language as a barrier to teaching Mathematical literacy thus far, the model represented above draws one’s attention to the current climate of teaching and learning in South Africa, particularly in terms of cultural and

socio-economic diversity. The model could be used as a good assessment for teachers, to assess how well-equipped they are in teaching Mathematical literacy in multilingual classrooms. By possessing the knowledge needed for teaching in multi-diverse classrooms in Mathematical literacy, teachers would be better equipped to assist all learners according to their levels of language proficiency.

2.4.3. Prior knowledge as a pre-requisite in learning Mathematical literacy

Mbonambi and Bansilal (2014), study in Mathematical literacy based on learners' proficiency in temperature conversion problems suggested that learners should be allowed to work with conversions in lower grades, particularly when the use of formulae is involved such as in the conversion of temperature. The study found that learners encountered difficulty when they had to solve for an unknown value or manipulate the subject of a formula. According to Long, Bansilal, et al. (2014), Mathematical literacy is complex and abstract yet requires a good foundation of knowledge of Algebraic skills. This view is supported by research (Mohyuddin & Khalil, 2016), which maintains that learners may know how to use a formula to convert, but they do not understand the abstract nature of the section.

Some of the sections that have been researched in the field of Mathematical literacy include taxation, inflation, temperature conversions, and calculations involving percentages by Bansilal (2017). All of these sections require learners to perform calculations involving conversions. However, very little content regarding Mathematical literacy concepts is explored in primary schools in South Africa, leaving learners with a weak Mathematical literacy foundation on which to build. According to Asl (2015), the prior knowledge of learners affects their learning, and teachers who understand their learners' prior knowledge may be more successful in the classroom. However, according to literature reviewed in studies conducted by Song (2017), there was minimal literature available on the importance of the comprehension of Mathematics and learning accomplishment. The research conducted by Song (2017) established that prior knowledge plays an undeniably relevant role in reading Mathematics, which in turn affects the comprehension and positive influence on the achievement of learning Mathematics, and that a teacher must become familiar with what prior knowledge learners possess to successfully create and implement effective learning strategies. These learning strategies are critical for learners to be able to practice

Mathematics as they require the use of formulae, substitution, solving for unknown variables, and changing the subject of a formula. According to Mabonga (2021), teachers and parents should use strategies that build on learners' prior knowledge, since doing so would build confidence in learners. Furthermore, the study emphasised the importance of learners being able to make sense of the Mathematics they are reading, otherwise known as Mathematical reading.

Concerning the findings of the study conducted by Song (2017), this research based on conversions and measurement has critically analysed the Annual Teaching Plan (ATP) that stipulates precisely what content has to be taught to learners in South African schools in grades 7 to 9 (Department of Basic Education, 2023c) since these years of schooling aim to equip learners with skills that will be furthered in the Further Education and Training (FET) phase (Department of Basic Education, 2023a; 2023b). Although the ATP does contain a platform for preparing learners with most skills needed for Mathematics, upon close inspection the ATP does not make mention of how teachers are to assess what prior knowledge learners have, or how to implement the ATP in a way that guides learners who would be more suited to choosing Mathematical literacy as their subject preference instead of Mathematics. In the Grade 9 ATP for mathematics conversions and measurement are not included. However, in Term 4, learners are expected to use their prior knowledge to convert units of measurement. This is reflected in Figure 2.2.

TERM 4	WEEK 1	WEEK 2	WEEK 3	WEEK 4	WEEK 5	WEEK 6	WEEK 7	WEEK 8	WEEK 9	WEEK 10
HOURS PER TOPIC	7 hrs		9 hrs		9 hrs		4,5 hrs	12,5 hrs		
TOPICS, CONCEPTS AND SKILLS	TRANSFORMATION GEOMETRY Transformations Recognise, describe and perform transformations with points, line segments and simple geometric figures on a co-ordinate plane, focusing on: <ul style="list-style-type: none"> - Reflection in the x-axis or y- axis - Reflection in the line $y = x$ - Translation within and across quadrants 		AREA AND PERIMETER OF 2-D SHAPES <ul style="list-style-type: none"> • Use appropriate formulae and conversions between SI units, to solve problems and calculate perimeter and area of: <ul style="list-style-type: none"> - Polygons - Circles 		SURFACE AREA AND VOLUME OF 3D OBJECTS <ul style="list-style-type: none"> • Use appropriate formulae and conversions between SI units to solve problems and calculate the surface area, volume and capacity of: <ul style="list-style-type: none"> - Rectangular prisms - Triangular prisms - Cylinders cylinders 		REVISION	FORMAL ASSESSMENT TASK EXAMINATION PAPER 1 AND PAPER 2 All topics from term 1-4		
PREREQUISITE SKILL OR PRE-KNOWLEDGE	<ul style="list-style-type: none"> • Translations, reflections, rotations enlargements and reductions with geometric figures and shapes on grid paper 		<ul style="list-style-type: none"> • Determine whether a triangle is a right-angled triangle or not if the length of the three sides of the triangle is known • Use the Theorem of Pythagoras to calculate a missing length in a right-angled triangle, leaving irrational answers in surd form • Use of appropriate formulae to calculate perimeter and area of polygons to include circles to at least 2 decimal places and convert between appropriate SI units, including and up to km^2 • Calculate perimeter and area of complex figures 		<ul style="list-style-type: none"> • Use of appropriate formulae to calculate the surface area, volume and capacity of cubes and rectangular prisms • Describe the interrelationship between surface area and volume of the objects mentioned above • Use and convert between appropriate SI units, including: <ul style="list-style-type: none"> - $\text{mm}^2 \leftrightarrow \text{cm}^2 \leftrightarrow \text{m}^2 \leftrightarrow \text{km}^2$ - $\text{mm}^3 \leftrightarrow \text{cm}^3 \leftrightarrow \text{m}^3$ - $\text{ml (cm}^3) \leftrightarrow \text{l} \leftrightarrow \text{kl}$ 					

Figure 2.2: 2023/2024 Annual teaching plans: Mathematical Literacy: Grade 9.: Adapted from Department of Basic Education (2023c, p. 6)

Figure 2.2 suggests that although conversions and measurement are not included in any of the topics from Term 1 to Term 4, in Term 4, the prerequisite skill or pre-knowledge indicates that learners need to be able to use and convert between appropriate SI units. Perhaps a challenge for teachers is to introduce conversions and measurements to learners who are already at a rather late stage of their schooling career, making it difficult for them to grasp the concept immediately. Learners would now have to familiarise themselves with the understanding of new Mathematical vocabulary as well as procedural knowledge when calculating conversions. Additionally, learners would also have to grasp the concept of exactly where the questions require them to either divide or multiply using the correct conversion factors without having previously explored these concepts in depth. The participants involved in this study indicated that they, as teachers found the ATP's to be ambiguous at times. There are no workshops or training provided to Mathematical literacy teachers to address the concern of ambiguity in the document.

2.4.4. Exploring the training of Mathematical literacy teachers

In her study, Ball (2007), questioned how much is done in effectively training Mathematics teachers to teach Mathematics. The study recommended that more research should be done to link the achievement of the learners to the preparation and knowledge of Mathematics teachers. According

to Bansilal et al. (2015), most teacher training opportunities for Mathematical literacy teachers were funded by the government and are, unfortunately, no longer available. A country consisting of unequal opportunities, high employment rates, and a questionable education system, would either advantage or disadvantage some of its population as stated by Areff (2015). Therefore, a teacher needs to be aware of what a learner could or could not have been exposed to. A typical example of this would be the use of proper cooking and baking utensils which not many learners have had the privilege of using. Undoubtedly, those learners have used utensils such as specialised measuring cups or spoons, kitchen scales, and so on. before would at least have the advantage of knowing which ingredients are measured in millilitres or litres, grams or kilograms. However, most learners come from homes that are faced with unemployment, so it cannot be taken for granted that all learners have this apparatus in their homes (Chikoko & Mthembu, 2021). Thus, learners need to have access to tools and resources when measurement is taught in Mathematical Literacy (Botha, Coetzee, & Zweers, 2023). Moreover, the use of manipulatives and practical, real-world objects is important for teaching conversions and measurement (Brijlall & Niranjana, 2015); (Deogratias, 2022). However, due to the lack of resources, most teachers use the ‘chalk and talk’ teaching strategy by talking and discussing using the whiteboard or chalkboard (Sharma & Kumar, 2018).

Maryani and Widjajanti (2020), conducted a study that concluded teaching Mathematical literacy in contextual parameters yielded more successful results. if this is so, surely all Mathematical literacy teachers should be provided with the opportunity to be trained to teach Mathematical literacy according to the appropriate contexts. According to an article published by a news agency named ENCA (2013), South Africa had a total of 7076 unqualified teachers, teaching in South Africa. Many teachers possess qualifications in other disciplines but have found themselves teaching due to unemployment dynamics. Moremedi (2007), stated that there is much to be known about whether teachers are adequately trained in Mathematical literacy. According to UMALUSI (Pijoo, 2020), South Africa is advised to invest in education and training. Accordingly, a study conducted by Taylor (2021) showed that South Africa is in dire need of efficient and qualified Mathematics teachers. In addition, Mathematical Literacy teachers need to have good knowledge of context, content, and pedagogical content knowledge (Bansilal, 2014). Accordingly, not having

skilled and efficient mathematics teachers results in the weak performance of learners in Mathematics (Lambrianos, 2019).

2.4.5. The continuous cycle of producing individuals with weak Mathematical skills in society

According to Ball et al. (2005), studies done previously revealed that the Mathematical skills of teachers seemed to be getting weaker as time passed. Ball (2005) claims that even in America, there is a cycle of weak Mathematical ability and skills which is common to teachers. This is due to learners who are weak in Mathematics becoming Mathematics teachers. One may ask, what could be the contributing factors that give this cycle of weak Mathematical culture to continue? Admissions to school during Apartheid were based on skin colour, consequently, Bantu Education was an inferior education system that prohibited academic excellence among African people (Moore, 1990).

This unequal footing is a reminder of the unfair and unequal opportunities given to people in education in the past and the consequences thereof are obvious in education. In an article written by Vithal and Skovsmose (1997), ethnomathematics plays a key role in improving Mathematics education by including the cultural backgrounds of learners and can be broken down into four aspects: The traditional history of Mathematics; Mathematical ideas found in traditional cultures; Mathematics of different groups and the relationship between Mathematics and ethnomathematics. The researchers claimed that third-world countries were pressured into adopting curricula that catered to industrialisation, rather than curricula that developed the full potential of learners, by considering the inclusion of their cultures in the curriculum (Al-Ansi, 2017). Since this is the case, the Mathematics and Mathematical literacy curriculum are still aligned to the principle of simply preparing learners for the workforce, rather than including their cultural backgrounds and indigenous knowledge to ensure that learners can develop a personal experience that provides a foundation for learning Mathematics.

By referring to the ATP discussed earlier, one can establish that the current South African Mathematics curriculum does not make provision to include much of the ethnomathematics learners may have been exposed to in their lives. The afore-mentioned article by Vithal and

Skovsmose (1997), provides one with insight as to how the former education system during Apartheid has impacted on career choices that “poor” learners and learners of African descent make. The article further provides an understanding of the history of how certain race groups were exposed to specific types of education that were placed to purposefully align individuals to particular careers. An important question one may ask is, how much have the career choices of people who were previously disadvantaged changed, and has enough been done by the South African educational system to address this question? Pijoo (2020), reported that UMALUSI had called on teachers to teach differently since the number of learners choosing Mathematics saw a significant decline. With fewer learners of Mathematics as their preference, UMALUSI suggested that teachers would need to be assisted in finding different ways to teach Mathematics. The article stated that problem-solving skills that enable learners to have the ability to attempt unfamiliar problems must be taught effectively at schools. If the cycle of producing individuals with weak Mathematical skills has to be addressed, then teachers have to be empowered with the best knowledge, skills, and strategies to effect changes in the performance of learners. Along similar lines, it is important to use examples for problem-solving in Mathematical Literacy that are relevant and meaningful to the learners’ context Manfreda & Hodnik, 2021; Stacey, 2015).

2.4.6. Inadequate resources for teaching Mathematical literacy

Many of the promises given to the South African population since the 1994 democratic elections have been built around free education (Naicker, 2002). Though learners are allowed to attend whichever school they desire to be enrolled in, provided they meet the academic requirements of the school, the provision of resources by the Department of Basic Education remains largely insufficient. Although for the participating schools in this study, the DBE has provided teacher support documents and study guides (Mathematical Literacy Subject Advisors, 2022a; 2022b), textbooks for each learner are not provided.

Moreover, as experienced by the researcher of this study based on conversions and measurement, many public schools still use outdated textbooks, worksheets, and other study materials that do not prepare learners for provincial examinations. It was concerning to note that more than half of the learners in Further Education and Training (FET) Mathematical literacy learners do not have calculators: a primary requirement for every school-going child. The Department of Education

classifies schools into quintiles based on the area and socio-economic characteristics of residents in those areas. Having this information and knowing that the unemployment and poverty rate in the country is drastically high, the Department of Education has not made provisions to provide schools with calculators, even if they could be shared amongst learners. As stated by Govender (2018), in an article, the Department of Education stipulated in 2008, that all teachers must ensure that they have relevant resources in their classrooms. These resources include textbooks, charts, and instruments required for teachers to use during lessons to enhance learning. However, the article concluded that many teachers reported that they do not have access to these very resources, since the schools where they teach are experiencing financial crises and therefore cannot afford to purchase the resources required. In keeping with the claims made in the article, the researcher of this study found that learners who come to the Mathematics classroom without calculators, often lag as they have to borrow from their peers and as a result, may not necessarily know how to use the functions in different calculators. Borrowing calculators during lesson time and examinations also impacts the concentration and amount of time learners can spend on calculating answers.

According to a study that was carried out by Dlamini (2016), the inability of the government to equip schools with technological devices that aid in the teaching and learning process needs to be addressed as it makes the work of teachers more difficult. The researcher recommended that the Department of Education provide all Mathematical literacy teachers with the relevant resources required to teach different topics stipulated in the Annual Teaching Plan so that all learners are given a fair and equal chance of engaging with relevant resources and no learner would be left behind. Sinyosi (2015), stated that there is little space for creative teaching to take place since there is inadequate support provided for teachers from School Management Teams (SMT). The study proved that most schools are inadequately resourced and therefore, teachers may be forced to implement older and less creative teaching strategies. To add to these challenges, in my experience as a teacher, I have noticed that child-headed families are fast becoming a reality in many homes in South Africa. Child-headed families are those in which the main custodian of the child is the child himself/herself. This situation can arise for a variety of circumstances, such as the demise of the parents or due to financial, or social instability in the household. These conditions can be extremely trying for the children involved, as they are forced to take on the role of an adult and care for as well as provide for their siblings. They are often left with no choice but to work, to

bring money into the household, meaning they are unable to attend school and receive a proper education. Sinyosi (2015), emphasised that many learners come from homes where the heads of the family are children themselves. If that is the case, those learners would not have the necessary financial and emotional support required to excel in Mathematics.

Hansraj (2021), emphasised the need for the use of technology in teaching space and shape in grade 10 Mathematical literacy. The study undertaken by Hansraj (2021), revealed that learners who struggled with English being the medium of instruction in school were better able to relate to concepts taught in Mathematical literacy when the use of technology was involved in lessons. Furthermore, learners were able to successfully use laptops, cell phones, and the internet which created a positive setting for homework to be done. The researcher did, however, state that funds were not allocated for the integration of technology in the teaching of Mathematical literacy. This notion is supported by other research conducted in schools in South Africa (Ankiewicz, 2021).

2.4.7. Inadequate teacher development and professional learning communities in Mathematical literacy

Teachers require regular training workshops as the academic year progresses since different topics are taught each term. Mshengu (2019), who conducted a study with Mathematical literacy teachers who were part of Professional Learning Communities (PLC) made a recommendation that teachers of Mathematical literacy should meet more frequently to share, discuss, and develop in their practice. It was further recommended by Mshengu (2019), that Mathematical literacy subject advisors should organise learning activities and develop the seven types of teacher knowledge on which Shulman (1987), had elaborated. Mshengu (2019), maintains that PLC involvement allows teachers to engage, share ideas, and most importantly, critically reflect on one's teaching practices. The study involved participants at different points in their teaching careers, yet all participants confirmed that PLC involvement had influenced their teaching practices positively. Teachers were allowed to collaboratively design assessment tasks, critique resources, share ideas and concerns, as well as discuss the content areas that posed as challenging for them and their learners.

According to Mshengu (2019), one of the key factors for the improvement of teaching, when teachers are enrolled in a PLC, is that such involvement allows these peers and colleagues to freely

moderate and correct each other should there be a need. The findings of Mshengu (2019), specified that there was very little indication of knowledge of context. These findings can be generalised, where lack of knowledge of context plays a negative role in the teaching of Mathematical literacy, however, it provides a basis for understanding the backgrounds from where the learners come. Mshengu (2019), further revealed that teachers were more familiar with some aspects of pedagogical teacher knowledge than others. It was established that teachers felt a sense of trust in terms of assessment tasks that were developed in the PLC since the tasks were collaboratively designed. Teachers displayed knowledge of the taxonomy requirements and were able to seek clarification if required. The study revealed content on discussions that teachers held based on policy and other crucial documents such as ATP's and work schedules.

Another reason for the advocacy of PLC involvement is that it provides teachers within clusters or district levels to engage in discussion about the areas that were challenging in the syllabus. In doing so, Mshengu (2019), advocated that teachers would be able to deduce in which sections learners experience difficulties, collectively. Such deductions would give these teachers the advantage of focusing on the problem areas by deepening their skills and knowledge, which could prevent learners from achieving poor results within the cluster or district levels.

2.5. Social responsibility and Mathematical literacy

Engineering conversions present a challenge for engineers, as they often need to convert between a variation of different measurements from one set of units to another. For example, when designing a product, engineers may be required to convert measurements from inches to centimetres, or from grams to ounces. Likewise, when designing a building, bridge, or other structures, engineers may be required to convert measurements from degrees Fahrenheit to degrees Celsius, or from millimetres to inches. Moreover, when working with mechanical machinery engineers may need to convert measurements from revolutions per minute (RPM) to angular velocity, or from Watts to horsepower if working with electricity or power. Due to their skill and knowledge, engineers need to be able to accurately convert measurements from one set of units to another, allowing them to correctly finish their tasks and design effective products and structures. Unfortunately, this expectation is not always met by engineers. Literature provides cases where failure to convert between units of measurement proved to be dangerous in various situations,

particularly when experiments were involved. Naheem (2020) carried out a study on the explosion of the Mars Climate Orbit that was launched by NASA. It was concluded that the failure of that launch was due to relevant individuals working with the finer details failed to convert the units of measurement, thus causing the explosion. Since Mathematical literacy entails a vast amount of work done on conversions and measurement, the NASA Climate Orbit failure emphasises the importance of conversions and measurement. The repercussions of incorrectly converting units of measurement proved to be fatal to those astronauts who were a part of the launch.

Mathematics and Mathematical literacy play an integral role in society, particularly in determining health risks in a society. A study undertaken by Govender et al. (2022), examined the risks of lower back pain among cashiers and concluded that cashiers over the age of 30 years old and work for longer hours are more prone to lower back pain. Knowledge of Mathematics, therefore, is of utmost importance when conducting studies based on health-related issues, since such studies require knowledge of selecting appropriate sampling sizes to draw reliable conclusions, which require Mathematics and the interpretation of the results requires literacy. People possess different types of Mathematical knowledge, whether they develop this knowledge through physical activities, learning from others, or by making logical decisions and reasoning. According to a study conducted in South Africa by Govender (2012), teachers expressed that they felt they did not have enough opportunities to develop their skills and expertise further. The study revealed that teachers needed training on an ongoing basis. Govender (2012), advised that there are critical aspects that contribute to effective teacher training. The aspects that were advised by Verspoor as cited in Govender (2012, p.3), include providing local and ongoing teacher training, forming organisations that offer support to teachers, adapting teacher training according to each teacher's level of expertise, and lastly, recognising the dedication of teachers. Roussouw (2019), stated that for teachers to teach Mathematics meaningfully in the real world, they need to be provided with long-term support and professional development (p.54). Since Mathematical literacy teachers expressed their dissatisfaction with teacher training opportunities available to them, Naidoo (2021a), stated that the teaching of Mathematics in multicultural classrooms can be supported by culturally based activities that encompass indigenous knowledge perhaps, teachers could then organise their opportunities within their cultural network to share, explore and learn from each other. Mathematics is a subject that is continuously changing, and it has been used in several contexts

throughout previous centuries. As changes emerge in societies; Mathematics also needs to advance to meet new needs (Yadav, 2019). In recent years, the notion of socially responsive Mathematics has developed, which emphasises the necessity to see Mathematics as a social instrument that may be used to improve the lives of people from all walks of life and so too, is Mathematical literacy.

Socially responsive Mathematics inspires the use of Mathematics to talk to social problems such as poverty, discrimination, and environmentalism. It also reassures the use of Mathematics to support the advancement of communities, particularly those that are underserved or sidelined. Using this approach, Mathematics can be used to design policies, improve strategies, and assist in improving the quality of life for all. Moreover, socially responsive Mathematics encourages the use of Mathematics to solve problems in a diversity of contexts, including healthcare, education, infrastructure, and social services. Finally, socially responsive Mathematics proves that Mathematics may be used to make a difference in the world and how it can be used to produce a more impartial and fair society According to Atweh and Ala'i (2009), Mathematics should enhance the learner's ability to transform the world. The researcher advocated that all stakeholders in education must recognise the need for the type of Mathematics that enables learners to become socially responsive. Therefore, since there are a larger number of Mathematical literacy learners than Mathematics, as teachers, we need to strive to ensure that we develop such skills in learners effectively through as many avenues as possible. To address socially responsive Mathematical literacy teachers need to be aware that they certainly make an impact on society and they need to be equipped with the skills and knowledge to do so.

The South African government and the Department of Education must ensure that all citizens are given a just and equal education. Mhlongo (2015), stated in his research that the education policy that is being implemented in South African schools to provide quality and non-discriminatory education to learners is met with resistance from teachers. The readiness to implement inclusive education according to Mhlongo (2015), revealed that teachers' readiness to adopt inclusive education reduces as teachers develop more experience in their years of teaching. The question of whether all mainstream schools have identified if they have enrolled learners with special needs and learning difficulties or not is yet to be answered. The researcher who carried out the study on conversions and measurement teaches at a public school, where there is one learner who can

immediately be identified as a special needs learner due to her having a physical disability. Unfortunately, no provisions have been made for this learner to accommodate her in the classroom in terms of special furniture nor is she receiving extra attention in terms of being taught. Apart from the learner mentioned, there are plenty of learners at the school, who the teacher noticed experience serious difficulty in reading and writing. Yet again, no system has been put in place by the school management to identify these learners and assist them with extra and appropriate care to accommodate them through their schooling career. During the data collection process of this study, many participants indicated that their learners experience difficulty in reading and writing. One of the schools involved in the study is in fact, classified as a special needs school. However, the school does not make provisions for the learners who are enrolled to be taught as special needs learners.

Thus, per the findings of Madiba (2021), teachers in mainstream high schools in Mahikeng were found to be untrained in providing inclusive education to learners with barriers to learning. Afifah et al. (2018), stated that teacher training institutions ought to offer opportunities for teachers to develop their ability in mathematical literacy. Madiba (2021), further stated that learners with special education needs did not receive the support they required. Furthermore, the study also found teachers to be operating in isolation and without the support of relevant stakeholders. Recommendations made in the study suggested that all stakeholders in education including parents be involved in communicating and moving forward with means of providing an inclusive education for learners in need. There was also a recommendation made for teachers to undergo training that addresses special education needs. These recommendations are synonymous with the situation that the researcher who did a study on conversions and measurement since she too identified learners with special needs in a mainstream secondary school but did not have the expertise nor the guidance of management to address the situation. It is unfortunate that, from engaging with other teachers, they seem to experience the same problem and do not have assistance in addressing the issue at their schools. One can only imagine the devastating impact that this failure to address the needs of special needs learners in mainstream schools has on the future of these learners. With the current cost of living being so high, and the demands on teachers to deliver the curriculum, very few teachers are willing to further their studies since funding is not available

to all teachers. Furthermore, the Department of Education does not recognise teachers who advance their qualifications by increasing their salaries.

2.6. The implications of roles and attitudes adopted by teachers

Botha et al. (2013) suggest that teachers must approach teaching Mathematical literacy without feeling that it is a subject that is inferior to Mathematics. This notion is also supported by Bansilal (2014). Teachers define mathematical literacy as simply having the ability to read and understand operations performed in mathematics (Özgün Sefik & Dost, 2016). However, mathematical literacy teachers are required to have a working knowledge coupled with skills that can only be achieved through teaching and learning to effectively facilitate efficient teaching of Mathematical literacy. Thus, teachers need to use teaching strategies that support learners as they learn content, improve their knowledge, and develop skills (Sarode, 2018). Currently, the Department of Basic Education (DBE) has provided teachers with a work schedule that has precise guidelines for teaching conversions and measurement as well as other sections. However, the resources and content that each teacher may use can differ quite drastically, leaving thousands of teachers to employ different methods and use different resources and strategies to teach Mathematical literacy content. Botha et al. (2013), further stated that teachers of Mathematical literacy frequently encountered difficulty in conceptualising word problems. Moreover, it was found that sometimes, teachers found relating to the concepts and language in Mathematical literacy more complex than usual routine Mathematical problems (Machaba, 2017). The research states that many teachers were forced or opted to teach Mathematical literacy without the necessary training required to do so. It was also stated that relevant policy documents do not guide in terms of what the appropriate skills, pedagogical content, and qualifications are required for one to teach Mathematical literacy. Therefore, many teachers who opted to teach it under the impression that it is an easier subject, are those who did not receive the proper training to teach Mathematical literacy and approach teaching the subject with less dedication, commitment, and motivation than they would Mathematics.

Mbatha (2013), conducted a study in South Africa which revealed that school management teams rarely included teachers in decision-making or consulted with teachers for input concerning general school matters and were thus hesitant to take on leadership roles. The study found that

generally, teachers simply followed instructions from School Management Teams (SMTs) and were not active in taking on management decisions beyond the classroom. The findings also revealed that in two of the participating schools in the research, where teachers were included in decision-making and providing input, school effectiveness was evident. The other school in which teachers were simply instructed to teach, was found to lack teacher leadership and school effectiveness was therefore not evident. The participants were expected to teach with limited resources and did not have a voice in terms of expressing their areas of concern as Mathematical literacy teachers. Teachers are aware that they need to incorporate real-life contexts in their lessons, but the knowledge on how to do so is lacking (Botha & Putten, 2018) Mbatha (2013), recommended that the Department of Education conduct workshops to empower teachers to take on leadership roles. Perhaps this recommendation, if followed, would provide Mathematical literacy teachers the opportunity to make decisions and provide input to school management teams regarding instruction time and resources required for successful Mathematical literacy lessons. In doing so, Mathematical literacy teachers would then be allowed the opportunity to explore the different types of knowledge that contribute to successful teaching.

2.7. The current state of Mathematics and Mathematical literacy in South Africa

According to Areff (2015), statistics based on learner performance in Mathematics in schools indicate that South African learners living in poverty could face a dreary future because the country's education system is not treating them equally. Statistics provided by the Basic Education Minister; Angie Motshekga revealed that at least one of four schools in the country does not offer Mathematics from grades 10 to 12. While this may be a discouraging reality, the reason behind such a disappointing result is a lack of trained and qualified teachers (Moremedi, 2007). It is relevant to make mention of the results obtained by learners in Trends in International Mathematics and Science Study (TIMSS) tests to understand the current situation of Mathematics in South Africa. Figure 2.3. demonstrates the ability of grade 5 learners to apply and use Mathematical knowledge in solving problems.

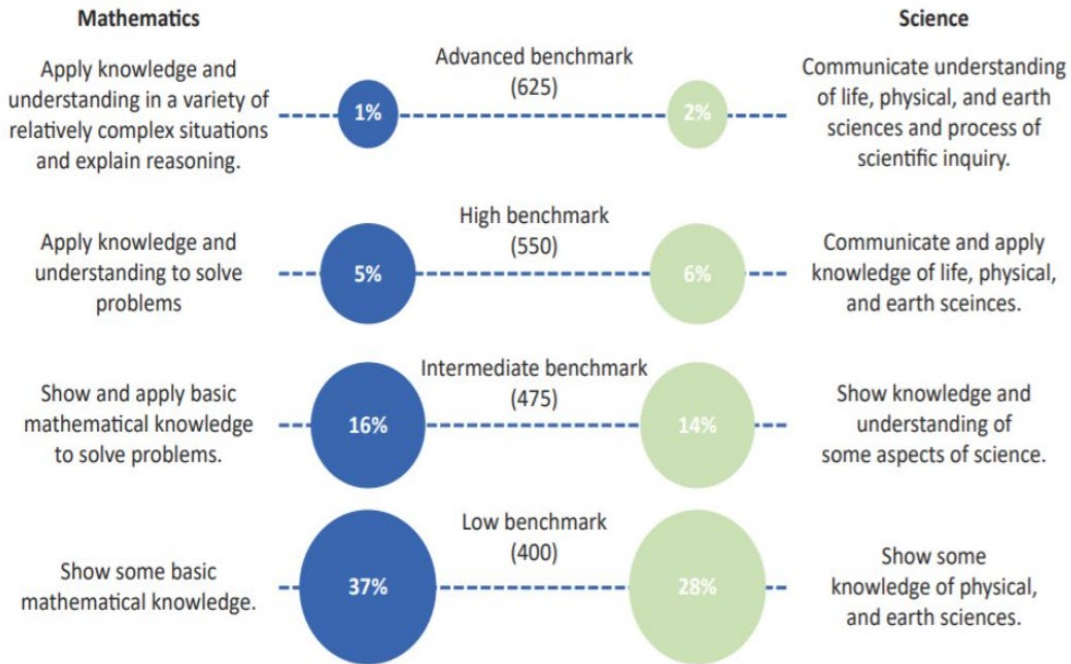


Figure 2.2: TIMSS: Percentage of grade 5 learners reaching International Benchmarks for Mathematics and Science: Adapted from Trends in Maths and Science Study (2019, p.15)

Based on the grade 5 results in Figure 2.3, a mere 37% of grade 5 learners were found to have basic knowledge of Mathematics which is known to be a low benchmark. Only 16% of the learners were found to display basic Mathematical knowledge when solving problems which is a measure of the intermediate benchmark. The high benchmark result revealed that only 5% of the learners were able to display knowledge of the application of procedures to solve problems. Lastly, a mere 1% of learners reached the high benchmark, which is determined by displaying knowledge of Mathematical applications in different situations. These results provide insight as to where there are knowledge gaps in grade 5 learners' Mathematical knowledge and can be used to devise strategies that could prepare learners for Secondary school Mathematics or Mathematical literacy.

Figure 2.4 is an illustration of grade 9 learners' ability to reason, apply Mathematical knowledge and demonstrate an understanding of whole numbers and graphs.

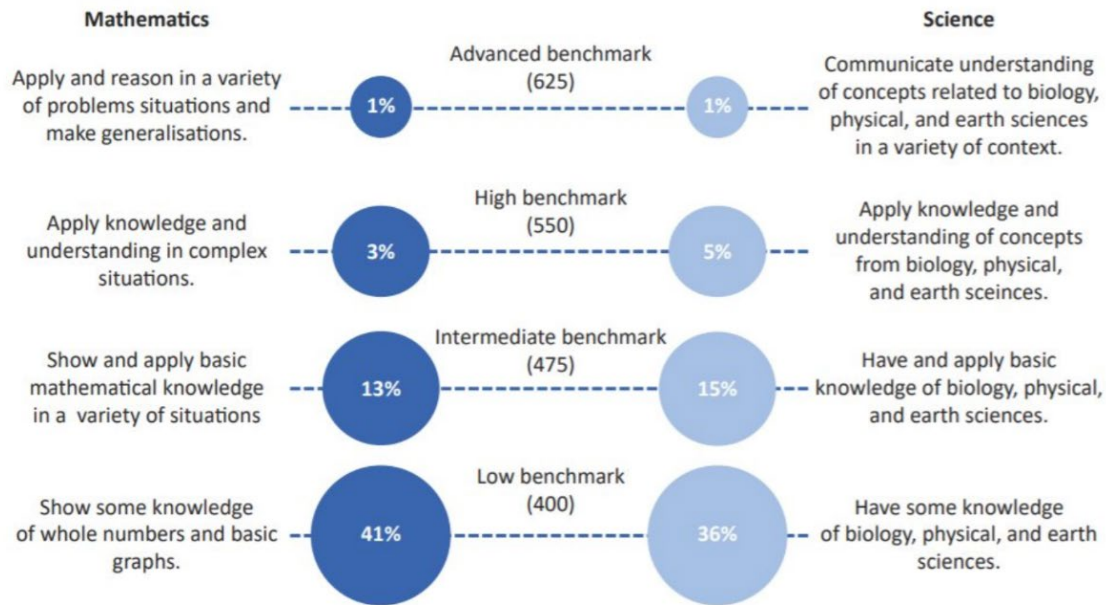


Figure 2.3: TIMSS: Percentage of grade 9 learners reaching International Benchmarks for Mathematics and Science: Adapted from Trends in Maths and Science Study (2019, p.15)

Based on the grade 9 results released by TIMSS, 41% of grade 9 learners were found to display knowledge of whole numbers and graphs, which is known to be a low benchmark. Only 13% of the learners were found to display basic Mathematical knowledge when solving problems which is a measure of the intermediate benchmark. The high benchmark result revealed that only 3% of the learners were able to display knowledge of the application of procedures to solve problems. Lastly, a mere 1% of learners reached the high benchmark, which is determined by displaying knowledge of Mathematical applications in different situations to solve problems.

The DBE (2020), reported that according to the TIMSS study in 2019, South African learners scored in the bottom three countries in multiple tests despite being older than learners in the same grade in other countries. Whilst Mathematics or Mathematical literacy are compulsory subjects, they are in no way comparable to increasing matric pass rates, schools are forced to offer Mathematical literacy on a larger scale and sometimes learners who fail Mathematics end up dropping out of school (Govender, 2012). Such a situation results in the learners having very limited choices in careers after school. Areff (2015), further stated that wealthier learners are allowed to continue with Mathematics and succeed and that disadvantaged learners who take

Mathematical literacy will remain disadvantaged. The dismal results released by TIMMS indicate learners' ability to apply Mathematical knowledge when solving problems in a variety of contexts. These results should be utilised in devising strategies that will equip learners for grade 10 Mathematical literacy.

2.8. Debatable matters on the preparedness of learners in Mathematical literacy

If you do not prepare everyone, then essentially you only have the privileged learners who are prepared to take advanced Mathematics (Garland, 2013). Whilst most countries strive to have a uniform curriculum in Mathematics, many of them have more than one type of specialisation in the subject. The aim of offering these different disciplines may have been noble, yet there is much room to debate whether all learners will be afforded equal opportunities in higher education institutions and ultimately their careers. Here, the issue is more centred on when and what should be taught.

Cai et al. (2017), stated that international comparative studies of learners in Mathematics can be used to identify similarities and differences in the performance of learners in sections. However, the performance of learners in Mathematics from different parts of the world cannot justly be compared to the performance of South African learners as there are undeniably huge differences between our country's international and national standards in the teaching and learning of Mathematics (Kreider, 1983). One such example is the percentage pass of Mathematical literacy in South Africa, which requires a learner to achieve a mere 30% to be considered as a pass mark. Therefore, a learner who chooses to do Mathematical literacy will be limited to options in careers, while those who are privileged enough to do Mathematics will have a choice. Madela (2016), indicated in her research findings, that South Africa is facing dire constraints due to professionals who have expertise in science industries, due to poor learner performance in Mathematics in schools. Mathematics has endless opportunities to embark on several career options (North, 2015). One may question whether the GET Mathematics ATP that was designed and adopted into the curriculum is effective in developing learners who are more suited to pursue Mathematical literacy as their preference instead of Mathematics.

2.9. Politics and Mathematical literacy education

The political power of a country has much to do with the education system and education policies that are adopted. South Africa is an example of how political power can influence the performance of education. The effects of different types of education allocated to different race groups during Apartheid still play a huge role in the education system years later. Political influence on education has very little to do with alleviating problems in the schooling system but rather uses education as a tool for power (Moore, 1990). According to Sanchez (2007), research needs to be done on emphasizing Mathematics. The study had argued the need for society to be familiar with Mathematics, due to comprehension and presentation of governmental and political reports. Sanchez (2007), further stated that Mathematical models are used in the planning of many important structures in a country. Some of these important structures include traffic planning, production of goods, and economic and environmental planning. Since South Africa is governed by a ruling political party, it would be fair to say that decisions based on education are largely influenced by the political party. These decisions made by leaders in governance, particularly relating to matters in education surely create an impact on learners, who in turn become teachers. Therefore, it would be just to say that politics certainly creates an impact on education. Figure 2.5. is a model of the mathematical modelling process (Blomhoj & Jensen, 2006), based on mathematical models and their functions in politics:

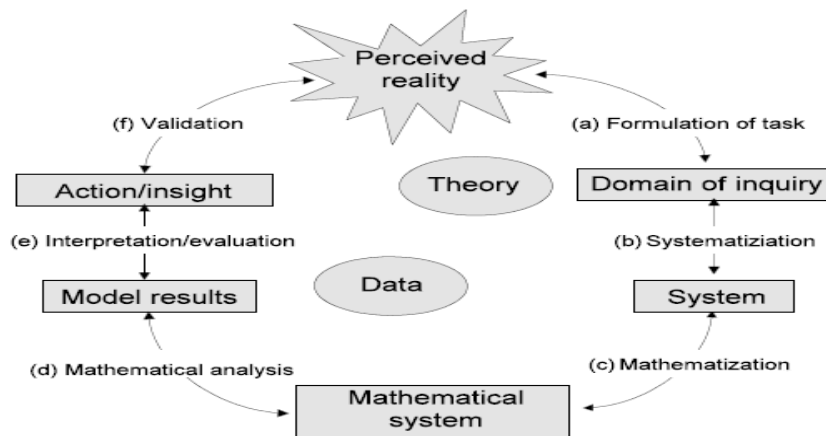


Figure 2.4: Mathematical Modelling Process: Adapted from Blomhoj & Jensen, (2006, p.10)

The model in Figure 2.5, according to Blomhoj and Jensen (2006), illustrates sub-processes in the role of politics in Mathematics and vice-versa namely.: problem formulation, systemization, Mathematisation, analysis, interpretation, and validation. In a society where according to its education policy, a 33% pass is required in Mathematical literacy, members of society would not be able to fully comprehend political issues, since there were very few people who were privileged in acquiring the skills needed. Since teaching requires different types of knowledge, the role of politics in Mathematics education in South Africa discussed in this study attempts to provide an understanding of whether teachers themselves, are aware of politics play a role in teaching and learning in South Africa. By examining Figure 2.5, a link can be made between the social implications of inequalities South African learners have faced. The process discussed in the model could assist in addressing strategies aimed at intervention concerning the different types of knowledge teachers possess.

According to Mohale (2024), UMALUSI is a council that ensures that all questions in examination papers and assessments, as well as the marking of assessments, are standardised. The council is responsible for the moderation of assessments and monitoring marking, monitoring examinations, and releasing grade 12 learner's results. UMALUSI (2020), stated that poor living conditions could be a contributing factor to attaining weak Mathematic results. Matters such as lack of access to water and sanitation were suggested to be addressed since there was a correlation between learners who hail from impoverished backgrounds and poor results in Mathematics. Not having access to water and sanitation can result in severe consequences for learners, as many of them may not be able to bathe or wash their uniforms daily, resulting in absenteeism The political parties in power must address socio-economic challenges with urgency and efficacy since many of the challenges mentioned have a negative impact on learning.

2.10. Policy and practice in teaching Mathematical literacy

It is of utmost importance for schools to have a comprehensive Mathematics policy that covers all areas of Mathematics education. Additionally, the policy should deliver guidance on how to evaluate learner progress and how to address learners' individual needs. Finally, the policy should outline strategies for inspiring learners to develop positive attitudes toward Mathematics and to foster a lifelong love for the subject. By having a well-defined Mathematics policy, schools can

ensure that all learners are receiving the highest quality Mathematics education. The Curriculum and Assessment Policy Statement (CAPS) documents, which claim to provide all learners with an education of high quality, and which are the core of all subjects, are an issue of controversy themselves. In terms of Mathematics, the CAPS document speaks of reaching all learners and providing equal opportunities to these learners. However, there is a large pocket of learners who are facing the consequences of social injustice through which their parents once lived. Even though learners are all given the same educational opportunities at present, most come from homes where parents are not academically inclined or cannot afford the child an opportunity to enter an academically advanced school that pushes learners out of their comfort zones. Figure 2.6. represents results of a survey, which demonstrates that there are numerous factors contributing to the inability of teachers to bridge the gap between policy and practice (de Korte, 2021).

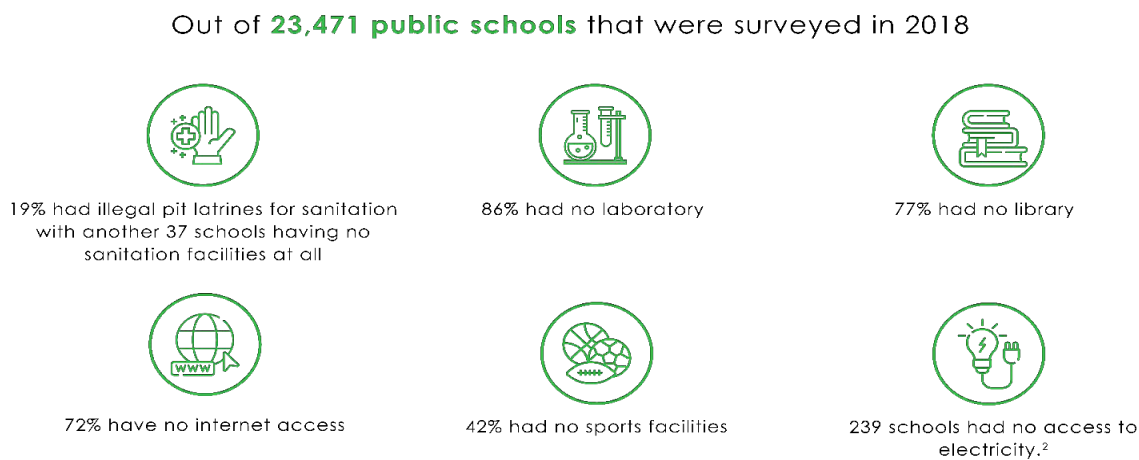


Figure 2.5: Blog information on schools that were surveyed regarding facilities.: Adapted from Education in South Africa (de Korte, 2021, p.1)

Figure 2.6. represents the data from many public schools surveyed in 2021, illustrating the lack of basic amenities viz. toilets, electricity and libraries. The lack of educational resources further contributes to teachers not being able to bridge gaps between policies and practices. While the CAPS document may seem motivating and aims to bring about transformation, more attention and funds should be invested into the lives of learners, to expose them to the resources and tools they require to become successful. According to Wright (2016), abstract and isolated Mathematics education at the upper secondary level is oriented towards a Mathematical elite and left without connections to the use of Mathematics in society. The situation also applies to South Africa.

Although the work done by Mshengu (2019), indicates the presence of some types of teacher knowledge being applied more than others, it does not refer to any areas of content specifically. Figure 2.6, provides information on the lack of basic resources in many South African schools. This information could be useful for the DBE in strategizing ways to assist teachers in school to deliver the curriculum by addressing the shortage of resources.

2.11. Summary

The literature reviewed in this chapter addresses the inequalities that the schooling system in South Africa is faced with and as such, makes it difficult for Mathematics teachers to deliver fair and just lessons. The imbalance in the distribution of resources and lack of professional training available for teachers, past societal imbalances such as segregated schooling and employment opportunities that have not been addressed by the government amount to added pressure on Mathematics teachers and in turn impacts the type of knowledge Mathematical literacy teachers have and use in teaching. To address research gaps, teacher training, policies and practices involved in the teaching of Mathematical literacy were discussed, thus providing a link to what strategies teachers use when teaching conversions and measurement in Mathematical literacy. The literature discussed in this chapter also addresses the social and economic challenges, as well as language barriers in teaching Mathematical literacy. The next chapter is based on the theoretical framework.

Chapter 3: Theoretical framework

3.1. Introduction

Christiansen (2014), explained in detail that a theoretical framework explains how things happen and includes why this happens. This chapter therefore entails details about the types of knowledge teachers require in their collection of skills and the productive use of these to teach Mathematics effectively and successfully. Since this research focused on the strategies teachers use when teaching conversions and measurement, how teachers teach conversions and measurement and why they do so in the way that they do, the types of teacher knowledge used when teaching conversions and measurement were explored.

Table 3.1: Table illustrating the link between research questions and theoretical framework

<i>Research questions</i>	<i>Link with the theoretical framework</i>
<ul style="list-style-type: none">• What strategies do teachers use to teach conversions and measurement in Grade 10 and 11 Mathematical literacy?	This research question is answered by exploring the general pedagogical content knowledge of Mathematical literacy teachers.
<ul style="list-style-type: none">• How do teachers teach conversions and measurement in Grade 10 and 11 Mathematical literacy?	This question is answered by exploring the curriculum knowledge as well as knowledge of educational contexts of Mathematical literacy teachers.
<ul style="list-style-type: none">• Why do teachers teach conversions and measurement in Grades 10 and 11 Mathematical literacy in the way that they do?	This question is answered by exploring the domains of teacher knowledge as per Ball (2005), and Shulman (1987).

Table 3.1 illustrates how exploring the types of teacher knowledge addresses the research questions of this study. Shulman's (1987) theory is linked to the main research questions for this study as follows. Teachers need to comprehend the subject matter to decide how best to teach conversions and measurement. They will need to prepare materials and resources to support their teaching methods and strategies to ensure effective instruction. Moreover, teachers need to evaluate and reflect on why they use specific teaching strategies to teach mathematical literacy. Hence this framework is well suited for the study under focus. Thus, the theoretical framework that

was chosen is relevant to this study since the study explores in-depth how teachers teach conversions and measurement in Mathematical literacy. Two main researchers influenced this study and some of their work is put forward and duly discussed comprehensively, within this chapter. The research done by Shulman (1987) and Ball et al. (2005), is squarely focused on teacher knowledge and has a great significance in the teaching of Mathematics. It is a commonly known fact that learner performance in Mathematics and Mathematical literacy should be improved as a matter of urgency in South Africa; the poor yearly matric results are proof of this. Shay (2020), stated that only 54 percent of learners who wrote the Mathematics examinations in in the year 2019 had passed.

The DBE (2021), has also stressed the need for the betterment of results in these fields. The research done on types of teacher knowledge used in teaching conversions and measurement can be particularly helpful in South Africa since the study addresses what strategies teachers use when teaching Mathematical literacy. By identifying the strategies used in teaching conversions and measurement, we can understand how teachers use pedagogical content knowledge, curriculum knowledge, and other types of knowledge. The study addresses whether teachers can provide a link to real-life situations for learners when teaching conversions and measurement. Examples of real-life situations where conversions and measurement are used may include basic tasks like the preparation of meals, calculating the cost of consumable goods, and calculating the cost of building materials. By addressing how teachers approach teaching conversions and measurement, further insight is provided as to what types of knowledge teachers do not use.

3.2. Theoretical frameworks

Merriam and Tisdell (2015), explained that a theoretical framework is based on concepts, terms, and theories of a field of discipline. It allows them to draw connections between the literature and the research question and between the research question and the data. It also allows researchers the opportunity to identify gaps in the relevant literature they are engaging in or identify gaps in the data that need to be addressed. This study is based on the types of teacher knowledge used when teaching conversions and measurement in Mathematical literacy. The study entails details about challenges, experiences, and practices concerning teachers of Mathematical literacy. Therefore, the theoretical framework that will encompass this study adequately is teacher

knowledge. Different types of teacher knowledge are needed for teachers to effectively manage classrooms while maintaining discipline and ensuring that learners understand the lessons being taught. Shulman (1987), stated that seven types of teacher knowledge contribute to successful teaching. These types of knowledge include content knowledge, general pedagogical knowledge, curriculum knowledge, pedagogical content knowledge, knowledge of learners, knowledge of educational contexts, and knowledge of educational aims, purposes, and values.

Teachers play an important and involved role in the successful development of learners and the education system. According to Makovec (2018), the factors that influence the role of a teacher comprise both internal and external factors. Some of the factors discussed include culture, social environments, expectations, and beliefs of teachers. The knowledge and experience possessed by teachers are key factors in providing learners with a decent, quality-based education. Teachers should have a grounded and deep understanding of the subject matter they teach, and they should know how to effectively communicate it to their learners. In addition to this, they also recognise the learners' learning styles and tailor their instruction such that it leads to the maximization of learning. Furthermore, teachers need to be able to provide a learning environment where it is safe and comfortable, which in turn encourages learners to ask questions and engage in meaningful discussions. Additionally, teachers must be able to successfully assess learners' progress and give timely feedback in a productive manner that will help learners to learn and make progress. Lastly, teachers need to be natural leaders in that they need to have the ability to motivate and inspire learners to help them reach their full potential. Further stated by Makovec (2018), teachers change through means of professional development, which benefits learners. Teachers, therefore, need to have the necessary knowledge, skills, and expertise to efficiently engage and teach their learners and assist them to do well. According to Shulman (1987), and Ball et al. (2008), effective teaching is more often than not determined by the teacher's management of their classroom. To thoroughly understand the ontology of how conversions and measurement are taught by teachers teaching conversions and measurement, one needs to understand the study is framed within the theories of teacher knowledge (TK), teachers specialised content knowledge (TSCK), and Mathematical Knowledge for Teaching (MKT). The next section discusses each type of knowledge required for teachers in detail.

3.3. Types of knowledge required for teachers

According to Bolisani and Bratianu (2018), knowledge is a commanding armament that can be used to advance our lives, our communities, and our world, including the betterment of society. Knowledge may be attained through many methods, be it from traditional education to practical learning (Killen & O'Toole, 2023). It is a changing set of concepts and perceptions of a given field of interest that can help people make better choices and lead to a more positive and promising future. Knowledge is in a constant state of growth due to changes. These changes happen as new information is discovered and conceptualized. With knowledge, one can better comprehend the world around us, recognise opportunities, make informed decisions, and effect positive changes for the foreseeable future. Knowledge is used to pave our lives, our industries, infrastructure, and our world for the better and is known to be revered around the world, regardless of whatever field of discipline it is. As teachers, it is important to respect all types of knowledge and recognise the different types of knowledge that are required to impart it to others. In this section, the research of two eminent academics who contributed to teacher knowledge is discussed. Shulman (1987) and Ball et al. (2008), describe in detail what types of knowledge are needed for successful teaching.

The term pedagogical content knowledge has been used in a broad spectrum; however, it must be noted that it does so without making direct reference to a specific content area. Through his article, Ball et al. (2008), sought to find what it is that Mathematical knowledge teachers need to know to be able to teach Mathematics. The author referred to the different types of knowledge needed for teaching, as Mathematical Knowledge for Teaching (MKT). The skills required for MKT according to Ball et al. (2008), could be sought by observing Mathematics teachers going about their daily tasks when teaching. Through this observation, the authors identified six domains that are of utmost importance for teaching Mathematics. These are common content knowledge (CCK), specialised content knowledge (SCK), knowledge of content and teaching (KCT), horizontal content knowledge (HCK), knowledge of content and curriculum (KCC), and knowledge of content and students (KCS). These six domains of knowledge were built upon Shulman's (1976), theory of pedagogical content knowledge.

Shulman (1987) conducted a study based on a teacher in California, that involved observing the content knowledge and pedagogical knowledge of new teachers which was done to monitor the

teacher-knowledge-growth of teachers in terms of development. He made claims that in the past, teachers and policymakers were of the view that the process of teaching simply requires knowledge of content, basic skills, and general pedagogical skills. The types and kinds of knowledge that Mathematics and Mathematical literacy teachers currently possess within South Africa are addressed by available literature that will be further discussed in this chapter.

3.4. Content knowledge

Concerning teacher knowledge, Mudaly (2016), stated that a good teacher of Mathematics has well-connected and well-understood conceptual knowledge and claims that the current state of teachers lacks a deep conceptual understanding of simple facets of school Mathematics; their fundamental knowledge leaves much to be desired. Upon examination of the results of a benchmark test of learners from higher educational institutions in 2009, the author made recommendations that teacher training institutions should implement changes in the way in which they train Mathematics teachers. This training would have been done with the hope of producing teachers who are well-equipped with content knowledge and conceptual knowledge. In my view as a teacher, unfortunately, the question of what has changed since the article was published, particularly related to Mathematics results, leaves much to be answered.

Ramdhani (2014), stated that the display by teachers of deep content knowledge is a strong indication of effective pedagogy. An article describing the findings of an empirical study conducted by Venkat and Spaul (2015), indicates that out of four hundred one (401) grade 6 Mathematics teachers, a mere 21% of those teachers were shown to display a higher level of content knowledge. The study involved testing Mathematics teachers on the four main learning areas in Mathematics according to the CAPS policy. The four main areas include numbers and operations; fractions and decimals; number and geometric patterns and space and measurement. The findings of this study also indicate that although teachers can apply general pedagogical content knowledge and curriculum knowledge, there are other types of knowledge that teachers do not seem to apply when teaching conversions and measurement, and in some cases, this is due to the challenges teachers are facing. Dismal Mathematics results produced in South Africa according to DBE statistics have left interested stakeholders in education wondering if teachers simply

applying general pedagogical knowledge and content knowledge in lessons create an influence on the Mathematics results produced in South African schools.

The article by Venkat and Spaul (2015), breaks down content knowledge into sub-groups described as Horizon Content Knowledge (HCK), Specialized Content Knowledge (SCK), and Common Content Knowledge (CCK). The results of the study show notable evidence of gaps in teacher knowledge. This has led the researchers to advocate the gathering of evidence based on the gaps in teacher knowledge within the curriculum and interventions, by all the relevant education stakeholders including teacher unions. Although Ball (2008), elaborated further on Shulman's theory of types of teacher knowledge required for teaching, Ball's theory (2008), focused mainly on six domains which were common content knowledge (CCK), specialised content knowledge (SCK), knowledge of content and students (KCS), knowledge of content and teaching (KCT), Knowledge of content and curriculum (KCC) and horizon content knowledge (HCK). These domains are further discussed in this chapter as they share the same characteristics mentioned by Shulman.

3.5. General pedagogical content knowledge

Ball et al. (2008), stated that pedagogical knowledge is made up of knowledge of content and learners as well as knowledge of content and teaching. From Ball's study, an important concept arose namely, Mathematical knowledge for teaching. Mathematical knowledge enables us, as teachers, to correctly enumerate, measure, and analyse data and may be used to further assist us in the formation of solutions for problems in several different ways. Mathematical knowledge may also be used to comprehend and clarify the principles behind countless phenomena, such as the rules of physics or the ideologies of Economics. By possessing an acute understanding of the Mathematics behind these concepts, we can better comprehend how the world works which enables us to make informed decisions that enhance the overall quality of our lives.

Ultimately, when one has a solid knowledge of Mathematics, it becomes a priceless advantage that assists us in the many facets of life. Mathematical knowledge for teaching focuses on examining what knowledge teachers need to teach Mathematics. An important question that Ball had asked was, is Mathematical content knowledge alone enough for effective teaching or are there other

types of knowledge a teacher needs to know to facilitate effective and successful teaching in Mathematics? Perhaps this question could be better answered by examining the traits required in the pedagogical content knowledge of teachers.

Table 3.2: A model of pedagogical reasoning and action addressing the strategies and how and why teachers use such strategies when teaching conversions and measurement. Adapted from Shulman (1987, p.15)

<i>Pedagogical reasoning</i>	<i>Action</i>
1). Comprehension	An understanding of the purposes and order of subject matter.
2). Transformation: Preparation, Representation, Selection & Adaptation	Interpretation, segmenting, and structuring content for clarification.
3). Instruction	Management of discipline, group work; administrating tasks, and encouraging interaction.
4). Evaluation	Checking, testing, and evaluating the understanding of learners.
5). Reflection	Critical analysis of one’s performance and practice in a classroom.

Table 3.2 illustrates the requirements put forth by Shulman (1987), for teachers to teach effectively. According to Choy et al. (2021), there is very little information available on how teachers learn from their practice. Comprehension, transformation, instruction, evaluation, and reflection are critical components of teaching Shulman, (1987). Comprehension refers to simply understanding the content being taught. Transformation is referred to as the planning and preparation stage of lessons. Instruction involves command and determining how lessons are to be taught. Evaluation refers to assessing learners on what was taught. Lastly, reflection on teaching is required after evaluation has occurred to find ways to improve teaching methods and strategies. A brief description of each of the attributes outlined in Table 3.1 is given about teaching within the South African context. Table 3.1. provides insight into what is required for teachers to demonstrate pedagogical knowledge.

3.5.1. Comprehension

Comprehension is a significant skill needed for children to learn, as it assists them to develop into better readers. Comprehension gives a child the ability to recite and understand text, and it includes being able to draw inferences and arrive at informed conclusions. Also, comprehension involves a learner making sense of the text by interpreting words, understanding the meaning and context, making connections to prior knowledge, and determining the core idea. Comprehension can be enhanced through continuous practice and teaching. Accordingly, the use of language, concepts, philosophy, and application of Mathematics Literacy for sense-making is important for teachers to grasp before trying to teach Mathematics Literacy to others (Schoenfeld, 2016). Similarly, Kurshumlia and Vula (2019), concluded in a study that, using reading comprehension strategies in Mathematics problem-solving in primary school has a positive effect on learning Mathematics. Teachers may use a variety of strategies at their disposal to assist learners evolve into better readers, such as modelling decent comprehension skills, providing clear instruction in skills such as summarising and identifying main ideas, and providing learners with ample chances to practice what they may have already learned.

According to Shulman (1987), for teaching to take place, teachers first need to fully understand what they must teach. Ideas need to be linked to other areas of learning, where possible so that learners can ideally develop an integrated and comprehensive understanding of concepts. Following the ATP provided by the DBE, core concepts are to be broken down into sub-groups and teachers should be mandated to adhere to the stipulated timeframe prescribed by the DBE for the teaching of these concepts. According to a study carried out by Mzila (2016), teachers were found to display difficulty in comprehension themselves yet they were facilitating lessons for grade 4 learners in IsiZulu. This finding raises concerns since the study reveals that teachers were unable to unpack, exhibit, and portray relevant strategies for teaching comprehension.

3.5.2. Transformation

Transformation is a dynamic process of shifting from one form or state to another. It is an imperative concept in life and applies to all subjects, from Physics to Psychology. It also could be said that it may be applied to people, establishments, and even complete societies. For people, transformation often includes a process of personal growth and progress, where an individual

strives to develop into a more well-rounded person than they were previously. This could include acquiring new skills and knowledge, altering their conduct, behaviour, and attitude, or identifying new potential within themselves. For organisations, it could involve a change in strategy, ethos, or structure as the organisation endeavours to become more effective and efficient. For societies, transformation may include the execution of groundbreaking policies, changes to the political system, or the presentation of new technologies that change the way people live and interrelate with every other person.

Transformation is a compound and multi-faceted process, and it is often an arduous, trying, and long journey. However, it can also be seen as a stimulating and satisfying one, as it could lead to a better sense of accomplishment and purpose, and ultimately an improved life for all those involved. The transformation ultimately leads to a sense of achievement. According to the findings of a qualitative study that was conducted by Matola et al. (2022), in KwaZulu-Natal, many factors influence teaching and learning. The study involved participants who were student lecturers at the University of KwaZulu-Natal. The study talks about the transformation of teaching and learning, with time being the most important aspect of teaching. It was found that learners' preparation is based on a critical understanding of content. Representation is based on ideas, metaphors, and analogies that can be and should be used in lessons. Selection refers to teaching strategies and methods a teacher may employ during lessons.

Adaptation refers to carefully modifying and making the content suitable enough for lessons, especially recognising the amount of time needed for planning, delivering, and reflecting on a lesson. Johnson et al. (2021), concluded that transforming a teacher's way of teaching has a direct impact on the learners' performance. According to Johnson et al. (2021), a teacher's method of teaching was transformed by rigorously identifying what strategies learners utilise at their disposal to solve questions, interpreting the thinking of learners, and then strategizing on how to move forward with teaching. Reflection involves critically analysing one's teaching through methods, representations, adaptation, and transformation. It is highly possible transformation is the most critical aspect of pedagogical reasoning and action since how the teacher delivers the content, and the lesson is dependent on the transformation process.

According to Naidoo (2020), research suggests that teaching and learning ought to be transformed to stay abreast with the fourth industrial revolution, and thus stay current and relevant in today's teaching methods. The article makes mention of the use of technology in learning as well as providing learners with the option of when and where they may choose to study. The researcher also mentions the use of a "flipped approach" to learning which would advantage school-going learners provided they have the resources at hand to engage in a flipped learning approach. However, public/government schools in South Africa have limited access to technology and technology-based tools for teaching (Ankiewicz, 2021).

3.5.3. Instruction

Instruction can be defined as a set of steps that must be followed to enable one to carry out a task, learn a skill, or accomplish a particular goal. It is vital to understand directives clearly and follow them meticulously and correctly to reach a desired outcome. Instruction plays quite a pivotal role in teaching since the teacher has the task of managing many duties such as classroom discipline, facilitating group work, administrating tasks, encouraging interaction, and overseeing time limitations. If teachers do not have enough time, they will not be able to assist learners who have problems understanding what is being taught (Hamukwaya & Haser, 2021). All of these duties are solely dependent on the teacher giving and following instructions. Hidayati (2020), conducted a study based on differentiated instruction. The study revealed that when teachers grouped learners according to their performances, learners had a better understanding and, as a result, they enjoyed the lessons, since all learners in the group worked at the same pace and in almost the same way.

In agreement with the findings of Moremedi (2007), as an educational practitioner in a state-owned school, I have found it quite difficult and cumbersome to get learners to follow instructions diligently during lessons. The study conducted by Moremedi spoke about the challenges Mathematics teachers face in implementing the new curriculum. One of the contributing factors to these challenges is a lack of being able to pay attention and overcrowded classrooms resulting in unnecessary noise pollution.

3.5.4. Evaluation

According to Aquino and Yambi (2020), evaluation is a tool that can be used to measure the effectiveness of teaching to ultimately improve learning. Evaluation involves the process of judging the performance of something or a process. It includes making a ruling about the value of something, and it can be used to determine anything, such as the performance of a learner to the quality of merchandise. Evaluation can be used to determine whether a person, assembly of people, or organisation has reached the targets or aims initially set forth. Evaluation is based on specific criteria, such as price, superiority, and efficiency, and the process may be used to recognise strong points and weaknesses, compare alternatives, or recognise room for improvement, as well as make decisions about whether to follow a specific course of action. Evaluation also assists in the planning and implementation of new stratagems. Evaluation in teaching is based on checking for levels of understanding, misconceptions, and misunderstandings. It can be said that here, the teacher is evaluating his or her performance in teaching. The DBE has specific levels of taxonomy that are used as a tool for teachers to apply in terms of setting tasks. This tool guides tasks to encompass questions of different levels of difficulty. It is questionable as to how teachers are expected to achieve 100% pass rates with distinctions in Mathematical literacy since the scope given to teachers by the DBE accommodates 10 to 15% of higher-level questions.

3.5.5. Reflection

According to Helyer (2015), people consciously reflect on occurrences in their lives. The author emphasised that reflection on learning achievements can lead to empowerment, ultimately playing a significant role in an individual finding employment. Reflection, in my opinion, is a powerful tool. It can be useful in helping us to understand our views, emotions, and conduct. It allows us the chance to stop and think intensely about the experiences we encounter and how they play a role in moulding us. It is a method of looking back at the course of our actions. Reflection enables us to mirror our views and actions and to deliberate how we could have responded or reacted differently in situations and what the outcomes of our choices could have been. When we make the effort to reflect, we expose our minds to new opportunities and different approaches which could lead to more favourable outcomes.

Reflection also provides us with the opportunity to learn from our errors and think critically with hindsight about how we can progress in the future. Reflection can be done in two ways; formally or informally, such as when writing in a diary or chatting with a mentor. Taking time to reflect on situations, decisions, and circumstances can help us to develop self-awareness, enable us to think more deeply, and assist us to make more informed decisions in the future. Perhaps one of the most integral aspects of teaching involves the reflection of lessons that have already taken place. The teacher should critically reflect on the strengths and weaknesses exhibited during the lessons, the efficacy of the choice of resources that were used, and the overall experience of the lessons. Hidayati (2020), stated that metacognition and self-regulation are both aspects of reflection which are important factors for effective teaching and learning. After engaging in discussions with other educational practitioners in this study, the evidence provided by these participants showed that teachers reflected on lessons, but they also shared that it was almost impossible to redo lessons where learners experienced difficulty in understanding due to a limited time frame to complete the scope of work in Mathematical literacy.

According to Farhang, et al. (2023), lesson plans serve as a basis for a well-delivered lesson. In terms of lesson planning, teachers are allowed to reflect on their lesson plans and resources used during their teaching. According to Shulman (1987), types of teacher knowledge should comprise seven important types of knowledge for successful teaching. These types of knowledge that are regarded as a knowledge base for teachers are curriculum knowledge, knowledge of learners and their characteristics, knowledge of educational contexts, factual knowledge, conceptual knowledge, expectational knowledge, methodological knowledge, and lastly, general knowledge. A breakdown of each of the seven types of teacher knowledge required for teaching as per Shulman's theory is provided.

3.5.6. Curriculum knowledge

Mulenga (2018), stated that the word curriculum has different meanings to different people and can be used in different contexts. One of the definitions of the word curriculum can be understood as content that is taught at school. Therefore, my understanding is that a curriculum is a collection of aspects that are specifically geared toward helping learners achieve educational objectives. These activities are as follows, courses, lessons, activities, and experiences. It can also be

broadened to include academic courses, physical education, extracurricular activities, career education, and technical studies. The main stakeholder in the creation of the curriculum in South Africa is the Department of Basic Education (DBE) The needs of the learners are covered comprehensively by the curriculum. As schools are stepping-stones to higher education levels such as universities, the curriculum should be carefully constructed to equip learners with the necessary knowledge required for them to enter these institutions. Thus, the curriculum should be standardised for all schools in South Africa.

As the world advances, the relevance of the curriculum should always be questioned. Hence the curriculum is constantly reviewed and revised thereafter to meet the changing times. However, with the need for standardisation, the curriculum cannot be too rigid. It should give teachers room to modify or customise their teaching methods and strategies to align with the needs of their learners. The main goal of the curriculum is to assist learners in reaching their full potential and to adequately prepare them for success in their futures.

Freire (1973) encouraged that the education curriculum should shift from being domineering in nature to being able to allow one to learn skills that can be useful in overcoming adversity. A curriculum is that which encompasses knowledge of the programs designed for teachers by a body of authority in education. The teacher is required to select appropriate materials for lessons to be in line with the stipulations of the curriculum. One of the reasons that this study is important, is that the study addresses the fact that there are prescriptive key concepts that teachers are required to teach regardless of the difference in social and financial backgrounds being considered.

Since South African teachers themselves hail from different cultural and linguistic backgrounds, the study attempts to also understand how epistemological differences among teachers influence the teaching of conversions and measurement in Mathematical literacy. According to Du Plessis and Letshwene (2020), teachers themselves find it challenging to teach Mathematical literacy as they need to first understand English, and then the content before they teach. In doing so, a better understanding of what methods do or do not work effectively will emerge. There is currently no research available on how epistemological differences among teachers influence the teaching of conversions and measurement within our multicultural landscape. Such data would be helpful to

teachers who are driven to teach learners skills that are required for the National Senior Certificate Examinations in grade 12 Mathematical literacy.

3.6. Knowledge of learners and characteristics

Smailes (2021) stated that through effective observation and classroom management, teachers ought to be able to get an idea of how learners relate to their peers, and which learners may have difficulty understanding content due to barriers to learning. In addition, teachers have socioeconomic details about learners including their places of residence, occupation of parents, and financial and social details. These details are readily available from a school registration form. However, teachers should or must know their learners well and be actively involved in the community as major contributors to the functioning of that society. Teachers should be acutely aware of the challenges, strengths, and weaknesses of the communities they teach to understand their learners and be empathetic towards the adverse situations their learners are met with daily. This is also important as teachers can use such knowledge to teach in a more socially responsive way and use their platforms in their classrooms to help learners strive towards emancipation and success.

Moreover, teachers should know how examination settings and limited understanding of curriculum content (Mazana, Montero, & Casmir, 2020) and learner anxiety caused by test conditions (Estonanto & Dio, 2019) results in poor performance of learners. According to Naidoo (2021b), the adoption of culturally-based activities that are eminent in indigenous knowledge could be used in a diverse classroom to support teaching. Perhaps linking indigenous knowledge and conversions and measurement would be an indicator of the teacher's knowledge of their learners and their characteristics.

3.7. Knowledge of educational contexts

Alshumaimeri (2023), wrote an informative article on how understanding educational contexts can make an impression on the achievement of academic success. The article highlighted that there is a need for changes in the educational field such as in curriculum reform, availability of resources as well as teachers, and technology, if education has to be a successful component of any nation. Bantwini (2010), conducted a study that explored the effects of curriculum reform in South Africa.

Thus, making it clear that the intention of the new educational policies adopted since the Apartheid regime was aimed at producing scientifically literate learners who would have the necessary skills to compete in a global economy. The article explains how the first change of educational policy was a means to bridge the gap between the education provided to learners of different ethnicities. What was interesting about the article mentioned above was that the participants seemed to have very limited knowledge of the purpose of the change in educational policies. The participants felt overburdened with having to keep up with the new requirements of administration.

In the data collection of the study done by Bantwini (2010), teachers revealed that they were unable to change their methods of teaching to new policy requirements which were becoming increasingly demanding, especially since there are highly overcrowded classrooms, a lack of resources, and a clear lack of parental involvement. Teachers also revealed their feelings of discontent with the salaries they earned compared with the amount of work required. Molefe (2016), conducted a study based on the policy related to teenage pregnancy. The study explored the challenges faced by teachers and school management teams about implementation. The study focused on schools that had learners from impoverished backgrounds, HIV-positive learners and family members of learners, and learners who hailed from child-headed families.

While the study appraised the DBE's attempt to design a policy that addresses teenage pregnancy, the results of the study lead to a recommendation that the policy should also include a focus on male learners to further promote sex education and limit teenage pregnancy. The study revealed that learners either dropped out of school when faced with pregnancy or had to wait almost a year after childbirth to return to school. The moment learners returned to school after childbirth, they were found to experience difficulty in catching up with the work done while they were absent. A question can be asked at this stage; what do the results of Molefe's study have to do with the teaching of conversions and measurement? The section based on conversions and measurement is pertinent in grades 10, 11, and 12 of Mathematical literacy.

The level of intricacy of solutions to questions and content that teachers attempt to expose learners to in each of these grades is of great importance. Grade 10 solutions to questions in Mathematical literacy require basic calculations namely. multiplying or dividing, involving the use of ratios and

providing reasons for calculations to simple questions. However, in grades 11 and 12, solutions required a structured approach where step-by-step, sensical display of calculations and ultimately logical conclusions for providing reasons that are based on answers to questions that cover a high percentage of the questions. Although Shulman (1987), provided insightful information on the types of knowledge that are required for teaching, there are, in my opinion, other types of knowledge that teachers would need to have to facilitate, plan, and deliver effective lessons daily. Based on my teaching experience and critical reflection while conducting this research as well as the literature discussed in this study, the additional types of knowledge I found would be appropriate include the following:

3.7.1. Factual knowledge

According to Wang et al. (2023), factual knowledge is of utmost relevance in enhancing learning that takes place within contexts. The article introduces a new theoretical framework for research, which is Knowledgeable In-Context Tuning (KICT). The authors claim that factual knowledge can be of use when In-Context Learning is involved. Factual knowledge can be achieved through learning from dependable sources such as journals, books, papers, and lectures. Factual knowledge can also be attained through personal experience and observation as it is a necessity for developing skills and abilities and provides a stable foundation upon which to build. Factual knowledge is based on the core outcomes of teaching and includes knowledge of policy requirements, stipulated time frames in work schedules, and key aspects of topics. Factual knowledge also includes contextual knowledge and the ability to inform learners on how questions or problems are phrased, as well as guide learners in terms of mark allocations and levels of difficulty presented in questions.

Thus, a teacher needs to be familiar with what sections and topics are assessed at the end of every term to adequately prepare learners to meet their goals per term. All of this should be done to prepare learners for their final examinations. In this study, the participants illustrated that they have a sound foundation of factual knowledge which showed in their teaching. The participants were aware of the outcomes that needed to be met in the topics they were teaching. The participants also provided evidence that they used factual knowledge in their teaching when they had to make decisions on how to teach content, based on following policy requirements of which the participants were well informed.

3.7.2. Conceptual knowledge

Hakim and Yasmadi (2021), stated that conceptual knowledge is a fundamental requirement needed to comprehend a core concept. It is this core concept once learned that knowledge in a specific area can be built on by learning the next concept. The description of conceptual knowledge can be worded as a type of knowledge that is grounded on understanding a concept and its association with other concepts. It is knowledge which enables individuals to think in a practical sense and to apply their knowledge to various circumstances. Further, according to Hakim and Yasmadi (2021), conceptual knowledge may be referred to as 'higher-order thinking' and is the foundation of sound academic performance and inventive thinking. Conceptual knowledge allows one the ability to think outside the box and to seek patterns and relationships within a given situation. Conceptual knowledge may be acquired via a variety of means, such as reading, attending lectures, listening to audio recordings, and participating in conversations. It is the kind of knowledge that can be applied when solving problems and is essential for comprehending a wide range of diverse concepts.

Conceptual knowledge develops progressively, and improvements may appear through practical experience. When learners have grasped a full understanding of a particular concept, they can apply it to real-world situations in a better way. According to Hussein (2022), conceptual knowledge is an important part of any academic course, and learners need to gain a strong foundation in this area to be successful in their studies. Conceptual knowledge in my view, would include knowledge based on the aspects taught in particular sections throughout the Mathematical literacy curriculum. A teacher must also be aware that questions or problems may be presented to learners within a multitude of contexts. The key concepts and procedures on how answers are calculated must always be made clear to learners. The Mathematical literacy curriculum comprises a vast scope and many real-life problems presented in topics. Teachers are thus required to inform learners that problems can be presented individually within a topic or as combined problems which will require the learner to apply a combination of problem-solving techniques and calculations to arrive at solutions. Moreover, to make the content understandable for learners, teachers need to use examples for problem-solving in Mathematical Literacy that are relevant and meaningful to the learner (Manfreda & Hodnik, 2021; Stacey, 2015).

3.7.3. Expectational knowledge

According to Taylor (2019b), content knowledge, pedagogical content knowledge, and curriculum knowledge are required for teaching however, other types of knowledge contribute to successful teaching. Perhaps one such important type of knowledge required for teaching is expectational knowledge. There is very little research done on expectational knowledge in teaching. From my understanding, expectational knowledge is based on the level of experience or level of interest a teacher has in their subject field. This knowledge would serve as a guide to prepare a meaningful way forward for the teacher since he/she would have gained exposure to many assessments and examinations, as well as through their marking experience throughout their career.

Expectational knowledge could also be based on a teacher's experience of teaching concepts and reflecting on lessons where learners experienced difficulty in understanding concepts, procedures, language, or calculations based on a topic. Expectational knowledge can be gained after the teacher has reflected on his/her teaching and the performance of his/her learners in certain aspects. According to Warwick (2010), staff at a university was found to experience difficulty in finding ways to measure knowledge deficits in students as well as how to measure how self-efficacy and anxiety contribute to students' learning ability and experiences. Therefore, the expectational knowledge a Mathematical literacy teacher has can be used to guide how they teach lessons; what resources they should use, and provide an idea of how long they should spend on certain aspects.

3.7.4. Methodological knowledge

Methodological knowledge would apply to a teacher's ability to demonstrate to learners how to follow effective steps or procedures required in solving problems or answering questions. Perhaps methodological knowledge can be seen as having similarities with procedural knowledge. Hussein (2022), defined procedural knowledge as knowledge of rules, otherwise called laws in Mathematics, that need to be applied to solve problems. There are specific ways in which questions are phrased in Mathematical literacy e.g., "show how"; "calculate"; or "verify". A teacher must be able to illustrate to learners how applying specific procedures or steps in calculations would award learners marks. Learners need to know how the procedures used would result in logical answers or conclusions to a question or problem and how the methods used in the approach to finding solutions are appropriate within a given context.

In addition, to perform calculations correctly, one must know which of the four operations (addition, subtraction, multiplication, and division) is appropriate for a problem. Therefore, teachers require methodological knowledge since it is important to demonstrate how to break down problems into manageable sizes and to illustrate what is the order of operations to follow when solving problems. The order is of utmost importance, especially where conversions are concerned since converting larger units of measurement to smaller units requires multiplication, and converting from smaller units of measurement to larger units requires division.

3.7.5. General knowledge

From my understanding as a Mathematics and Mathematical literacy teacher, general knowledge would include knowing the learners and their capabilities thoroughly. As teachers, it is important to understand and be familiar with issues like how gender influences the performance of learners in Mathematics and how their performances would then influence career choices. While there is no evidence of the current Mathematics curriculum itself being in favour of a particular gender, there are quite a few classroom practices and social views that affect the performance of learners regarding their gender. In the classroom teachers are directly responsible for helping all learners achieve their maximum potential as well as assisting learners in identifying their strengths and weaknesses. In my opinion, as much as teachers try to stress gender equity, it is a difficult task to manage because many factors relate to the performance levels of boys in comparison to girls.

Pertinent to this study, and according to research undertaken by Govender (2012), there is not much difference in the performance of learners in Mathematics in terms of gender, but rather the difference in the use of strategies that boys and girls use in attempting to solve problems. However, the study claims that boys are more dominant and competitive while girls are more inclined to please teachers by following rules stringently. The study suggested that boys were found to use a more autonomous approach to solving problems while girls adhered to rote procedures. According to Skemp (1976), part of relational understanding is the capability of applying rules without really understanding how they work. Thus, teachers need to know how learners of both genders may approach solving questions differently. This knowledge can be understood as general knowledge.

3.7.5.1 Teacher's knowledge of taxonomy levels

A teacher's knowledge of taxonomy levels is imperative to ensure that the outcomes for each topic are adequately met. According to Long, Dunne, et al. (2014), it is a challenging task for teachers to be able to assess exactly what a learner knows and does not know by simply applying taxonomy levels. The levels of taxonomy that the Department of Education requires Mathematical literacy teachers to teach are categorised from level one questions to level four questions. Level one questions are considered to be basic questions whilst level four questions consist are more complex.

3.7.5.2 Tacit knowledge

Tacit knowledge is the knowledge that one gains through personal experiences and exposure to different contexts. Along similar lines, research (Ribeiro, 2013) suggests that tacit knowledge is gained through experiences and cannot emerge without experience. According to Lennerstad (2013), there are many ways to reach solutions to questions in Mathematics and there are two types of knowledge that are required to do so: provable Mathematical knowledge and conceptual Mathematical knowledge. The former is a type of knowledge that is required to prove a calculation and the latter refers to the type of knowledge that is not based on any Mathematical calculation or proof, but rather reasoning. According to Oranga (2023), tacit knowledge can be linked to knowledge management. Tacit knowledge is knowledge of being able to do things without much thinking but rather using experience (Govender et al., 2022). If this is so, teachers should constantly evaluate and manage their knowledge by reading, practising different methods in teaching, or upgrading qualifications to stay within the current level of pedagogic practices.

3.7.5.3 Silent knowledge

Silent knowledge refers to the use of all the above types of knowledge a teacher will use when delivering lessons. Research (Toom, 2012) maintains that silent knowledge is implicit in a person's actions and can be considered a practical skill professionals use. Thus, silent knowledge can be attained through watching others, listening to something, or from observations. This type of knowledge can be further deepened when someone practices something for a long time. According to Wulph (2017), silent knowledge can be defined as the knowledge of how something is happening and what is happening.

Thus, a teacher should constantly be observing and reflecting on how his/her lessons have taken place. Teachers must be aware of areas in which learners faced challenges which areas they performed well and which resources were helpful in teaching or not. Thus, teachers' lessons should be designed in a manner that poses as both rewarding and challenging for their learners. Observations on which aspects learners were engaging in discussion due to not understanding, and which problems learners attempted to answer on their own, should also be made so that the teacher can understand where peer learning is required.

The theoretical framework of this study was used to establish what types of teacher knowledge teachers have and apply when teaching conversions and measurement. The goal of this research was reached by analysing the resources chosen, lesson plan sand implementation of lessons, since doing so reveals that pedagogical knowledge was mostly used by mathematical literacy.

3.8. Summary

This chapter presents discussions focusing on the theoretical framework that frames the study under focus. Mutereko (2013), stated that the history and heritage of South Africa have a direct influence on the present teacher learning situation. The researcher further stated that student teachers are groomed and trained in a way that enables them to perform effectively in the classroom and meet all the demands that are expected of a teacher. This study was framed by the works of Shulman (1987), and Ball (2008), who focused on the types of knowledge base required for teaching, therefore this chapter included details about the types of knowledge required for effective teaching. The types of knowledge discussed in depth in this chapter included pedagogical content knowledge, content knowledge, curriculum knowledge, knowledge of learners and their characteristics and knowledge of educational contexts.

The research questions used in this study were addressed by linking the theoretical framework to determine what types of knowledge teachers use when teaching. Table 3.1 provides a clear link between the research questions and the theoretical framework used in this study. Therefore, types of teacher knowledge were discussed in this chapter and it was linked to the research questions, allowing for data to be generated accordingly. The next chapter of this study is based on the

research methodology which, seeks to explore what types of knowledge teachers apply when teaching conversions and measurement in grade 10 and 11 Mathematical literacy.

Chapter 4: Research Methodology

4.1. Introduction

This research aimed to explore teachers' espousal of teaching conversions and measurement in Grades 10 and 11 Mathematical literacy. The research is based on qualitative methodology since the data collected was categorical. Categorical data is data that describes the nature of something. According to Bertram and Christiansen (2014), a researcher may start the qualitative study with a few samples and then expand on the number of samples if the need arises. In (2017), stated that a pilot study is necessary since it is primarily used to collect preliminary data. The preliminary data can then be a guide to determine the quality and efficacy of the main study. Therefore, this research employed the use of a pilot study which was used to guide the rest of the research process.

This research called for the use of triangulation since the research instruments used in the study included interviews, document analysis, lesson observations, and focus group interviews. All the instruments that were utilised in the pilot study were carefully analysed and were found to be fit for purpose. Thus, the main study employed the use of the same research instruments as the pilot study. All the research took place in public secondary schools in the greater Durban area, KwaZulu-Natal. The schools chosen to be a part of the study cater to learners who hail from different racial, social, and economic backgrounds; hence the study can be representative of the demographics of South Africa.

A qualitative study undertaken in the city of Johannesburg, South Africa, by Morapeli (2017), advocated that many learners in South Africa experience difficulty in solving problems in Mathematical literacy in grade 11. The problem areas that were identified in the study were based on the calculations of the surface area of rectangular prisms. The learners were found to have considerable gaps in demonstrating a sound understanding of conceptual and procedural knowledge when performing calculations based on surface area. Solving problems on surface area calculations and rectangular prisms is a sub-topic taught in conversions and measurement in Mathematical literacy, which is why a study based on conversions and measurement is necessary. Furthermore, the level of difficulty involved in solving such problems is more complex in grade 11 and requires learners to relate to added contexts. The added contexts range from calculations based on municipal tariffs, transport tariffs, and the cost of ingredients required for a variable

number of people, to currency exchange rates, and so on. Therefore, since calculations based on measurement proved to be a problematic aspect of the curriculum in the study, a study on conversions and measurement is necessary.

Tachie (2020), stated that there have been many transitions and policy changes in South Africa since the Apartheid regime, particularly in the education sector. He stated further that although there were amendments made to policies that aimed at addressing inequalities of the past, there was a misfit between the training of Mathematics teachers and their preparedness for the Mathematics classroom, particularly in Geometry. Tachie's study claimed that the teachers displayed a lack of pedagogical content knowledge, as well as subject content knowledge. The study also mentioned that although the policies were duly changed in terms of the curriculum, unfortunately, many of the teachers did not undergo proper training before they were required to teach the new curriculum. Such a finding is very important since the researcher argued that without teachers being properly trained in understanding and teaching the new curriculum, Mathematical literacy teachers will find it difficult to address the different needs of their learners efficiently. Thus, the methods and research instruments used in this study were carefully chosen, as this study too, attempts to explain what types of knowledge teachers use when teaching conversions and measurement in Mathematical literacy.

According to Bartell and Foote (2011), Mathematics education creates selection, omission, and seclusion among learners in terms of their gender, race, language, and socioeconomic status. The language barrier that exists between learners and teachers due to past political issues in South African classrooms, especially when teaching Mathematical literacy is involved. It provides a far greater challenge for learners to relate to contexts in Mathematical literacy problems. Hlatshwayo (2013), indicated that teachers are experiencing huge challenges in multi-diverse and multilingual classrooms. The findings of the research studies mentioned above show that even though teachers are aware of the demands of teaching in multi-lingual classrooms, they are not adequately empowered to cope with these growing demands. With this in mind, it can be deduced that Mathematical literacy teachers do not have a way of mitigating the challenge of teaching in a multi-diverse classroom. Thus, a study based on types of teacher knowledge used in the teaching of

conversions and measurement is necessary since the topic plays a significantly large role in the Mathematical literacy curriculum.

4.2. The paradigm

A research paradigm provides a guideline as to what is acceptable when one is conducting research within a field of study. According to Rehman and Alharthi (2016), paradigms are based on the ontology, epistemology, methodology, and methods of data collection. Ontology is what leads a researcher to inquire about what realities exist about a certain topic, due to the beliefs of people. Epistemology is what leads a researcher to refute the idea that subjects must be analysed or studied without getting to know the subjects better and gaining a deep understanding of their beliefs of the subjects Rehman and Alharthi (2016).

The interpretive paradigm does not permit predictions or assumptions but rather focuses on observing the world through perceptions and experiences. Muzata (2021), stated that data generated within the interpretive paradigm is created through the understanding of the data and that the researcher is said to influence the methods chosen in the research design to provide a meaningful understanding of the data. Alharahsheh and Pius (2020), stated that researchers may have to consider their choice of paradigm based on the nature of the research and its purpose and that qualitative studies are more aligned to creating a deeper understanding of a context.

Pham (2018), continues by saying that one of the trending topics amongst educationalists around the world is questioning the approach of teachers. One of the strengths of the interpretivist paradigm mentioned by Pham (2018), is that the paradigm makes allowance for the researcher to understand phenomena in a social context without making any generalisations. This research was thus based on the interpretivist paradigm since conclusions were made only after the researcher had personal interactions with participants in their natural field. This research was carried out in a non-intrusive manner and the researcher could interact with the study from the participant's point of view as well as from a practitioner's point of view. Since ontology is purely based on a set of concepts, the need to combine the understanding and experience in teaching Mathematical literacy between the researcher and the chosen participants is strengthened significantly since the teacher

had chosen a paradigm for the research that allowed all the participants to share their own experiences based on teaching.

4.3. Research site background and selection

Considering the extensive training of Mathematics and Mathematical literacy teachers meted out by the Department of Basic Education, the research sites that were chosen for this study were those that were identified as schools that performed poorly in Mathematics and Mathematical literacy. This research was conducted at different secondary schools in Durban, KwaZulu-Natal, South Africa. The entire research was carried out with the involvement of five participants in the main study. The participants teach at differentially ranked schools by the DBE in quintiles (groups that categorise the socio-economic standards of schools based on the area they are in). According to Ogbonnaya and Awuah (2019), quintiles were introduced to address the issues of unemployment, low literacy rates, and poverty in less affluent areas. The aim behind introducing these categories which are rated from one to five, is to ensure all learners receive an equal opportunity to learn with dignity. The ranking varies from quintile one being a school in a poor community to five being a school in an affluent community. Schools that are ranked from quintiles one to three are regarded as non-school fee-paying schools and receive more funding from the government. Despite not being categorised as the highest quintile schools, none of the schools are part of the nutrition program run by the DBE. This is unfortunate since the learners who attend these schools do not reside within proximity of the schools and learners are travelling quite a distance to attend school. It is unclear if the DBE is aware that most learners hail from townships and informal settlements and must travel to urban areas to attend school

Each of the participants being Mathematics and Mathematical literacy teachers, is employed in schools that consist of learners from diverse cultural and socio-economic backgrounds. It is unfortunate that after observation, it is obvious that the schools in which the research was undertaken, lack the basic resources such as paper and computers that would be of assistance in teaching Mathematical literacy. Eight participants were chosen for this study since the participants were split into a pilot study group (three participants) and a main study group (five participants). All participants chosen for the pilot study were from the same school due to convenience and time constraints. The participants themselves were from different ethnic groups and had taught at

numerous schools before, where there were also learners from mixed social backgrounds. The participants consist of level one teachers (classroom-based teachers who teach and facilitate, administrate, and mark written work done by learners), as well as some members of school management and some teachers who were senior markers of Mathematics and Mathematical literacy in the National Senior Certificate examinations (NSC). This created a nice spread of experience and hierarchy within the participants, aiding in getting better and more indicative data.

4.4. Research strategies

A strategy is a plan of action designed to achieve a particular goal. It outlines each of the steps that need to be taken to conduct a successful research project. It should include the resources needed to complete the research, the methods of data collection to be used, and the methods of data analysis. The research strategy should be specific to the research questions being asked and should be modified as and when required, through the evolving nature of the research project. Additionally, a research strategy should consider the ethical and legal implications of the research. Ultimately, a research strategy should be meticulously planned in such a way that it ensures the research is carried out in an orderly and efficient manner, which guarantees the use of the results in an effective manner interpreted correctly. This research was based on an interpretivist and qualitative framework that involved inductive reasoning. According to Sauce and Matzel (2017), inductive reasoning can be used to characterise the problem-solving, learning, and sociological functions of humans and animals alike. Inductive reasoning is based on logical thinking which makes use of observations and investigations to reach a conclusion. The data collection took place at schools and the instruments involved were filled in at the data collection site.

The research was strategised to be implemented in a way that would not interrupt teaching and learning time and conducted during the times that the sections were prescribed to be taught. The research instruments involved in this study were based on the idea of inductive reasoning and included informal observation, semi-structured interviews, focus group interviews, and document analysis which were part of the data generation process. According to Milyankova (2019), people place different understandings of a situation, to make sense of and comprehend the reasons, actions, and intentions of other people. Therefore, this study involved triangulation of data collection.

4.4.1. Research design

This study was guided by the interpretive paradigm and was carried out in schools in KwaZulu-Natal. The study was designed keeping the context of the schools and the type of learners who attend in mind. The schools have a population of learners who come from different racial and socio-economic backgrounds. The language of instruction used in all these schools is English even though most of the learners are of African ethnicity and are not English home language speakers. The participants involved in the study disclosed that learners who attend these schools face many challenges on a social and economic level.

This study, therefore, consisted of a pilot study and the main study. According to Christiansen (2014), a researcher may start the qualitative study with a few samples and then expand on the number of samples if the need arises. Thus, much consideration was given as to how many participants were required to carry out this research and draw conclusions based on common responses from the data collected in the research process. This research is a qualitative study that was carried out while keeping in line with the grade 10 and grade 11 Mathematical literacy syllabus as set out by the Department of Education (DBE). The data generated from the study was analysed thematically from semi-structured interviews, document analyses, and focus group interviews. According to Thakur (2021), Research strategies are crucial to the success of any research design. They involve the process of preparing, organising, and implementing research competently and effectively. Some effective strategies include developing a research question, designing a research plan, gathering and analysing data, and writing up the research findings. Developing a research question is important in defining the objectives of the research, identifying the aim, and providing a path for the research project. Collating a research plan involves classifying the resources and methods required for the research and stipulating a timeline for the research project. Gathering and analysing data involves collecting and revising the data necessary to answer the research questions and test any hypotheses. Lastly, writing up the research findings includes recording the research process, summarising the data, and interpreting the findings in a non-biased manner. Effective research strategies are key to ensuring the success of a research project.

It is the background of a study that links the aims and objectives of any research project to the methods that are used to achieve those objectives. Research designs vary depending on the type of

research being conducted. The research approach used enables the researcher to generate data namely. qualitative, quantitative, and mixed methods approach. According to Meyer (2015), a theoretical background of a study can be a qualitative approach based on the claim that reality is socially constructed through an exploration of experiences. Therefore, this research was based on the qualitative method since the responses gathered in the data collection were categorical. The questions and research instruments that were used in this research were guided by the theoretical framework and paradigm used in this study.

4.4.2. Research methods

According to Shukla (2020), research methods are the procedures, processes, or strategies used to gather and analyse data. Types of research methods may include surveys, interviews, observation, field studies, case studies, experiments, and tests. Relevant research methods are used to determine whether a study is either qualitative or quantitative. In this qualitative research, a pilot study was designed and implemented to ensure that the research instruments used in the collection of data were valid and reliable. The pilot study involved three teachers from secondary schools in the Durban South region who were currently teaching grades 10, 11, and 12 Mathematical literacy. The pilot study required the participants to engage in a semi-structured interview, provide relevant documents about lessons on conversions and measurement, and engage in a focus-group interview. The main study involved the remaining five of the eight participating teachers from two different schools. The participants, who were teachers of Mathematical literacy and Mathematics, were arranged into two groups for the focus group interviews. The first group was made up of two participants. The second group involved three participants. All participants were from public schools and all the participants followed the same guidelines stipulated by the DBE during teaching the prescribed topics. The participants were chosen with consideration of gender, age, diversity in ethnicity, and years of experience in teaching Mathematical literacy. The research method included first conducting semi-structured interviews, lesson observations, document analysis, and lastly semi-structured focus group interviews. The lesson observations were carried out to identify common strategies, methods, and approaches used in the teaching of conversions and measurement.

4.4.3. Sampling

Sampling is an imperative tool for researchers, as it provides an insight into the population that would otherwise not be available. Sampling can be used in interviews, questionnaires, case studies, and surveys. The participants from the schools that were involved in this research indicated that their learners wrote the same exam and test papers set by the DBE and these tests and examinations were marked using the same marking tool. Therefore, participants involved in this study were teachers of Mathematics and also taught Mathematical literacy. Purposive sampling enables the researcher to aim for certain numbers of the population that are more likely to provide the data that is required. This method is usually used in qualitative research studies, such as interviewing a small number of people to gain insight into a specific phenomenon. Hence, this study involved the use of purposive sampling. Gentles et al. (2015), defined sampling as the source of collection of precise data that may be used to reach research objectives.

4.4.4. The participants

The participants, who are teachers of Mathematical literacy were of different ethnicities and taught at schools that were partially funded by the Department of Basic Education. Much consideration was given to the number of participants that were required for this study to produce adequate data. The participants were selected through purposive means, according to their years of experience in teaching Mathematical literacy and knowledge acquired through teaching at various secondary schools in the Durban area. The research involved responses from teachers who teach Mathematical literacy at two secondary schools in Durban, KwaZulu-Natal. All of the teachers that were involved in the study initially indicated that the schools where they taught were producing fewer desirable results in Mathematical literacy as the years passed, allowing the participants to share a common concern.

4.5. Research instruments

According to Adosi (2020), a selection of appropriate data research instruments allows a researcher to generate credible and authentic research data. To ensure that data can be easily attained in terms of logistics, the researcher chose specific research instruments that would be fit for the study. This study, therefore, involved the use of different types of research instruments and was found to be effective in data collection. Such instruments comprised lesson observation schedules, semi-

structured interviews, document analysis, lesson observations, and focus group interviews. Observations were done to gain insight as to how the participants delivered their lessons based on conversions and measurement. The lesson observations also provided insight as to what resources were used in the lessons and how. The semi-structured interviews were conducted to gain insight as to what strategies teachers used when they taught conversions and measurement, how they taught conversions and measurement, and why they did it in the manner that they did. The semi-structured interviews were conducted to provide insight into the participant's individual views, while the focus group interviews were conducted to gain insight into the participants' views collectively. These research instruments were used consecutively, as the data collection followed a logical process.

Table 4.1. provides information about the research questions, data generation methods, research instruments and data analysis used in this study.

Table 4.1: Data generated in responding to the three critical research questions

<i>Research Question</i>	<i>Data generation method</i>	<i>Data analysis</i>
1. What strategies do teachers use to teach conversions and measurement in Grade 10 and 11 Mathematical Literacy?	<ul style="list-style-type: none"> • Semi-structured Individual Interviews • Document analysis of lesson plans and the ATP • Lesson observations 	The data generated from the semi-structured interviews were classified into themes.
2. How do teachers teach conversions and measurement in Grade 10 and 11 Mathematical Literacy?	<ul style="list-style-type: none"> • Semi-structured Individual Interviews • Lesson observations • Focus group Interviews 	Thematic analysis was used in the analysis of the data generated from the semi-structured and focus group interviews.
3. Why do teachers teach conversions and measurement in Grades 10 and 11 Mathematical literacy in the way that they do?	<ul style="list-style-type: none"> • Semi-structured Individual Interviews. • Focus group Interviews 	Inductive reasoning was used in the data analysis of the focus group interviews

Table 4.1 provides insight into how the data was generated in this study. Lesson plans that were collected from teachers were designed to be in line with the CAPS policy document as well as the work schedule provided by the DBE. All the research instruments used in the main study allowed participants to share their different experiences freely through teaching conversions and measurement. All the responses from participants were recorded while interviews were conducted. The teachers involved in the study were transparent about their feelings about being accountable for results since they were involved in intervention lessons after school and sometimes on weekends.

According to Hyman and Sierra (2016), participants involved in a focus group interview should share common experiences or interests. Since the participants involved in this study were all teachers of Mathematical literacy, they shared something in common. All of the participants are required to teach conversions and measurement in grades ten and eleven. All the participants are required to have lesson plans. All the participants are required to compile a diagnostic analysis based on the performance of their learners. The participants are also required to work within a stipulated timeframe, according to a stipulated process specified by the DBE. It was therefore determined that lesson observations, semi-structured interviews, and focus group interviews would be necessary to allow teachers to air their concerns or frustrations.

4.6. The data collection process

Primary data was personally collected in this research, by the researcher. According to Rutakumwa et al. (2019), data collected in interviews without a recorder may be deemed unreliable or unethical. Therefore, all of the data that was collected in this research study was backed up by recorded evidence. The research instruments that were used in the data collection process of this study were designed specifically for gathering data based on the teaching of conversions and measurement. Participants were requested to hand in lesson plans based on teaching measurements and conversions electronically for their convenience. All the data generated through the semi-structured interviews and focus group interviews were collected when participants had non-teaching periods so that their contact times for lessons would not be compromised. Lesson observations and document analysis were part of the data collection process. According to Knapik

(2006), to generate data from the participants who are deemed experts in their field, the researcher can assume the role of a learner. Therefore, the researcher did not participate or provide any input in the data collection process.

4.7. The pilot study

According to Janghorban et al. (2013), a pilot study provides a basis for self-assessment of the researchers' groundwork and could assist the researcher. The need for a pilot study in this research was to inform the researcher of the effectiveness of the methods and instruments that were used in the initial phase of the study. In (2017), stated that a pilot study is necessary as it allows the researcher the opportunity to test the effectiveness of the research instruments used in a study. It was further stated that a pilot study assists the researcher in becoming more mindful of the research process. Three of the eight participants were randomly chosen for the pilot study. Participants from different schools were chosen to avoid any generalisations during the research process. All research instruments used in the pilot study were the same for each participant. The methods used in administering the data collection process in the pilot study were the same to avoid biases. Interviews have been a fundamental method of collecting data for qualitative studies for many years, and the interview method either face-to-face or telephonic must be well-considered before going about data collection (Oltmann, 2016). The qualitative approach and research methodology as well as triangulation of data used in the study enhanced the trustworthiness and reliability of the study.

Purposive sampling was used for the pilot study, due to the convenience and expertise of the participants in this phase of data collection. The data collection for the pilot study took place in three stages. According to Christiansen (2014), the difference between a pilot study and a main study is that a pilot enquires whether research can be done, whether the researcher should proceed with the research, and if so, how to go about conducting the research.

All of the three participants were interviewed. The interviews were conducted outside of teaching times so that the participants were able to reflect on lessons focusing on conversions and measurement in Mathematical literacy that have already taken place. Participants' responses were probed for clarity of responses. Document analysis was used after lesson plans were submitted to

the researcher by the participating teachers. A semi-structured focus group interview schedule was then conducted with the two groups of participants (see Appendix 4a) and participants' responses were further probed for clarity of responses. The semi-structured focus group interview was recorded and transcribed.

4.8. The main study

A main study was conducted after the successful preparation, planning, implementation, and revision of research instruments used in the pilot study. Christiansen (2014) stated that a main study is conducted with a larger sample. The research instruments and data collection methods used in the pilot study of this research were revised slightly after the pilot study. The main objective of this full-scale study was to explore teachers' espousal of teaching conversions and measurement in Grades 10 and 11 Mathematical literacy.

Specific details concerning the participants for the pilot and main study have been included in Chapter 5, section 5.3. The main study in this research process involved five participants. The participants were chosen from two different secondary schools. The five participants were not involved in the pilot study. The focus group interviews conducted in the main study consisted of two groups. One group was made up of two participants, while the other group was made up of three participants. One of the schools involved in the research process was identified as an underperforming school in the NSC 2022 exam and unfortunately, the participants in that school were disappointed about the Mathematical literacy results produced in the previous year (Education, 2022). The participants were made aware that they would be requested to share information based on their lessons, resources, and experiences through teaching conversions and measurement in Mathematical literacy.

A seasoned teacher indicated that he was creative and had markings outside the classroom door indicating height measured in metres so that learners could measure their peers' heights whenever they wanted. The same educator had also posted a chart based on conversions which involved abbreviations, to familiarise learners with the factors used in multiplying or dividing. Another teacher had put up the units of measurement on the chalkboard but explained the factors used in multiplying and dividing by referring to the textbooks given to learners. Most teachers used a

worksheet as a resource. Face-to-face semi-structured interviews with the participants were conducted outside of school times to avoid disruption of teaching.

4.9. Methods used for data generation

4.9.1. Lesson observations

Ciesielska et al. (2018), described observations as an underpinning foundation for people in everyday life. However, Öhlander added that it is extremely important to choose how to go about observations in the research field since research observations are used to draw conclusions. Some of the participants agreed to be informally observed during their lessons while teaching conversions and measurement. The observations took place before the semi-structured interviews. During the observation process, it was noted that one teacher used visual tools when teaching conversions and measurement. Lesson observations were done with three participants from two schools. The lessons were observed by the timetables the participants followed. Each lesson observation lasted for about forty five minutes on average. The observations were conducted during normal teaching periods. Each participant followed the ATP. As an observer, I greeted the learners and took a seat at the back of the class while the participants taught their lesson.

4.9.2. Semi-structured interviews

A semi-structured individual interview schedule was used (see Appendix 4a). Semi-structured interviews are typically conducted face-to-face but can also be conducted telephonically. The interviews lasted 20 minutes on average with each participant. The participants were from two different schools so the data obtained would not be generalised. In a semi-structured interview, the interviewer generally starts by asking participants questions about the topic and then follows up with more specific questions based on the answers given. Therefore, during these interviews, participants were probed for clarity of responses. The interviews were recorded and transcribed.

4.9.3. Document analysis of lesson plans

According to Nidhish (2020), paperwork is the most preferred method of storing information even in today's technologically advanced world. The purpose of a study undertaken by Courtney et al. (2015), was to determine what perspectives practising teachers have on lesson plans as compared to perspectives that prospective teachers have on them and to find the difference between these

two views. The study found that practicing teachers felt that lesson plans helped them keep track of what was done but were also a burden to compile whereas prospective teachers viewed lesson plans as a reflective tool that would assist them in improving their teaching. Lesson plans which were printed and given to teachers were emailed to the researcher by the participating teachers. These documents were analysed to identify common findings or themes. The analysis of the document included examining the time taken, the vocabulary used in the lessons, and the resources required for the lessons. In doing so, the researcher was able to identify strategies, resources, and methods used by the participants. It must be noted that the Department of Basic Education and Training does provide lesson plans which are given to teachers by subject advisors or cascaded to teachers by heads of departments. The lesson plan provided is, however, a very simple and general lesson plan that did not include space for reflection or observations during and after the lessons had taken place. The lesson plans included spaces for dates that teachers filled in as they completed the syllabus. It was interesting to see that the teachers who participated in the research chose to use the lesson plans provided by the DBE whereas previously, teachers were allowed to compile their lesson plans.

With regards to other documents that were a part of this study, the grade ten and grade eleven Mathematical literacy ATP's were of utmost importance. The participants based their lessons on the guidelines set out in the ATP, which provided information on timeframes, resources, and prior knowledge that was required to teach their lessons. The ATP was also of great importance to the researcher when analysing the lesson plans, as it provided insight into how teachers followed the ATP. Thus, a document analysis of the ATPs was also done.

4.9.4. Focus group interviews

Dilshad and Latif (2013), stated that a focus group interview is a valuable way to collect qualitative data and that focus group interviews would consist of participants who share views or ideas based on a common topic. Face-to-face focus group interviews were conducted in this research with the participants. A semi-structured focus group interview schedule was used (see Appendix 4b). Participants' responses were probed for clarity of responses, this time as a team. Participants were arranged into two groups and were from different schools, in doing so, generalisations of data and findings were avoided. There were two participants in group one and three participants in group

two. The focus group interviews were recorded and transcribed. It was important to note that teachers shared the same sentiments about the importance of section conversions and measurement. In addition, participants were asked to indicate whether being involved in this research study has influenced their reflections, thoughts, and strategies that they are currently using during the teaching conversions and measurement in grades 10 and 11.

According to King (2018), an interview involves a conversation between a researcher looking for specific information and a willing participant who is interested in engaging in the discussion and providing information. All participants were informed about when, where, and how the interview process would take place. Focus group interviews were used in the data collection process in this research and they were conducted with each group. There was a total of nine questions that each participant answered (see Appendix 4b). By collecting and organising the data collected from groups, valuable insight into the opinions and experiences of the participants was noted.

4.10 Ethical considerations

In keeping with the policy of the University of KwaZulu-Natal, the research process had only begun once the proposal for this research was reviewed, and accepted and ethical clearance was granted. Once the proposal was accepted, the researcher identified that the best participants for the data collection required would be practicing teachers of Mathematical literacy. Once the participants agreed to be part of the study, all participants and stakeholders were given informed consent forms that stated that the research was purely based on a voluntary purpose and the purpose of the study. All participants were informed that their involvement was based on anonymity and that they would be free to withdraw from the research at any point for any reason. (see appendix 3).

4.10.1. Gatekeeper's letter

Andoh-Arthur (2019), stated that gatekeepers play an essential role in the research process since they are in a position of power to either accept or deny a researcher the opportunity to collect data within their institutions. The research process began after obtaining a gatekeeper's letter from the principals of participating schools and informed consent was granted from participants, permitting the research to proceed. The informed letters of consent and gatekeeper's letters explained the

purpose of the research, who the researcher was, and why the research was being conducted (see appendices 2 and 3).

It was noted that principals of the schools who were involved in the research were very supportive and welcoming of the research being done in their schools. It was explained to the principals that the research was aimed at gleaning a holistic view of the experiences that teachers had when teaching conversions and measurement in Mathematical literacy before the principals were asked to consent to the research. Finally, all ethical clearance was granted, and the study was approved by the University of KwaZulu-Natal before the research process began.

4.10.2. Validity and credibility

Cohen et al. (2018), stated that the instruments used in data collection in research must be appropriate to adequately extrapolate the required data for a particular purpose. To maintain validity, the research instruments used in the study were designed to support the theoretical framework of the study, as well as to ascribe to the characteristics of qualitative research. The research instruments were piloted first to ensure that they were valid for the research being conducted (see Appendix 4a). Additionally, participants remained anonymous which enhanced truthfulness in terms of their responses. To maintain credibility, the research was designed to be unbiased in all aspects such as involving participants of mixed race, gender, and age for data collection. A detailed description of the participants was provided in the section on sampling. All participants were made fully aware of the title of the research, and what the research was based on and were told why the research was deemed relevant by the University.

4.10.3. Trustworthiness and transferability

Gunawan (2015), stated that dependability, credibility, transferability, and conformability are components of trustworthiness. To maintain dependability, the researcher collected data from participants from two different schools to determine whether all the participants involved in the study shared the same sentiments. The researcher further stated that the use of triangulation in research increases the trustworthiness of the research and that all audio or visual recordings of data collection must be made available. Therefore, the research instruments used in this study were lesson observations, semi-structured and focus group interviews, and data analysis. The

participants were also informed about what the data collection process was, how it would be undertaken, what research instruments were used, and that all participants would be anonymous throughout the study by being given pseudonyms.

There was a balance regarding gender between all participants as well as diversity in terms of race, culture, and age. Chapter five provides a profile of the participants involved in the study. Stake (2013), stated that generalisations should not be made when compiling data. Therefore, the same questions were asked in both semi-structured interviews and focus group interviews. In terms of transferability, the researcher ensured that the study does not make generalisations based on this research especially since this study was carried out mainly in a purposefully chosen environment and consisted of specific individuals pertinent to the study. To maintain credibility, focus group interviews were held. Participants were allowed to respond as the interview progressed. In this manner, participants were able to openly agree or disagree with each other.

4.11 Data analysis

Taherdoost (2020), claimed that data analysis is a procedure whereby already collected data is broken down into a more comprehensive way. According to Christiansen (2014), data may be analysed according to deductive reasoning or inductive reasoning. Inductive reasoning is a process whereby data is organised and analysed by looking for patterns or themes. Therefore, to draw conclusions based on common responses from the data collected in the research process, the data generated in this research was classified into themes. The process of document analysis was implemented by examining lesson plans and ATPs. Additionally, lesson observations enabled the researcher to incorporate the findings into themes which were then used to interpret the findings. The themes were generated by analysing the data gathered from the lesson observations, semi-structured and focus group interviews, and document analysis. The lesson observations, lesson plans, and document analysis allowed for the first question to be addressed, by providing insight into the strategies teachers used to teach conversions and measurement. The semi-structured and focus group interviews allowed for inductive reasoning to take place, providing details about resources, methods used, and reasoning behind why teachers taught conversions and measurement in the way that they did. Thus, the themes that emerged were based on the three main research questions for this study. Essentially this included details of what strategies teachers used, how the

teachers taught conversions and measurement, and why teachers taught conversions and measurement in the way that they did.

4.12 Summary

This chapter entails details about the research design. The research methods and the implementation of the research instruments used in this research were also discussed. An explanation of the paradigm used in the study and why that particular paradigm was used were provided. Details about the process of data analysis were also included in this chapter. Insight based on the background of the site selection, the selection criteria of participants, and how and why participants were chosen is provided in this chapter. The sampling method, ethical considerations, and the need for a pilot study were also discussed. The next chapter is based on the research findings of this study.

Chapter 5: Data presentation, analysis, and interpretation

5.1. Introduction

The previous chapter discussed the research methodology, design, sampling, and the research instruments used for data generation. In this chapter, the generated data will be presented, analysed, and interpreted. The data for this qualitative research study was generated by conducting lesson observations, semi-structured individual and focus group interviews, and analysing annual teaching plans and lesson plans.

5.2. Data generation plan

The data was gathered through triangulation after all requirements for ethical clearance were met. A pilot study was conducted before the main study to ensure the validity and reliability of the data generation process and instruments. The pilot and main study participants included eight teachers who taught Mathematical literacy in four different schools in KwaZulu-Natal, South Africa. The pilot study included three participants from two schools, and the main study included five participants teaching at two schools.

This research study was based on teachers' espousal of teaching conversions and measurement in Grades 10 and 11 Mathematical literacy. The data presented, analysed, and interpreted in this chapter was generated from lesson observations, individual semi-structured interviews, focus group interviews, and a document analysis of Annual Teaching Plans and lesson plans. The data generation for this research was focused on generating responses to three research questions; these questions are as follows:

1. What strategies do teachers use to teach conversions and measurement in Grade 10 and 11 Mathematical literacy?
2. How do teachers teach conversions and measurement in Grades 10 and 11 Mathematical literacy?
3. Why do teachers teach conversions and measurement in Grades 10 and 11 Mathematical literacy in the way that they do?

5.3. Profile of the participants and their schools

The pilot and main study participants were experienced post-level one and post-level two teachers (Okeke & Mtyuda, 2017). The participants taught at four different schools in Durban, KwaZulu-Natal. Two schools were part of the pilot study, and two schools were part of the main study. The participating teachers for both the pilot and the main study taught Mathematics and Mathematical literacy. All schools for this research are public schools which are also called government schools in South Africa (Mestry, 2017). Teachers at the participating schools predominantly teach using the chalkboard, textbooks, and DBE guides.

5.3.1. Profile of the pilot study participants

The pilot study participants had similar years of teaching experience and profiles as the main study participants. Three participants participated in the pilot study. These participants taught at two schools similar to those in the main study. The purpose of the pilot study was to assist in refining the research instruments, validating the research instruments, and finetuning time frames for the interviews. Each pilot study participant was observed once while teaching Grade 10 or 11 mathematical literacy. Subsequently, each participant was interviewed individually using a semi-structured interview schedule. After that, the three pilot study participants participated in one focus group interview. Based on an analysis of the data generated from the pilot study, the observation schedule and individual interview schedule were revised to ensure that the data generated from the main study would assist in responding to the three main research questions for the study under focus. The profile of each participant for the pilot study is reflected in Table 5.1.

Table 5.1: The profile of the pilot study participants

<i>Participant</i>	<i>Name of school</i>	<i>Post Level</i>	<i>Years teaching</i>	<i>Qualification</i>
1. Mrs. Metre	Fahrenheit High	Level 1 (Teacher)	11 years	Bachelor of Education Degree
2. Mrs. Litre	Fahrenheit High	Level 1 (Teacher)	23 years	Diploma in Education
3. Mr. Grams	Celsius High	Level 2 (HO D)	Nine years	Bachelor of Education Degree

Table 5.1. illustrates a detailed profile of participants teaching in Fahrenheit High School and Celsius High School.

5.3.2. Profile of Fahrenheit High School

Mrs Metre and Mrs Litre taught at Fahrenheit High School, which is situated in the Umlazi district. The school has a mix of learners from different ethnic groups and socio-economic backgrounds. The schools are dependent on the Department for funding. The school offers extra Saturday classes to learners in Grades 10, 11, and 12 in Mathematics, Physical Science, Life Sciences, and English. A private business owner funds these extra classes. Mrs Metre has taught for 11 years and has completed a Bachelor's in Education degree. Mrs Litre has 23 years of teaching experience and a Higher Diploma in teaching. She majored in Mathematics and Science in her diploma.

5.3.3. Profile of Celsius High School

Mr Grams taught at Celsius High School. This is based in a predominantly Indian township. The school is situated in Chatsworth and services a mix of learners in terms of ethnicity. The staff has changed due to teachers retiring and leaving for work abroad. The participant, Mr Grams, has nine years of teaching experience and has recently been promoted to Head of Department. The participant indicated that as much as he found the responsibility of managing his Department overwhelming, the members of his Department have been supportive. The teachers in his Department have been assisting him since he has fewer years of experience in teaching than they do. Mr Grams has completed a Bachelor's degree in Education and majored in Mathematics education.

5.3.4. Profile of the participants in the main study

Mr. Gallon and Mr. Pounds taught at Metric High School. Mr. Gallon is an experienced teacher who has been teaching for 25 years and has a background in the corporate industry. Mr Gallon shared that teaching was not his first choice of vocation, but he added that he settled comfortably into the profession. Mr. Pounds, however, is from a family of teachers. He is a young teacher with four years of teaching experience.

The participants from Imperial High School were Mrs. Miles, Mrs. Ounce, and Mr. Yard. Mrs. Miles has been teaching for thirty years. She was promoted to Head of Department in 2021. Mrs. Ounce is initially a B.Sc. graduate majoring in Microbiology. Unfortunately, Mrs. Ounce could not find employment within her field and was desperate to earn a living, so she studied further to become a Mathematics teacher. Mrs. Ounce had very little experience (3 years) teaching Mathematical Literacy. She taught Mathematics for 11 years. Mr. Yard has been teaching for fourteen years. The profile of each participant is reflected in Table 5.2.

Table 5.2: The profile of the main study participants

<i>Name of participant</i>	<i>Name of school</i>	<i>Post Level</i>	<i>Years teaching</i>	<i>Qualification</i>
1. Mr. Gallon	Metric High	Level 1 (Teacher)	25 years	Bachelor of Commerce Degree
2. Mr. Pounds	Metric High	Level 1 (Teacher)	Four years	Bachelor of Education Degree
3. Mrs. Miles	Imperial High	Level 2 (HO D)	30 years	Diploma in Education
4. Mrs. Ounce	Imperial High	Level 1 (Teacher)	11 years	Bachelor of Science Degree
5. Mr. Yard	Imperial High	Level 1 (Teacher)	14 years	Bachelor of Education Degree

5.3.5 Profile of Metric High School

Table 5.2. illustrates a profile of the participants of Metric High School. Based in the suburban town of Isipingo in Durban, KwaZulu-Natal, the school is a public school, also known as a government school in South Africa (Mestry, 2017). Classes consist of about thirty-five to forty learners in each class. The results produced by the school in recent years may have weakened significantly. However, the teachers and learners from the school have not been identified as

underperforming in all subjects. This is aligned with research focusing on underperforming schools in that these schools perform poorly in subjects such as Mathematics, Accounting, and Physical Sciences (Msomi, 2018); Msomi, Mabusela, & Ntshangase, 2023). The school caters to learners residing predominantly in the Isipingo township and Umlazi areas.

5.3.6 Profile of Imperial High School

Imperial High School falls under the Umlazi district in education. The school is situated between the outskirts of a suburb called Chatsworth and the Umlazi areas. The classrooms in the school house more than forty-five learners per class from grades R to 12. Mrs. Miles, Mrs. Ounce, and Mr. Yard expressed their concern, discomfort, and dissatisfaction at teaching such large numbers since the number of learners per class can reach sixty-four. The KwaZulu-Natal Department of Basic Education learner-educator ratio (LER) is 35:1 for secondary schools and 40:1 for primary (Makhoba, 2018). Thus, the number of learners per class at Imperial High School is not aligned with the LER and the norm of the current Post Provisioning Norms (PPN) as set out by the Department of Basic Education (Buthelezi & Makhoba, 2020).

5.4. Presentation and analysis of the lesson observations

The participants indicated they used lesson plans from a teacher support document provided by KZN DBE (Mathematical Literacy Subject Advisors, 2022a; 2022b). The lesson plan provided by the participants focused on measuring volume within the conversions and measurement section. Based on the lesson observations, it was evident that all participants saw the need to emphasise to their learners the need to ensure that all units of measurement were the same before starting with problem-solving activities focussing on volume. All participants also did a recap on the previous lessons taught, which were based on measuring area and perimeter. This showed the participants had good pedagogical content knowledge (Shulman, 1987). The lessons that were taught focused on simplifying units of measurement to calculate volume. The grade 10 lesson discussed the difference between capacity and volume, and the grade 11 lesson plan included temperature conversions. When presenting the lesson, the participants were observed to display sound evidence of using pedagogical knowledge, curriculum knowledge, and pedagogical content knowledge (Shulman, 1987). All observed lessons were based on introducing volume within conversions and

measurement. The lesson plans participants used to teach their lessons are included in appendices 5a and 5b. Details of the three observed lessons are included in the following sub-section.

5.4.1 Lesson Observation One

School Name: Metric High School

Grade: 11

Class size: 32 learners

Lesson duration: 45 minutes

Teacher: Mr. Gallon

Lesson Topic: Measuring and Estimating Volume: Measuring Temperature

Mr. Gallon introduced learners to examples of measuring tools during his lesson. Mr. Gallon had explained and made notes on the chalkboard. Mr. Gallon used examples of measuring tools, such as teaspoons, tablespoons, and cups, as part of their introduction to their lesson. In doing so, the participant reminded learners of what they were already familiar with, illustrating excellent command of pedagogical content knowledge and curriculum knowledge (Shulman, 1987).



Figure 5.1: Examples of measuring tools used by Mr. Gallon.

As seen in figure 5.1, Mr Gallon explained to learners the actual measurements of objects such as cups, spoons, and measuring tape. Mr. Gallon informed learners that skills based on conversions and measurement were important in undertaking activities such as tiling, fencing, or cooking. In addition, he discussed how temperature conversions can be useful when travelling abroad (degrees Celsius versus degrees Fahrenheit). He continued the class activity once he introduced the lesson using real-world objects. Based on the lesson observed, it was evident that although Mr. Gallon used concrete manipulatives and resources, his lesson was mainly teacher-centred (Killen & O'Toole, 2023).

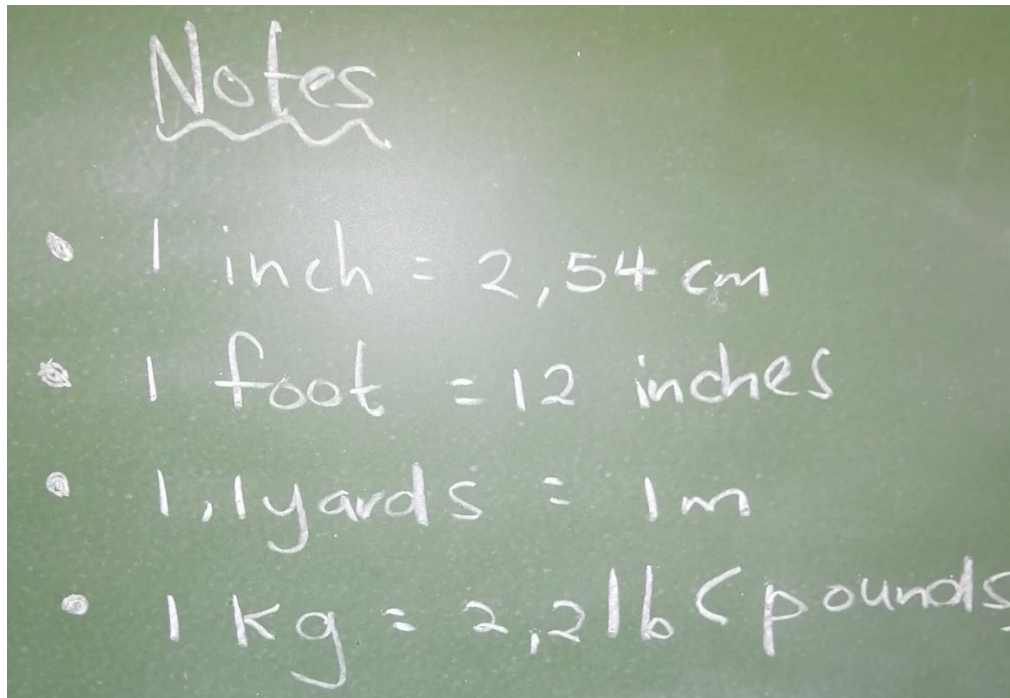


Figure 5.2: Notes written by Mr. Gallon

Figure 5.2. is a picture of the notes written on the chalkboard. The class activity focussed on a recap of converting between metric systems and imperial and vice versa. Learners did a few examples on their own. The class was then guided on measuring volume and capacity. The lesson was not learner-centred since it did not allow collaboration or group work (Killen & O'Toole, 2023). A definition of volume and capacity was written on the board.

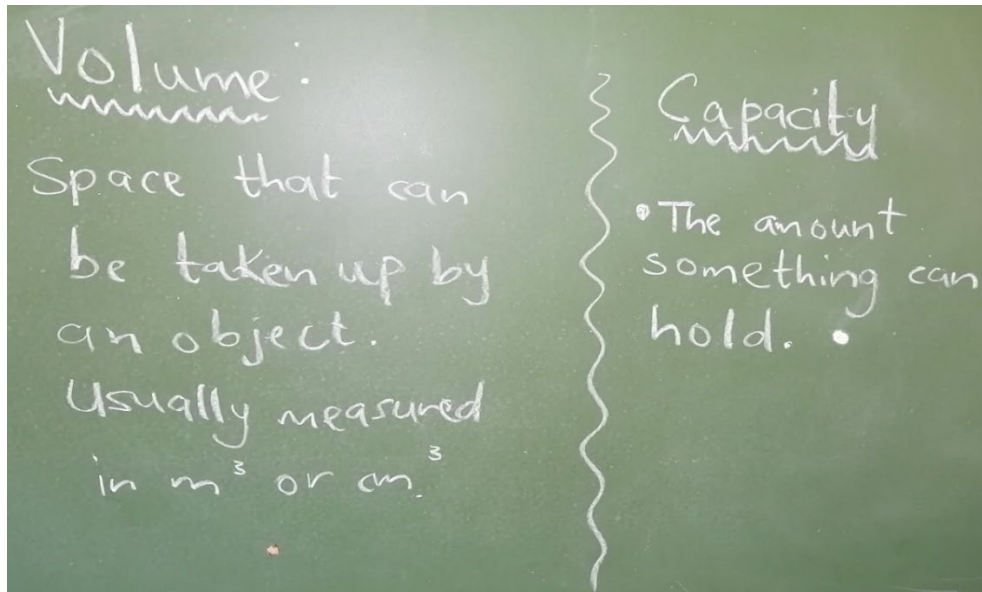


Figure 5.3: Notes on volume and capacity written by Mr Gallon

Figure 5.3 shows the definitions that were explained by using real-world examples of cooking and baking. This showed evidence that Mr. Gallon was trying to incorporate aspects of the learners' context within the lesson under focus. Using learners' real-world context shows evidence that Mr. Gallon used his knowledge of his learners (Ball, et al., 2008) to support his pedagogical content knowledge (Shulman, 1987).

Afterwards, a class activity was written on the chalkboard, and Mr. Gallon discussed the questions. Learners provided chorus-type answers.

EXAMPLES

1 Consider a measuring jug that has a capacity of 1,5liters of water.

1.1 How many teaspoons of water are there in this jug?

1.2 How many cups of water are in the jug?

1.3 If you want to mix some juice in the jug and the instructions say that you must dilute the juice as follows: four parts water and one part juice, how much juice and how much water would be in the jug, if the jug is full.

SOLUTIONS

1.1 $1,5L \times 1000 = 1\ 500ML$

1 t/spoon = 5ml

So $1\ 500/5 = 300$ teaspoons.

1.2 1 cup = 250 ml,

So $1\ 500/250 = 6$ cups

1.3 Four parts water to one cup juice means there are five parts altogether. So, $1\ 500/5 = 300$

We will use 300ml of orange juice (one part), and 4×300 ml of water (1200 ml of water) which is four parts.

Figure 5.4: Class activity used by Mr. Gallon

Figure 5.4. illustrates the class activity that was discussed with the learners, and they were asked to complete this activity from the KZN Step Ahead Study Guide. The activities included questions focussing on measuring volume and measuring temperature later on in the lesson. The teacher began with an activity intended for grade 10 learners, to revise what was done previously. At the end of the lesson, the questions not completed during class time were given as homework.

5.4.2 Lesson Observation Two

School Name: Metric High School

Grade: 10

Class size: 35 learners

Lesson duration: 45 minutes

Teacher: Mr. Pounds

Lesson Topic: Measuring Volume/Capacity

Mr. Pounds asked learners to take down important points as he introduced the concepts of area, perimeter, and volume in the measurement section. Mr. Pounds did not introduce measuring instruments to his learners; rather, he referred to examples of measuring instruments, assuming that learners knew of them. He explained the importance of using the correct measuring instruments to measure quantities. He also discussed that some measuring instruments use different units. For example, they may be in metric or imperial units.

Consequently, this led to a brief discussion of conversions from metric to imperial units and vice-versa. However, Mr. Pounds did not use any real-world objects or resources; rather, he relied on his learner's prior knowledge of measuring instruments, such as measuring tape or measuring cups. Mr. Pounds displayed the use of knowledge of learners and their characteristics (Shulman, 1987). He supported learners who he knew needed extra support. He asked learners who generally grasped concepts quickly to help answer questions that he posed about measuring and converting from metric to imperial. Mr Pound then proceeded to discuss the difference between volume and capacity. He asked learners to recall what they had done previously. He asked learners to think about a measuring jug and think about where, for example, 250ml would be in a jug that held 1 litre of liquid (Based on his probing of learner responses, it was evident that he expected learners to respond that it would be above 200ml but below 300ml, or quarter way).

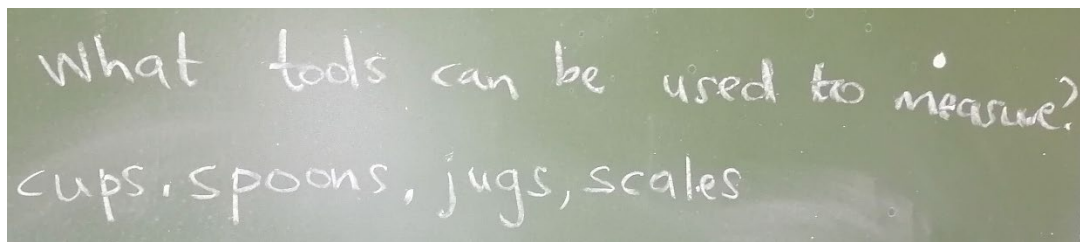


Figure 5.4: The introductory question written by Mr. Pounds

Figure 5.4 represents a question that the teacher wrote on the chalkboard, asking learners when the lesson began. However, since learners did not have any real-world example (the actual measuring jug) in front of them, it was difficult for them to provide the response that was wanted. After that, he proceeded with the lesson and explained converting units of weight and length from metric to imperial and vice versa.

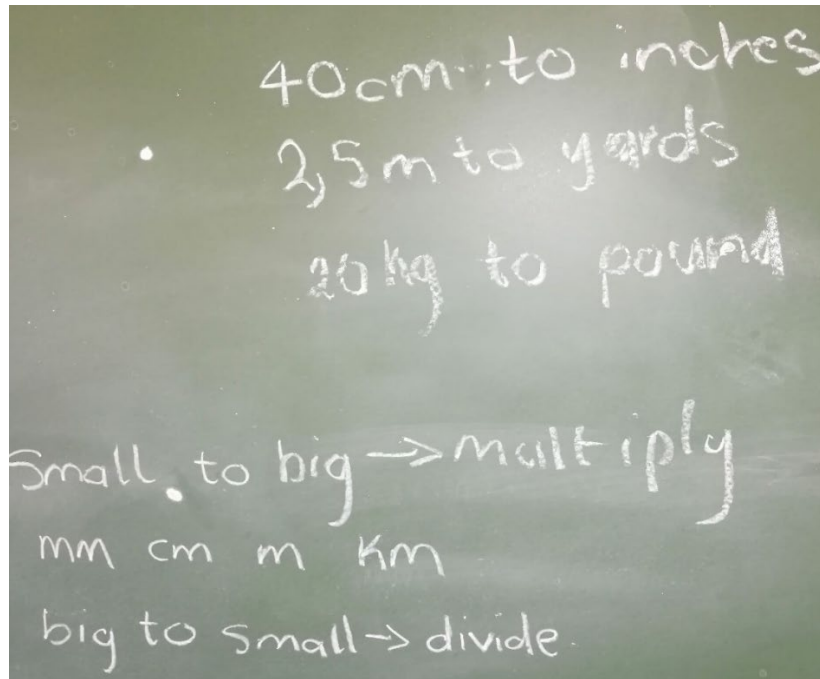


Figure 5.5: Examples of questions that Mr. Pounds posed to learners

As illustrated in figure 5.5, the teacher provided a short exercise (five questions written on the board focussing on converting within the metric system and three questions on converting between imperial and metric) that learners needed to complete. He walked around the class, checking learners' responses. After that, he wrote a few examples on the board (three questions on measuring volume). He answered the first question for the learners and then asked learners to answer the next two. Learners provided chorus answers. At this stage, Mr. Pounds was satisfied that his learners knew how to solve questions on measuring volume. He gave learners an exercise from the KZN Step Ahead Study Guide as a class activity. Learners completed the activity in class. The activity was scheduled to be marked in the next lesson since the lesson ended before the marking could be done. The lesson under focus was not learner-centred but rather teacher-centred (Killen & O'Toole, 2023). Mr. Pounds did not allow learners to partner with each other or collaborate in a group to solve the examples given.

5.4.3 Lesson Observation Three

School Name: Imperial High School

Grade: 11

Class size: 33 learners

Lesson duration: 45 minutes

Teacher: Mrs. Ounce

Lesson Topic: Measuring and Estimating Volume: Measuring Temperature

Mrs. Ounce used the same Grade 11 lesson plan that Mr. Gallon used. The DBE provided the lesson plans. Mrs. Ounce started the lesson by recapping or attempting to remind learners of their prior knowledge. She spoke about conversions between the metric system and conversions that were required when cooking or baking. Mrs Ounce asked specific learners questions regarding the examples she spoke about concerning the unit for temperature used in different countries (degrees Celsius versus degrees Fahrenheit).

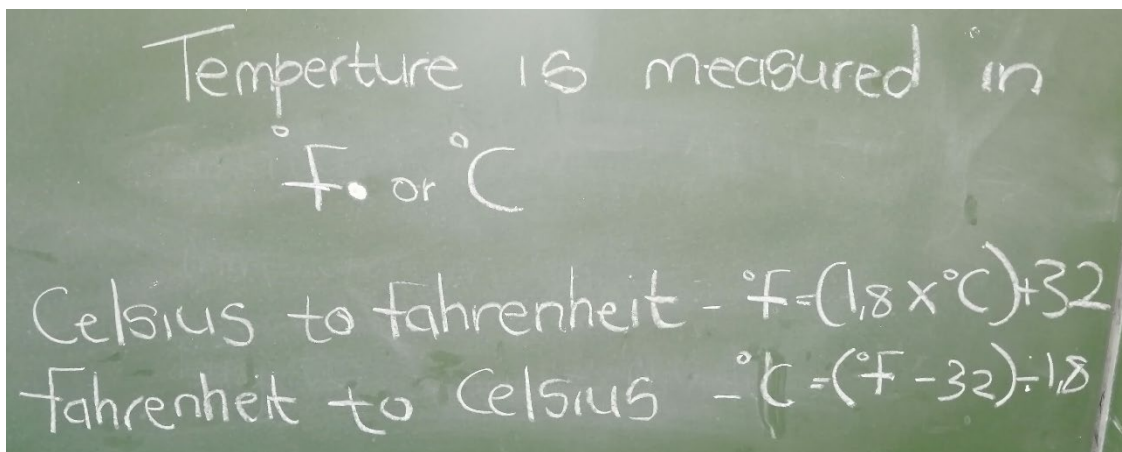


Figure 5.6: Conversion formulae written by a learner

Figure 5.6. illustrates that Mrs. Ounce had asked a learner to volunteer to write down the formulae for temperature conversions on the board. A picture of the learner's involvement is seen in figure 5.6. It was evident that Mrs. Ounce knew her learners well (Ball, et al., 2008) in her class. She knew who would recall their prior learning and who struggled with recalling previous knowledge. She also showed evidence of knowing which learner could support their peers regarding what was completed previously. She allowed learners to collaborate to support knowledge production. The

introduction to her lesson was learner-centred. After that, the lesson became teacher-centred (Killen & O'Toole, 2023).

Once satisfied that the learners had adequate knowledge of converting between the metric and imperial system and temperature conversions (degrees Celsius to degrees Fahrenheit), Mrs Ounce explained the tasks that learners would engage with during the lesson under focus. She explained by writing examples on the board, solved the first example, and asked specific learners to attempt different examples. Although it was evident that Mrs Ounce had good knowledge of her content and her learners, what was missing from the lesson was the use of real-world objects and other resources to support her discussions. She used traditional teaching and learning methods, such as the chalkboard, the KZN DBE Teacher Support Document, the KZN Step Ahead Study Guide, and a textbook, to support her discussions during the lesson. After the learners had participated in the chalkboard activities, Mrs Ounce then went on to explain the activity that they needed to complete. The activity was based on an activity from the KZN Step Ahead Study Guide on converting and measuring volume and temperature. The lesson ended before the activity could be completed. The learners were asked to complete the activity as homework. Thus, what was evident from this lesson was that the majority of the lesson under focus was teacher-centred, whereby Mrs. Ounce led the discussion, provided instructions, and used the traditional 'chalk and talk' teaching strategy (Killen & O'Toole, 2023).

From the data collected through observations, all participants were observed to focus on teaching the appropriate vocabulary for area, perimeter, and volume. Thus, it was evident that the participants understood what they were teaching and had the appropriate pedagogical content knowledge (Shulman, 1987) to show links with prior lessons while they taught the lesson under focus. The meaning of the vocabulary, for example, area, perimeter, and volume was explained since it was used later in each participant's lessons. Similarly, research (Machaba, 2016) supports the view that vocabulary is important in enhancing learner performance in activities involving area, perimeter, and other mathematical concepts.

The participants provided learners with examples of real-life contexts in which calculations involving area, perimeter, and volume are necessary. Thus, the participants knew the content and

knowledge of their learners (Ball, et al., 2008). The participants understood that it was important to relate what learners were learning to the real world so that what was being taught was relevant and had meaning (Stacey, 2015) for the learners in the classroom. Mr. Gallon used the chalkboard, a textbook, the KZN DBE Teacher Support Document, the KZN Step Ahead Study Guide, real-world objects, and manipulatives to support the teaching of his lesson. At the same time, Mr. Pounds and Mrs. Ounce focused on using the chalkboard, a textbook, the KZN DBE Teacher Support Document, and the KZN Step Ahead Study Guide. Based on the lesson observations, learners were interactive and engaged during the lessons. All participants had good classroom management skills. The participants provided class and homework activities for their learners, which were taken directly from the KZN Step Ahead Study Guide. The teachers used their copies of textbooks (For example, Study & Master Mathematical Literacy or Oxford Successful Mathematical Literacy) to support them as they taught and provided examples on the board.

5.5. Document Analysis

To assist in responding to the second main research question, a document analysis of the annual teaching plans and the lesson plans submitted by the participants was conducted.

5.5.1 Document analysis of the Annual Teaching Plan

Annual Teaching Plans (ATP) are documents issued to teachers at the beginning of every school year. These documents stipulate what content ought to be taught, how long a topic should be taught, and how the topics taught will be assessed. ATPs provide information on the syllabus flow that needs to be taught, which is done by specifying the order of topics. By issuing the ATP, the DBE attempts to ensure uniformity in teaching regarding syllabus, time frames, and order of topics taught in public schools. Upon analysing these documents (Grade 10 and Grade 11 ATP), it was evident that the ATP was content-heavy. The grade 10 ATP for Measurement is shown in Figure 5.7.

WEEK 3	WEEK 4
MEASUREMENT	
Conversions: <ul style="list-style-type: none"> • Metric system • Conversion using factors, tables. • Time formats conventions, conversion (sec, min, hours, days, weeks, months, years, decade) 	Measuring & estimating: <ul style="list-style-type: none"> • Length • Distance • Weight, mass • Volume • Temperature • Time • Calculate costs of products and services
Page 63	Page 64-67
Grade 8 & 9 work	Grade 8 & 9 work
Measuring instruments: <ul style="list-style-type: none"> • Ruler • Tape measure • Baking measures (spoons, cups) Relevant sources: <ul style="list-style-type: none"> • Baking recipes • Conversion tables • Plans of school, house 	Measuring instruments: <ul style="list-style-type: none"> • Thermometer • Kitchen, bathroom scale • Baking measures (spoons, cups) Relevant sources: <ul style="list-style-type: none"> • Baking recipes • Conversion tables • Plans of school, house
Worksheet on conversions and measuring	

Figure 5.7: 2023/2024 Annual teaching plans: Mathematical Literacy: Grade 10. Adapted from Department of Basic Education (2023a, p.2)

Figure 5.7. shows that teachers have only one week to complete conversions and one week to complete measurements. For the content that needed to be completed, this time was inadequate. This was also true of the Grade 11 ATP shown in Figure 5.8.

WEEK 4	WEEK 5	WEEK 6	WEEK 7	WEEK 8
MEASUREMENTS				
<ul style="list-style-type: none"> • Conversions: <ul style="list-style-type: none"> - Metric to imperial - Temperature (°C to °F and vice versa) • Time <ul style="list-style-type: none"> - Duration (hours to minutes and vice versa) 	<ul style="list-style-type: none"> • Conversions: <ul style="list-style-type: none"> Equivalent proportionality conversions e.g., 5 litre paint covers 20 m² 1 teaspoon = 5 ml 	<ul style="list-style-type: none"> • Measuring & estimating: <ul style="list-style-type: none"> - Length - Distance - Mass, weight - Volume - Temperature 	<ul style="list-style-type: none"> • Calculate: <ul style="list-style-type: none"> - Perimeter - Area (Surface Area) - Volume <p>Note: Costs calculations may apply to the above sections.</p>	
Page 63, 70		Page 64-69		

<ul style="list-style-type: none"> • CAPS document • CAPS aligned textbooks • Examination guidelines • Calculators • Distance: <ul style="list-style-type: none"> - Ruler, tape measure - Scales, trundle wheels - Odometers • Mass, weight: <ul style="list-style-type: none"> - Bathroom-, kitchen scales - Electronic scales • Volume: <ul style="list-style-type: none"> - Spoons, cups - Jugs, bottles - Buckets, wheelbarrows • Temperature: Thermometer 	
Short test on conversions and time	Worksheet on perimeter, area and volume

Figure 5.8: 2023/2024 Annual teaching plans: Mathematical Literacy: Grade 11. Adapted from Department of Basic Education (2022b, p. 1)

From Figure 5.8, it is evident that Grade 11 teachers have four weeks to complete the teaching of measurement, which includes conversions, measuring, estimating, and calculations. Calculations could also include cost calculations. The time allocated for this section is inadequate, and the participants supported this view during the interviews. The interview transcript excerpts that best capture these views are shown as follows:

Mr Gallon: *“Not enough time to do justice to the work. We can’t even use group work because this will take time.”*

Mr. Pounds: *“Sometimes, just to complete the syllabus, I have to cover more than one lesson at a time.”*

Mr Yard: *“I want to do practical work, but we don’t have resources, and there’s no time. You find that you are always rushing to complete the syllabus.”*

The preceding excerpts showed the participants were uncomfortable with the timeframes allocated for teaching the topics. They believed that the time to teach the content was inadequate. Similarly, Du Plessis and Letshwene (2020), maintained that time was limited for teaching and too much time was allocated for assessments. In addition, during the interviews, participants claimed that the memorandums supplied with the ATPs were not accurate, and the content in the ATP was repeated across different topics. The interview transcript excerpts that best capture these views are shown as follows:

Mr. Gallon: *“Measurement and conversion are included in many other topics but for application mostly. We must make sure they understand the work before moving on so that they can apply what they learnt to the other topics.”*

Mrs Ounce: *“There are many issues with the memos, especially in grades eleven and twelve. There are always errors in the memo. How can stakeholders not realise there are errors? It’s very frustrating because I have to re-mark. The ATP has lots of repetition. It is very brief. We are not sure about what is new or old. We are unsupported.”*

Mr. Yard: *“Also, with measurement, in grade eleven, it keeps coming out in the year in other sections for application, so you must keep re-doing the work because it is covered in so many other topics.”*

The preceding excerpts showed that the ATPs were not specific enough and often had content repeated within different topics. Thus, although the topics were listed in order with stipulated time frames, there were too many contexts in which conversions and measurements were covered throughout the year. This increases the workload for teachers. Along similar lines, Du Plessis and Letshwene (2020), identified that one of the challenges teachers face in South Africa is an overburdening workload. Conversions and measurement are linked to other topics throughout the year, such as cost calculations in the Finance topic.

5.5.2 Analysis of the Lesson Plans

A lesson plan is a document that teachers use to plan how they will deliver their lessons. Teachers can either design their lesson plans or use lesson plans provided by the KZN DBE (Mathematical Literacy Subject Advisors, 2022a; 2022b). Lesson plans typically entail details of the topic that will be taught, the sub-topics involved in the topic, and the lesson duration. The lesson plan also states what resources are required and used to teach the lesson. The participants indicated they used the KZN DBE’s lesson plans (Mathematical Literacy Subject Advisors, 2022a; 2022b). Thus, the lesson plans used in this study were standard. The lesson plans used by participants in this study were based on measurement. The sub-topics include volume, capacity, and measuring temperature. The DBE lesson plan for Grade 10 is shown in Figure 5.9. The complete lesson plan has been included in Appendix 5a.

Term	2	Week	4
Duration	Hours	Date	
TOPIC	MEASUREMENT		
SECTION	MEASURING VOLUME/CAPACITY		
LESSON OBJECTIVES	<ul style="list-style-type: none"> • Determine volume using appropriate measuring instruments, eg spoons, cups, T/spoons, t/spoons, jugs • Measure out quantities to complete a task, e.g. quantities of drinks needed for a function, monitor quantities, and e.g. measure rainfall over time. • Calculate the cost of a certain volume of a product, e.g. the cost of 2,5l of milk at R7.99/l 		
KEY CONCEPTS/ TERMINOLOGY/ VOCABULARY	Volume measures the amount of space taken up by an object. Capacity describes how much an object/ container can hold eg the amount of liquid that a container can hold		
PRIOR-KNOWLEDGE/ BACKGROUND KNOWLEDGE	<ul style="list-style-type: none"> • Units for volume • Conversion Converting units of volume		

Figure 5.9: Grade 10 lesson plan. Adapted from Mathematical Literacy Subject Advisors, (2022b, pp. 48,49)

Figure 5.9 shows that the lesson plan provided by the participants focused on a recap of learners’ background/prior knowledge of converting within the metric system. The lesson plan focused on calculating volume, measuring out quantities, and calculating costs for the measurement topic. The lesson plan states the topic, the grade to be taught, and the duration of the lesson and provides a

breakdown of the activities that follow the lesson’s introduction. Stated in the lesson plan, was what prior knowledge learners should have and what skills and values learners should develop in this topic. Although the lesson plan refers to a textbook named the Answer Series, this specific textbook was not provided to all the participants. One copy is given provided per school. The participants used the KZN Step Ahead Study Guide. The findings of this study indicate that the participants were not pleased that the resources (concrete manipulatives and textbooks) stipulated in the DBE lesson plan were not provided to them. Similarly, Hansraj (2021) maintained that it is important to use different resources when teaching Mathematical literacy. The lesson plan for Grade 11 is shown in Figure 5.10. The complete lesson plan has been included in Appendix 5b.

Duration	1 HOUR	Weighting	20% (±5)
LESSON OBJECTIVES	learners must be able to : <ul style="list-style-type: none"> - To determine volume using appropriate measuring instrument including: - measuring spoons and cups - jugs bottles and / or canisters - buckets and wheel burrows Measuring volume (be able to convert volume into capacity) <ul style="list-style-type: none"> - Convert from degrees Celsius to degrees Fahrenheit using given formula. -interpret temperature values to plan trips.		
KEY CONCEPTS/ TERMINOLOGY/ VOCABULARY	<ul style="list-style-type: none"> • Volume • Capacity • degrees Celsius : • degrees Fahrenheit 		
EAC STRATEGY	Reading , Writing, Listening, Speaking and Comprehension		
PRIOR-KNOWLEDGE/ BACKGROUND KNOWLEDGE	Convert between metric systems, <ul style="list-style-type: none"> • Conversion using a given conversion required cooking. • radius • diameter Probability		
INTRODUCTION	<ul style="list-style-type: none"> • Volume: the amount of space that can be occupied by an object, can be measured in ³ e.g. m³ cm³ • Capacity: the amount that something can hold. e.g. milliliters, liters 		

Figure 5.10: Grade 11 lesson plan. Adapted from Mathematical Literacy Subject Advisors, (2022a, p. 35).

The lesson plan provided by the participant focuses on a specific aspect that involves conversions and measurement, namely volume and temperature. The lesson plan indicates that the lesson needs to be introduced by defining and explaining the difference between volume and capacity.

According to Farhang et al. (2023), lesson plans provide a foundation for education and describe lesson methods, time, and objectives. Upon analysing the lesson plans, it is evident that some aspects of lesson planning are missing. In this case, teachers would then need to rely on their specialised knowledge to guide them on what resources must be used since they are not provided with tangible resources. Specialised content knowledge (SKC) was applied since the lesson plan did not provide details on formulae to be used, so the teacher used their specialised knowledge to explain the difference between area, perimeter, and volume to avoid confusion among learners. The participant applied knowledge of content and curriculum (KCT) and common content knowledge (KCC) since the lesson plan does not provide many examples based on calculations involving volume. There are also examples of real-life contexts provided in the lesson plan, which further leads the teacher to apply KCC to explain these examples to learners efficiently. Three types of teacher knowledge used by the participants are evident from the findings of the lesson plan analysis.

However, according to Shulman (1987) and Ball et al. (2008), it takes more than just the three types of knowledge displayed in the lesson planning phase of this study to teach successfully. Thus, from the analysis of the lesson plans used in this study, it is evident that the participants had to use different types of knowledge to implement the lesson plans provided by the DBE. However, there are types of teacher knowledge that are not present in the findings of this study. Therefore, this study's findings align with the findings of Mudaly (2016), who advised that a good teacher has sound conceptual knowledge. Still, teachers in South Africa lack a deep conceptual understanding of simple facets of school Mathematics (Mudaly, 2016). Furthermore, only one participant introduced learners to tangible resources when teaching conversions and measurement. Therefore, there is a need for streamlined, detailed, and uniform resources in the form of support materials and measuring instruments to ensure that all teachers implement a more structured approach to their lessons.

5.6. Presentation and analysis of the semi-structured interviews

The study participants were five teachers. Two male level one teachers taught at Metric High School. Two female and one male participant taught at Imperial High School. One female participant from Imperial High School is a level two teacher. She is the Head of the Mathematics and Science department. The other two participants are level-one teachers at Imperial High School. The semi-structured interviews were conducted with each participant, and their responses were audio-recorded. Each participant was allocated a pseudonym to protect their identity. The pseudonyms and the profile of each participant are shown in Table 5.2. Each interview transcript was analysed thematically. The thematic analysis resulted in the six themes emerging. These themes are discussed in the subsections that follow.

5.6.1. Learner performance in conversions and measurement in Grade 10 and 11 Mathematical Literacy

The first theme that emerged was participants' views on learner performance in conversions and measurement in Mathematical literacy. Participants expanded their responses, focusing on their reflections on the performance of their learners. Excerpts from selected interview transcripts are as follows:

Mr. Gallon: *Measurement and conversions can be a problem sometimes because of the mix-up of multiplication and division. But I created this mnemonic and a flow chart. With measurement, it's not so much of a problem because the problematic areas are that the learners are unable to substitute. After all, measurement most of the times use formulae.*"

Mrs. Miles: *"Learners don't perform well. They seem to fail in literacy but not numbers. I am teaching in a school where English isn't the home language of most learners. The language, words like kilo, etc., they don't seem to understand. I have a problem with the questions in exams or tests because of the way they are structured. I was previously teaching pure Maths but due to the decrease in the number of learners doing Maths, I am teaching Maths literacy. They produce poor results. If they have to measure anything, they leave blanks or get the answer completely wrong. Especially when you use real-life examples, like tiling, etc."*

Mrs. Ounce: *"When it's a simple example, they can substitute easily; they cannot solve it once it's different. They cannot change the subject of the formula. Learners performed very badly. They do*

not know conversions, like 10 millimetres equals one centimetre. You have to repeat it since they have no concept, and they forget. I noticed that they can add different units of measurement without changing the units to the same unit of measurement.”

Mr. Pounds: “They did achieve generally well, certain questions, like I said, involving a large factor; sometimes, some of them make an error with the conversions from one to another. Like from millimetre to kilometre and so on.”

Mr. Yard: “In the exam, they didn’t tell them to convert because they expect them to remember. By grade twelve, they should know it on their own.”

Based on the selected transcript excerpts, it was evident that most of the participants found that their learners were struggling to comprehend the language involved in conversions and measurement. The participants indicated that learners did not work well with conversions and measurement. The participants felt they had to keep enforcing the vocabulary used in conversions and measurement as learners forgot what the vocabulary meant. Learners were also found to simplify answers without applying the proper calculations to equate units of measurement before simplifying. Mrs. Miles emphasised that most learners were not English first language speakers, which presented problems in grasping concepts. The use of language, concepts, philosophy, and application of Mathematics Literacy for such teachers would have been something they would have to learn and understand at a deep level before trying to teach Mathematics Literacy to others. This view is supported by research in the field (Schoenfeld, 2016). Interestingly, the DBE does not readily provide access to an organogram of all the relevant stakeholders who play a vital role in Basic Education in the country. A study by Makoelle (2014) included an organogram of the South African School system, represented by Figure 5.11.

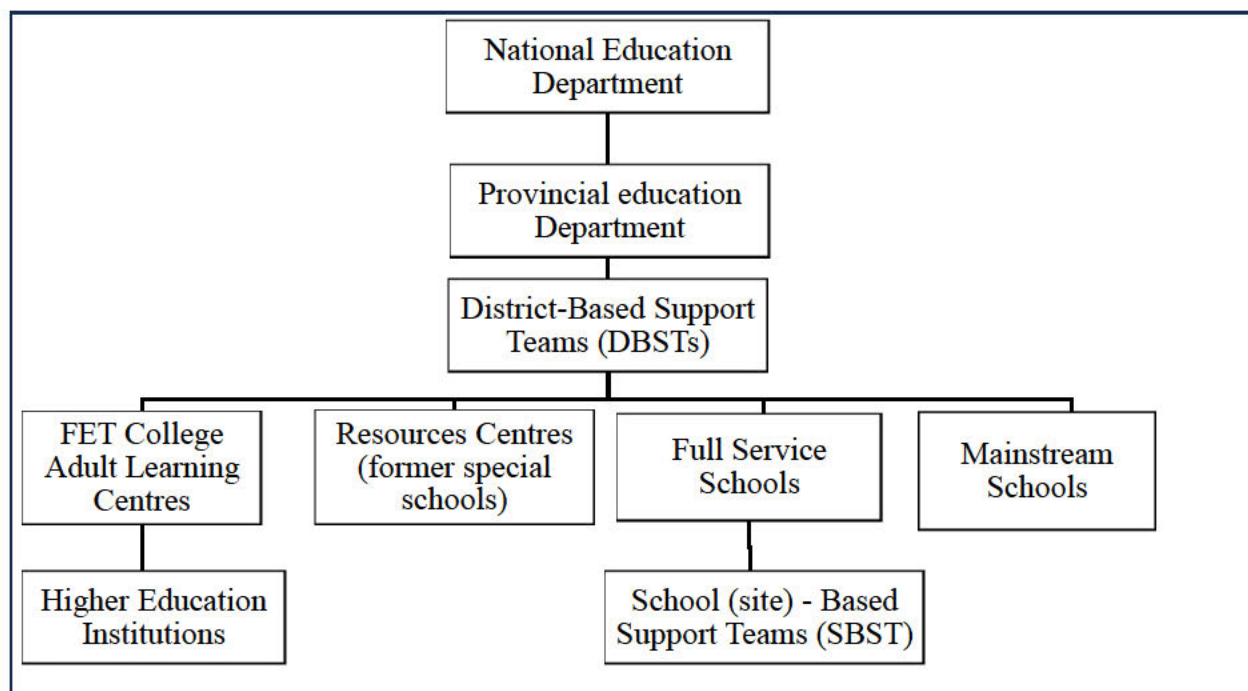


Figure 5.11: Organogram of the South African Higher Education system: Adapted from Makoelle (2014, p. 68).

In interrogating Figure 5.11, it is suggested that perhaps teachers should also have been mentioned as stakeholders in the education system. Similarly, Govender (2018), indicated that teachers play a vital role in the education system but are excluded from making decisions in curriculum discussions. As discussed in the previous chapters, the role of teachers plays a vital part in the development and achievement of learners. Multiple stakeholders are responsible for ensuring that the education system addresses challenges faced in curriculum design and implementation from the government level to members of communities.

5.6.2. Participants' experience in teaching Mathematical literacy

The second theme from the thematic analysis was participants' experience teaching Grade 10 and 11 Mathematics Literacy. This theme was important as it explored the experience and skills of teaching Grade 10 and 11 Mathematical Literacy. Selected interview transcripts have been included as follows:

Mr. Gallon: *“I teach grades ten, eleven, and twelve.”*

Mrs. Miles: *“I am now teaching grade 11 Maths literacy. I have to adjust to the attitude of Maths literacy learners, who think the subject is easy. Due to literacy issues, there’s a lot of explaining to do. I must teach in-depth, explaining that measurement units must be equal.”*

Mrs. Ounce: *“I have been teaching grades twelve and eleven, no grade ten. The learners I have been teaching did pure Mathematics, and they all dropped to Mathematical literacy.”*

Mr. Yard: *“I have been teaching grades ten, eleven, and twelve, mostly grade ten and eleven.”*

The preceding responses show that the participants have different experiences teaching Mathematical Literacy in Grades 10 and 11. Mrs. Ounce had not taught Grade 10 Mathematics Literacy previously but had taught Grade 11 and 12. Mr. Gallon and Mr. Yard had taught Grades 10, 11, and 12, while Mrs. Miles did not teach Grade 11 previously. During the interviews, it was also revealed that not all participants were initially qualified as teachers. Mr. Gallon and Mrs. qualified in different fields but furthered their education to join the teaching fraternity to earn an income. Along similar lines, a study conducted by Verster (2020), revealed that engineering, hospitality, and commerce graduates were desperate for employment and thus turned to teaching as a career. Many of the participants also indicated that they were initially trained as teachers of Mathematics and not specifically Mathematics literacy. Mrs. Miles found it difficult to teach Mathematical literacy since she had to adjust her teaching based on the attitude of her learners, who believed the subject was easy. As a result, she believed that learners did not take the subject seriously enough.

5.6.3. Teaching strategies used by the participants

The next question focused on determining the teaching strategies the participants used. Some teachers mentioned that they had little time to spend on conversions and used traditional teaching strategies. Traditional teaching strategies are generally teacher-focused and directed and do not allow for much learner interaction (Tularam, 2018). Selected interview transcripts are included as follows:

Mr. Pounds: *“Depending on the resources in the textbook, if it’s done well enough in the textbook. If it’s not, we supplement it with our worksheets. So, I’m working with sir next door, and he’s more*

experienced, so if he has any worksheets that are used, I do the work with him, based on his worksheets, since he's a senior teacher."

Mrs Ounce: "At the start, I put it on the board, divide by ten or divide by hundred, etc. I tell them to always convert to the same unit of measurement, then move on to area, perimeter, and formulae."

Based on the responses from participants to question five, Mr. Pounds response focused on resources and the worksheets that he used. Using worksheets and textbooks in a classroom is a traditional teaching strategy. Mrs. Ounce, on the other hand, mentioned using the chalkboard to teach her learners. The 'chalk and talk' teaching strategy is also traditional. None of the participants mentioned using any non-traditional teaching strategies. Non-traditional teaching strategies include e-learning, online learning, and blended and flipped classrooms (Tularam, 2018).

Participants were probed further to determine why they used specific teaching strategies to teach conversions and measurement. Selected interview transcripts are reflected as follows:

Mrs. Miles: "I adapt the strategies if necessary."

Mrs. Ounce: "I tell them that they must be able to apply themselves due to the change in the context of questions."

Mr. Yard: "It differs. In grade ten, I think they forget. In this term, it was also like they learned a new concept in grade twelve. They forget and mix the units of measurement. They don't remember to convert."

The response from participants indicates that they change their strategy if required. Only one participant mentioned that she had informed learners that the context of questions would be different and that learners would have to be able to apply skills that were taught during lessons to each context appropriately. Mr. Yard answered the question by explaining that learners forget concepts taught in grade 10, so he uses teaching strategies that focus on helping his learners remember important concepts and vocabulary. Essentially, Mr. Yard discussed the reasons for using the review strategy and recap of previous lessons when teaching conversions and measurement. Research (Stavnezer & Lom, 2019) supports this teaching strategy, maintaining that

a recap of previous lessons also supports learner interaction in the classroom. This was evident during Mr. Ounce's lesson observation, as discussed earlier in Section 5.4 of this chapter.

5.6.4. Resources used by the participants

The question concerning resources used aimed to establish what resources were used by each participant. It was evident from the interviews that although the participants were teaching the same topic within the same timeframe stipulated for teaching conversions and measurement, they used various teaching resources in the classroom.

Mr. Gallon: *"Uhm, with conversions, it's a chalkboard, worksheets, textbook. For measurement, I actually use measuring instruments and measuring tape. I have a scale here. What else for measurement? Uhm, cups; spoons; bottles for capacity, and some models for surface area and volume."*

Mrs. Miles: *"I currently use the Answer series. There are a lot of notes. I tell learners to write their own notes as I explain what's in the book. The learners don't know their grade nine work, such as the Theorem of Pythagoras. I have to explain what a hypotenuse is, what it means to square a number, etc. Regarding mathematical literacy, there is great difficulty with resources such as maps, annexures, and scale. Only one booklet is given to the school head of the Department and then passed on to each teacher to duplicate. This places added pressure on the teacher because there is no time to duplicate and distribute the resource to the learners. There is also a challenge in terms of paper, ink, printer, and the fact that we are under-staffed."*

Mrs. Ounce: *"Generally, I use past exam papers and sometimes textbooks."*

Mr. Yard: *"Normally, I make examples using the ruler to explain. For volume, I show them containers. I always try to use examples. We need help with resources. For example, learners don't know how big a meter is. If you have those rulers, learners will be able to see. We need to do practical work and group work. The Department needs to assist with resources."*

The participants used different resources when teaching conversions and measurement. Some of them tend to use more resources, whereas others were found to adhere to the 'chalk and talk' teaching strategy. The 'chalk and talk' teaching strategy refers to the lessons teachers teach by talking and discussing using only a whiteboard or chalkboard as a resource (Sharma & Kumar,

2018). The more seasoned teacher, Mr. Gallon, used a variety of resources, both visual and tangible. Mrs. Ounce indicated that she preferred to use past examination papers. Most resources are provided digitally, and teachers are given one hard copy. Based on Mrs. Miles's response, it was evident that the school where she teaches is understaffed, negatively impacting her preparation and lesson planning time. Mrs. Miles also shared her frustration at the Department of Education for not providing booklets with maps, annexures, and scale diagrams for learners at the beginning of the year when conversions and measurements are being taught. The participants' response regarding the lack of resources correlates with the findings of Dlamini (2016), who stated that the Department of Basic Education is lacking by not providing adequate resources to teachers.

5.6.5. Reasons for selecting specific teaching strategies and resources

The following question was used to determine if teachers had specific reasons for using a particular resource or teaching strategy. Knowing the answer to this question is important as it addresses whether teachers plan the resources used in lessons or not. Selected transcript excerpts that best responded to this question are included as follows:

Mr. Gallon: *"I've been teaching for a while. That's how I was taught in school, and models make it more practical. Learners get to physically measure the models or watch me measuring them."*

Mr. Gallon: *"I suggest or recommend teachers use the mnemonic system for conversions between the Metric system. Do you want to know the mnemonic? My Cat Drinks Milk or King Henry of Denmark makes Delicious Cake Mixtures."*

Mrs. Miles: *"The main thing is conversion tables. I make them draw; I enforce prefixes. I try to make them understand, like connecting the prefix. When I teach, I keep reinforcing, and I want them to understand why we use certain prefixes."*

Mrs. Ounce: *"Learners need to know how to answer to get used to exam-type questions, but before that, they need to know the language. I use past exam papers and sometimes textbooks."*

Mr. Yard: *"I start by defining units of measurement. I try to use simple English. Most learners are Zulu-speaking, so I switch to Zulu. The problem is that non-English speakers don't understand. Code-switching helps a lot. I took another class today. The learners understood when I spoke in Zulu. But the learners who did not understand Zulu then had a problem because they could not figure out if I were teaching additional work or explaining the same thing."*

All participants indicated they align with traditional teaching strategies, specifically the ‘chalk and talk’ method. Mr. Gallon indicated he used models, tactile resources, and mnemonics. However, none of the participants indicated using learner-centred strategies in teaching conversions and measurement. Each participant had a reason for using the resources they did. However, many of them were found to limit learners to paperwork. None of the participants indicated that they used technology as a resource in teaching conversions and measurement. Research (Hansraj, 2021) suggests that learners understand Mathematical Literacy better when technological resources are used. Based on the participants’ responses in this study, the Department of Basic Education and the school management team did not assist the participants with technological resources. This view is supported by research conducted in South Africa (Ankiewicz, 2021).

From the transcript excerpts, it was evident learners did not have a deep understanding of the language, specifically the vocabulary involving the units of measurement used in the conversions. Morapeli (2017) stated that learners who do not have adequate knowledge of mathematical language will encounter problems understanding mathematical concepts. Accordingly, Hlatshwayo (2013) maintains that teachers face challenges teaching in diverse classrooms, and even though educational policies may have changed over the years, the linguistic profiles of schools have not. As is evident from Mr. Yard’s response, teachers know the prerequisites and prior learning required for learners to understand conversions and measurement. However, regardless of their teaching strategies, they may not successfully address the language barrier when teaching Mathematical literacy.

5.6.6. Knowledge used to support the teaching and learning of conversions and measurement

The last theme that emerged from the thematic analysis of the semi-structured interviews was the participants’ use of knowledge in their classroom. This included, for example, the use of experiential (tacit), implicit (silent) knowledge, and pedagogical content knowledge. The excerpts that best capture participants’ use of knowledge are shown in the excerpts that follow:

Mrs. Ounce: *“I was initially employed here as a Maths teacher. I used to have fewer learners in my class. The maths learners usually try, and they try to work hard without me forcing them. I am now teaching math literacy, and it’s different. I have no training in Maths Literacy. The way the questions are structured, I am learning as I go. I must constantly deal with the bad attitudes of learners who must repeat the grade. It’s a constant challenge every day.”*

From the preceding excerpt, it is clear that the participant has not undergone any professional development or teacher training in Mathematics Literacy. She is using her knowledge of content to support her pedagogical content knowledge. In addition, the same participant shared her dissatisfaction with the Mathematical Literacy examination questions. This is reflected in the transcript excerpt that follows:

Mrs. Ounce: *“I feel what we teach and what comes out in exams are different. For example, in June 2022, there was a question that asked what contribution goes towards UIF. It is an ambiguous question. We don’t know what types of questions to expect because they are always phrased differently. We try our best in the classroom to prepare the children.”*

Based on the preceding excerpt, Mrs. Ounce believes that the examination-based questions and the questioning and taxonomy levels are unclear. As a result, teachers need to use their knowledge of content and pedagogy to assist them as they transfer their knowledge of content to their students. They had to use their pedagogical content knowledge (Shulman, 1987) to support their learners in the classroom.

Other participants supported Mrs. Ounce’s view and indicated that they had to use their own teaching experiences to assist their learners. This view is shown in the excerpt that follows:

Mr. Gallon: *“I’ve been teaching for many years, so I know what to expect. I know where to expect learners to encounter challenges from experience. If learners are well-taught in tariffs, for example, they won’t be overcharged. So, I am constantly making learners aware of what they need to know using my experience so that they will be more aware.”*

As is evident from the preceding excerpt, Mr. Gallon used the tacit knowledge he gained from his own experiences to support teaching and learning in the classroom. Similarly, research (Ribeiro, 2013) suggests that tacit knowledge is gained through experiences and cannot emerge without experience.

In addition, Mrs. Miles uses her implicit (silent) knowledge based on her experience of observing her learners in action. Along similar lines, research (Tularam, 2018) maintains that silent knowledge is implicit in a person's actions and can be considered a practical skill professionals use. Similarly, Mrs. Miles observed what confused or challenged her learners so that she could take practical steps to make them more aware of these constraints to enhance teaching and learning in her classroom. This is evident in the transcript excerpt that follows:

Mrs Miles: "I watch how they try to solve problems; they get confused when converting. They don't know whether to multiply or divide, even if they use the correct factor. I also observed that they cannot change the subject of a formula. When it involves some easy calculations, they can do it, but the moment they see formulas, they leave blank spaces in their work. I try to make them more aware as I teach. This helps with the learning."

Moreover, Botha et al. (2013) emphasised that insufficient research has been done on what knowledge is needed to teach mathematical literacy successfully. Other research (Kurshumlia & Vula, 2019; Mzila, 2016) highlighted the importance of using reading comprehension strategies to support the teaching and learning of problem-solving in mathematics and mathematical literacy. However, if teachers are not trained to teach mathematical literacy, they may not be aware of the use of such strategies. According to Pijoos (2020), teachers need to be trained to assist them in finding different ways to teach. Thus, teachers need to be involved in professional learning communities that would assist them in developing their skills and expanding their knowledge by interacting with peers (Mshengu, 2019).

5.7. Presentation and analysis of the focus group interviews

The focus group interviews required the participants to be together. However, it was challenging for all participants to be available simultaneously since their timetables did not allow this. Even

when participants had a non-teaching period (NTP) reflected on their timetable, they were serving relief for colleagues who were absent or on official duty out of school. In addition, all participants did not have NTPs at the same time. Moreover, some participants were hesitant to participate in the focus group interview outside after school hours. As a result, the focus group interviews were conducted in two groups. The first focus group interview comprised two participants, and the second comprised three. Table 5.3 shows the participants who participated in each focus group interview.

Table 5.3: Participants in each focus group interview

<i>Focus group 1</i>	<i>Focus Group 2</i>
Mr. Gallon	Mrs. Miles
Mr. Pounds	Mrs. Ounce
	Mr. Yard

Table 5.3. represents which participants belonged to focus group 1 and focus group 2.

During the focus group interview, participants were asked questions similar to those of the individual interview. Similar questions were asked to probe responses and obtain more information and clarity concerning teachers' espousal of teaching conversions and measurement in Grades 10 and 11 mathematical literacy. The discussions that follow capture the key views of the participants.

5.7.1. Participants' views on learner performance in conversions and measurement

The participants were asked their views on how their learners perform in conversions and measurement. Focus group transcript excerpts that best capture the participants' views are included as follows:

Mr. Gallon: *"Uhm, with conversions integrated with other aspects there, this poses a bit of a problem. So, I'll say learners score an average that is not very low and not like they would do in a data handling question, for example. Ja, so there's a small problem with the topic conversions."*

Mrs. Ounce: *"Learners do not perform well in this section; they get the lowest marks."*

Mr. Yard: *“They are trying but not doing their best. More needs to be done in grade ten because they do this section all the way up to matric. We have only done informal tasks so far. It wasn’t bad with the grade ten; they can do the conversions but struggle to understand. Older learners are starting to understand.”*

Based on the participants’ responses, it was evident that learners experience challenges when learning and applying conversions and measurement. Mr. Yard mentioned that Grade 10 learners are struggling, and although they can do the basic conversions, they do not fully understand the section. This view is supported by research (Mohyuddin & Khalil, 2016), which maintains that learners may understand rote learning and how to use a formula to convert. However, they do not have a conceptual understanding of the section.

In addition, the participants indicated that they did not have enough time to teach. This view is reflected in the focus group interview transcript that follows:

Mr. Gallon: *“Sometimes, we have to teach one and a half lessons in one lesson. This is a problem. We don’t have time to check if the class understands.”*

It is important to have ample time for teaching so that learners and teachers spend ample time on teaching and learning. If teachers do not have enough time, they will be unable to support learners who have problems understanding what is being taught (Hamukwaya & Haser, 2021).

Regarding responses based on learners’ performance on tasks, participants shared that the learners performed better in activities and class-based investigations where teachers could assist and not very well in examinations and tests. This view is captured well in the focus group interview transcript that follows:

Mr. Gallon: *“We did activities and investigations together, and they did very well. Assignments are open book, so generally, they do very well compared to exams and tests, which is much lower.”*

Mrs. Miles: *“When they work together, they do better, but it is difficult with large numbers. I tend to teach and give examples and activities on the board because of the large class.”*

As the preceding excerpt shows, learners do well when they have the teacher's and their peers' support. However, they do not perform well independently or in examination-based settings. Research supports this view, maintaining that examination settings, limited understanding of curriculum content (Mazana et al., 2020) and learner anxiety caused by test conditions (Estonanto & Dio, 2019) result in poor performance of learners. Similarly, a study by Taylor (2021) showed that South Africa direly needs efficient and qualified mathematics teachers. Not having skilled and efficient mathematics teachers results in the weak performance of learners in Mathematics (Lambrianos, 2019).

Mrs. Miles indicated that she was frustrated that questions based on conversions are posed differently in the provincial and national exams than in resources used during lessons. This view is reflected in the transcript excerpt that follows:

Mrs. Miles: *"I have a problem with the questions in exams or tests because of the way they are structured. Questions are asked differently in the common test papers; the language is used differently than in the resources we teach."*

The use of ambiguity in questions and unclear instructions in examinations results in learners struggling to comprehend the vocabulary used in examinations.

5.7.2. Participants' view on resources for the teaching and learning of conversions and measurement

The participants indicated that resources were a huge challenge and that there was very little assistance provided by the Department of Basic Education in this regard. Selected transcript excerpts are included as follows:

Mr. Gallon: *"Well, right now, they provide nothing for grade elevens. But I saw they do provide the Step Ahead and Just in Time resources for Gr 10. That was a good resource."*

Mr. Pounds: *"Mr. Gallon helps me whenever I find something unclear. I go to him. He provides me with resources as well."*

Mrs. Ounce: *“Textbook, I only have my copy, but it is not entirely suitable. Past year exam papers are better. The Department should provide more resources and give us cones, models, and nets so that learners can construct and learn practically.”*

Apart from textbook and paper-based resources, the participants emphasised the need for real-life, practical examples for teaching conversions and measurement. This view is reflected in the focus group interview transcript excerpts that follow:

Mr. Gallon: *“Well, resources like I told you, chalkboard, worksheets, textbooks, and physical objects like the measuring instruments, the models.”*

Mr. Yard: *“We need more resources for demonstration and practical work. For example, we need containers for volume so you can reference them. We need calculators. It is a challenge without calculators; they need to practice using them.”*

Mrs. Miles: *“I use examples from their daily life, this helps them understand. It is difficult to include all examples that suit all of them.”*

Mr. Yard also indicated that learners needed measuring tools and calculators. These views are supported by research in the field (Botha et al., 2023). Physical models, manipulatives, and practical, real-world objects are important for teaching conversions and measurement (Brijlall & Niranjana, 2015). Although these manipulatives, tools, and calculators are important for the teaching and learning of conversions and measurement, the Department of Education does not provide them. Similarly, a study conducted by Adebayo, et al. (2020) maintains that learners in schools better equipped with resources achieve better results than learners from poorly resourced schools. This was not the purpose of this study since all participating schools were similarly resourced. However, comparing learner performance in well-resourced and inadequately resourced schools will be an interesting study to conduct in the future.

5.8. Summary

This chapter provides insight into the data generated, analysed, and interpreted for this study. The data generated and analysed exhibits the profile of the participants and their schools, a document analysis of existing Annual Teaching Plans for mathematical literacy, and the lesson plans the participants used to teach their lessons. In addition, an analysis of the semi-structured individual

and focus interviews reveals the participants' views on learner performance and the use of teacher knowledge to support teaching and learning. Moreover, this chapter reveals the challenges and limitations that emerged due to inadequate teacher training, limited teaching resources, and language barriers in diverse classroom settings. The chapter showcases various teaching strategies and resources participants used to help alleviate the challenges and limitations faced in their classrooms. In chapter six that follows, the findings are discussed in response to the main research questions. In addition, the recommendations, limitations, and conclusion of this study are provided.

Chapter 6: Discussion of the research findings, limitations, recommendations, and conclusion

6.1. Introduction

This research study focused on teachers' espousal of teaching conversions and measurement in Grades 10 and 11 Mathematical Literacy. In the previous chapter, Chapter Five, the data generated for this study was presented, analysed, and interpreted. This chapter will discuss the research findings in response to the three main research questions. In addition, limitations, recommendations, and a conclusion to the study are included.

6.2. Discussion of the research findings

The findings of this study are discussed by linking the findings to the three main research questions. The three main research questions for this study are:

1. What strategies do teachers use to teach measurement and conversions in Grade 10 and 11 Mathematical Literacy?
2. How do teachers teach measurement and conversions in Grade 10 and 11 Mathematical Literacy?
3. Why do teachers teach measurement and conversions in Grade 10 and 11 Mathematical Literacy in the way that they do?

6.2.1. Strategies teachers use to teach measurement and conversions in Grade 10 and 11 Mathematical Literacy

For this study, teaching strategies, as discussed in Chapter Two, are methods the participating teachers used to teach Mathematical Literacy in Grades 10 and 11. Teaching strategies support learners as they learn content, improve their knowledge, and develop skills (Sarode, 2018). While teaching strategies may differ from teacher to teacher, they aim to effectively deliver the content of their lessons to the learners (Killen & O'Toole, 2023). To respond to the first question, the participants were observed teaching in their classrooms. After that, participants participated in individual and focus group interviews. The teaching strategies that were evident in this study are discussed as follows:

6.2.1.1. Teacher-centered teaching strategy

Based on the lesson observations, it was evident that the lessons were teacher-centered. During the interviews, the participants attributed using the teacher-centred approach to having limited training in using different teaching strategies for Mathematical Literacy. Thus, the responses show a gap in teacher knowledge regarding the use of different teaching strategies by the participants of this study. It was evident from the interviews that the participants did not have the know-how to use different teaching strategies, but they used teaching strategies they were familiar with. Based on the lesson observations, all participants started their teaching by talking to their learners and discussing key vocabulary related to the topic under discussion. The teacher monopolised these discussions (Tularam, 2018). None of the participants allowed learners to work collaboratively or in groups. While it would have been useful to use presentations, pictures, or games to teach conversions and measurement, none of the participants were observed doing this, and none mentioned these strategies during the interviews. Although Mr. Gallons used concrete manipulatives and real-world objects to teach his lesson, these were only used initially. The rest of his lesson was predominantly teacher-centred. Although the participants used a study guide and teacher support material to support their discussions and teaching, the teaching was teacher-centred and teacher-directed (Tularam, 2018).

6.2.1.2. The chalk-and-talk teaching strategy

It was evident from the data that all participants adhered to the chalk-and-talk teaching strategy when delivering lessons on conversions and measurement. Whilst one participant (Mr. Gallons) introduced measuring instruments in their lessons, no practical strategies were implemented or applied when teaching, such as asking learners to physically measure things themselves or build, bake or prepare things in activities. Mr. Gallon used teacher-led demonstrations in his lessons. Even though Mr. Yard indicated he would like to do practical work, he indicated that DBE did not provide resources. However, after examining the topic being taught and the possibility of incorporating practical activities, it was evident that there was no need for special resources or equipment. Everyday items from the real world (Stacey, 2015) could have been used effectively in explaining the concept of measurement to a class of learners. This was observed during Mr. Gallon's lesson, and everyday real-world objects were incorporated effectively. In response to question one, the findings suggest that the participants adhered to chalk-and-talk-styled lessons

and did not use different teaching strategies, such as integrating a blended approach or using technology when teaching conversions and measurement (Hansraj, 2021).

Participants disclosed that they used the chalk-and-talk teaching strategy as it was available to them. For example, metric units of measurement were written on the chalkboard, and a description concerning what these measurements were used to measure was provided. The learners were instructed to copy the formulas needed for conversions from the chalkboard. In addition, the participants wrote examples and activities on the chalkboard, which were discussed with the learners. Although the participants interacted with the learners to obtain answers and explanations, only the chalkboard was used. The participants did not hand out worksheets or use the overhead projector, PowerPoint presentations, or any other technology-based resources (Hansraj, 2021) to support their discussions or provide activities for the learners to engage with.

6.2.2. How teachers teach measurement and conversions in Grade 10 and 11 Mathematical Literacy

To answer research question two, observing the participants as they were taught was important. In addition, it was important to interview the participants to understand further how they taught conversions and measurement in Mathematical Literacy. The study under focus was framed within the ambits of teacher knowledge. Thus, this study was guided by the work of Shulman (1987) and Ball, et al. (2008). Shulman (1987) stated that it takes seven types of teacher knowledge to signify effective teaching. These types of knowledge are content knowledge, general pedagogical knowledge, curriculum knowledge, pedagogical content knowledge, knowledge of learners, knowledge of educational contexts, and knowledge of educational aims, purposes, and values. Ball, et al. (2008) expanded on Shulman's theory of teacher knowledge and added the concept of Mathematical Knowledge for Teaching (MKT). The research conducted by Ball, et al. (2008) proposes that for teachers to teach mathematics effectively, pedagogical content knowledge needs to include knowledge of content, learners, and teaching. This is also true for Mathematical Literacy, as revealed by research in the field (Bansilal, 2014).

When observed teaching and during the interviews, the participants exhibited content knowledge, general pedagogical knowledge, curriculum knowledge, pedagogical content knowledge,

mathematical knowledge for teaching, knowledge of learners, knowledge of educational contexts, and knowledge of educational aims, purposes, and values (Ball, et al., 2008; Shulman, 1987). This was evident from the lesson observations and the participants' answers during the interviews. This view is supported by the discussion of the findings in the sub-sections that follow.

6.2.2.1. The use of manipulatives, real-world objects, and relevant examples

The participating teachers used real-world examples to support their teacher-led teaching of conversions and measurement. This was evident during the lesson observations. The participants used their general pedagogical knowledge, pedagogical content knowledge, curriculum knowledge, and knowledge of their learners (Shulman, 1987) to teach volume and capacity in their grade 10 and 11 Mathematical Literacy classroom. The participants knew that they needed to use relevant examples for their learners to make the lesson more meaningful (Stacey, 2015). Consequently, to make the examples and activities easier to understand, the participants used examples that learners could relate to in their daily lives. This was evident in Mr. Gallon's lesson when he linked temperature conversions to baking, cooking, and travelling. In addition, Mr. Gallon used concrete manipulatives and real-world objects during his teacher-led demonstration about volume and capacity. He used measuring tools, such as teaspoons, tablespoons, and cups, to explain how measuring in daily life could be achieved. In this way, he made his lesson relevant to his learners. This teaching strategy is supported by research in the field (Stacey, 2015).

Knowledge of learners and characteristics (Shulman, 1987) also emerged during the interviews when the participants spoke about their learners' socio-economic circumstances. In addition, the participants exhibited knowledge of their learners and their characteristics when they shared that many learners had chosen Mathematical Literacy instead of mathematics due to performing poorly in mathematics.

6.2.2.2. The use of teaching resources provided by the Department of Basic Education

When teaching conversions and measurement, the participants showed evidence of knowledge of educational aims, purposes, and values, curriculum knowledge, knowledge of educational contexts, and knowledge of their learners (Shulman, 1987). This was evident in the lesson observations in that all participating teachers used the resources the Department of Basic Education (DBE) provided to teach their lessons. They used the Annual Teaching Plan (ATP), teacher support documents, and study guides provided by the DBE. The participants followed the teaching strategies provided in the ATP and considered the time allocation for each lesson. They knew the educational context and knew their learners often struggled with content, as evident in their interview responses concerning learners' poor performance in assessments. Thus, they were aware that to make the content understandable for their learners, they needed to use examples for problem-solving in Mathematical Literacy that were relevant to the learners' context (Manfreda & Hodnik, 2021). Based on their awareness of the educational context, they were cognisant that the basic resources required for teaching and learning, such as duplication paper and textbooks, were not readily available. These sentiments were presented and discussed in the previous chapter, Chapter 5. The participants echoed their concerns regarding limited resources during the interviews, which was evident during the lesson observations. Thus, they used teacher-centred demonstrations (Tualram, 2018) and the chalk-and-talk teaching strategy (Sharma & Kumar, 2018) to teach conversions and measurement.

Along similar lines, Dlamini (2016) proposed that the DBE needs to provide various resources to schools to support the effective teaching and learning of Mathematical Literacy. In addition, the participants mentioned during the interviews that when the DBE provided resources such as textbooks or study guides, there were insufficient copies. This led to the need to duplicate worksheets or activities for teachers and learners, which, in most cases, was problematic since no duplication paper was available. The lack of resources in this regard once again influences the teacher to use the chalk-and-talk teaching strategy (Sharma & Kumar, 2018).

From the interviews, it was evident that in instances, for example, when mapwork and plans are necessary for teaching scale in conversions and measurement, these cannot be duplicated for each learner due to resource constraints. The chalk-and-talk strategy cannot be used, so the teacher used

a teacher-led demonstration (Tularam, 2018). However, during the interviews, the participants did indicate that they are aware of the importance of each learner having a copy of a map or plan to meet and achieve educational aims, purposes, and values (Shulman, 1987), and they did try to duplicate by reducing the size of these maps. This showed evidence that the participants used their general pedagogical knowledge to make resources for learning available to the learners. However, based on the discussions with the participants during the interviews, this approach did not work. Rather, this led to confusion amongst the learners when they tried to calculate distances using the given scales. Learners could not calculate distances accurately using the given scales due to the reduced size of the maps.

6.2.2.3. The use of mnemonics, code-switching, repetition, and peer support

The participants used mnemonics, code-switching, and repetition to teach conversions and measurement. The participants asked learners to repeat the units of measurement to familiarise them with the vocabulary and conversion factors. Participants mentioned that they usually write down the units of measurement on the chalkboard when they teach conversions so that the learners can see how the conversions are calculated, from bigger units to smaller units or vice versa. The conversion formulas involved multiplying or dividing by a certain number, depending on the conversion unit being calculated. Repeating and visualising these conversions assisted learners in remembering (Johnson et al., 2020) the formulas related to conversions. Thus, by using mnemonics and repetition during their lessons, the participants showed evidence of using pedagogical content knowledge, content knowledge, and knowledge of their learners (Shulman, 1987) to support the teaching and learning of conversions and measurement.

When the participants were teaching learners with different English language abilities, they used code-switching. For example, Mr. Yard used code-switching in his class to support learners who spoke English as a second language. In this study, Mr. Yard relied on the assistance of learners who were proficient in both English and isiZulu to translate aspects of the teacher's instructions or activities into isiZulu for other learners who needed assistance following instructions in English. Even though he did not speak isiZulu, he wanted to ensure that learners understood what was expected of them so that they could complete their tasks effectively. Along similar lines, Morapeli (2017) proposed that learners who do not have suitable knowledge of mathematical language will

experience difficulties in understanding concepts in Mathematical Literacy. Thus, teachers must try their best to ensure that their learners understand mathematical language to understand Mathematical Literacy concepts successfully. Nevertheless, Hlatshwayo (2013) emphasised that teachers face challenges in diverse classrooms because they are not adequately equipped or trained to respond to these challenges. Thus, teachers must be trained to respond to challenges in their classrooms effectively.

Apart from using mnemonics, code-switching, and repetition, the participants also encouraged peer support in their classrooms. For example, based on Mrs. Ounce's lesson observation, when learners could not recall the previous content, she asked learners who had a better grasp of the previous content to assist learners struggling to recap information. Along similar lines, Stacey (2015), stated that through effective observation and classroom management, teachers ought to get an idea of how learners relate to their peers and which learners may have difficulty understanding content due to barriers to learning. In this way, appropriate peer support may be encouraged. Moreover, peer support is important in teaching and learning Mathematical Literacy (Mshengu, 2019) as it encourages peer interaction and promotes confidence. Using code-switching and peer support, it was evident that the participants used their knowledge of the learners and educational context (Shulman, 1987) to support teaching and learning in the classrooms under focus.

6.2.3. Reasons teachers teach measurement and conversions in Mathematical Literacy in the way that they do

During the individual and focus group interviews, the participants explained their reasons for using teacher-centred and chalk-and-talk teaching strategies. The main reasons revealed in this study are discussed in the following subsections.

6.2.3.1. Teaching to accommodate for limited resources

The participating teachers were vocal about their challenges when teaching Mathematical Literacy. The predominant challenge echoed during the interviews was the lack of material resources. Due to this challenge, the participants indicated that they used the chalkboard, the teacher support document, and the study guide as their main resources when teaching conversions and measurement. Learners did not have access to textbooks, so if homework activities were to be

given, they had to copy down these activities from the chalkboard. Similarly, another research. Although soft copies of resources (worksheets and tasks) are readily available on the Department of Basic Education website, teachers could not always provide worksheets to learners due to the lack of duplication paper at the participating schools. As a result, the participating teachers used traditional teacher-led (Tularam, 2018) and chalk-and-talk teaching (Sharma & Kumar, 2018) strategies.

In addition, the participating teachers also indicated that there was a lack of human resources at their schools. This resulted in the participants not having free periods for lesson planning and developing other resources, such as models and posters, that could support teaching and learning in their classrooms. All non-teaching periods (NTPs) were spent on relief teachers for colleagues who were absent or in meetings. Also, due to not having enough teachers at the participating schools, the class sizes that the participating teachers taught were large. Thus, these schools were not aligned with the learner-educator ratio (LER) and the norms of the current Post Provisioning Norms (PPN) as set out by the Department of Basic Education (Buthelezi & Makhoba, 2020).

Moreover, during the interviews, the participants indicated that having more resources or doing more practical activities would improve understanding since learners could visualise what was being converted or measured. Along similar lines, Adebayo, et al. (2020) claimed that the learner performance between learners from schools equipped with more resources is better than those from public inadequately resourced schools. Thus, the Department of Basic Education should consider providing basic resources to all public schools in the country. These basic resources include but are not limited to textbooks and chalkboard measuring instruments, such as the meter ruler, the chalkboard compass, and the chalkboard divider. This would support teachers and learners at inadequately resourced schools.

6.2.3.2. Teaching to accommodate for time constraints and complete the syllabus

Based on an analysis of the interviews, another reason the participants taught in the way that they did was due to time constraints. All participants used the ATPs to guide them as they taught their lessons. Due to the content-heavy ATP and the limited time allocated for each topic, teachers shared that they had to rush through the lessons based on conversions and measurement to avoid falling

behind with the syllabus. Thus, the participants were concerned about completing the syllabus and used the traditional teacher-led and chalk-and-talk teaching strategies to save time instead of using effective learner-centred teaching strategies such as practical work, collaboration, and group work (Killen & O' Toole, 2023). In some instances, more than one lesson was taught simultaneously, as indicated by Mr. Pounds.

In addition, the participants indicated that they are aware that conversions and measurement were included within other topics in Mathematical Literacy. However, this was more for application purposes; therefore, it was important to ensure that all learners understood the content covered in each lesson before moving forward. As a result, teachers were placed under pressure and strain to ensure that the syllabus was completed and learners grasped the concepts adequately and reverted to using the traditional teacher-led and chalk-and-talk teaching strategies (Sharma & Kumar, 2018; Tularam, 2018).

6.2.3.3. Teaching to accommodate for diversity and improve learner performance

The participants involved in the study expressed their concern that learners were being expected to grasp complex concepts of Mathematical Literacy in grade 10 without any prior exposure to the content. As such, these learners lack the knowledge of the basics of Mathematical Literacy pre-grade 10. Thus, the participants used repetition, recap (Johnson, et al., 2020), and several examples on the board to support their teaching in the classroom. Also, to add to this problem, little foundational work is done in Mathematical Literacy with the learners in primary school. For example, learners are taught formulas in conversions or measures in earlier grades but not necessarily how to apply these formulae when solving real-world problems since this was not part of the ATP (Department of Basic Education, 2023c). Accordingly, during the interviews, the participants mentioned that more work needs to be done in the lower grades to prepare learners for Mathematics and Mathematical Literacy when they reach secondary school.

Participants indicated that they face numerous challenges in teaching Mathematical Literacy; for example, some learners are not committed to learning, display a bad attitude, or repeat the grade. In addition, learners do not grasp key concepts or have a strong foundation of the mathematics language and concepts on which to build. Some of the participants were discontented about the

high number of learners they teach. It is concerning that the Department of Basic Education stipulates a learner-educator ratio (LER) in public schools (Buthelezi & Makhoba, 2020); however, it does not make provisions for schools to implement the LER. This results in challenges for teachers in ensuring that all learners grasp key concepts and have an adequate understanding, impacting learner performance. Due to high LER in schools, there is limited space in overcrowded classrooms. Thus, the participants, for example, Mrs. Miles, avoided allowing learners to work in groups. Rather, traditional and chalk-and-talk teaching strategies were used to teach (Sharma & Kumar, 2018; Tularam, 2018).

6.2.3.4. Teaching to accommodate for inadequate teacher training

The participants indicated during the interviews that they were not initially trained as Mathematical Literacy teachers. Most of the participants were trained as mathematics teachers. Thus, the participants used what they knew about mathematics teaching in their Mathematical Literacy classrooms. Mr. Gallon indicated that he taught in the way he was taught in school. Considering that Mr. Gallon has been teaching for 25 years, it has been a long time since he was in school, and learners and schooling have significantly changed. Thus, there is a need to use different strategies for contemporary learners to cater for diverse learning styles. Accordingly, Mathematical Literacy teachers must receive training and professional development to improve the teaching and learning of Mathematical Literacy. Ball, et al. (2008) supports this view, maintaining that encouraging teacher education and professional development will assist and support teachers in improving learning outcomes and learner performance.

Suppose teachers are not adequately trained in teaching and understanding the nature of Mathematical Literacy. In that case, they may not necessarily have a good idea of their learners' prior knowledge of Mathematical Literacy. Furthermore, even if teachers are adequately trained and follow the ATP, the ATP does not refer to how teachers should assess their learners' prior knowledge (Department of Basic Education, 2023a; 2023b;2023c). In addition, the ATP does not indicate how teachers should teach in a way that guides learners who would be more suited to choosing Mathematical Literacy as their subject preference instead of Mathematics.

The use of learner-centred practical exercises (Killen & O'Toole, 2023) and specific resources, physical objects, and concrete manipulatives (Brijlall & Niranjana, 2015; Deogratias, 2022) will assist in reinforcing the fundamental definitions a learner requires to understand conversions and measurement. Group work will also help learners share ideas and improve their understanding. This will assist in keeping learners actively involved in lessons (Killen & O'Toole, 2023). Thus, Mathematical Literacy teachers require training to assist them in deciding what type of teaching strategy would best suit their students within their educational context.

6.3. Limitations

This study had limitations. Firstly, this study focused on five participants teaching in two secondary schools. Thus, since the sample size was small, the results of this study are not generalisable. Moreover, after scheduling lesson observations with the five participants, two participants cancelled the lesson observations at the last minute due to personal or work commitments. Further attempts to reschedule the cancelled lesson observations were not successful. Thus, for this study, only three participants were observed teaching.

6.4. Recommendations

The findings of this study suggest the following recommendations for policymakers, the Department of Basic Education and Teacher Training Institutions.

- Policymakers are to review the Annual Teaching Plan by reconsidering the grade 9 Mathematics syllabus to prepare learners for Mathematics and learners who choose to do Mathematical Literacy.
- Mathematical Literacy applications related to solving real-world problems that involve conversions and measurement need to be introduced to learners in earlier grades (for example, Grade 9) so that they are familiar with the application and problem-solving techniques linked to real-world examples before they reach Grade 10.
- The Department of Basic Education should provide adequate resources and support material (written, practical and technological) to Mathematical Literacy teachers and learners to facilitate improved teaching and learning.
- The Department of Basic Education is requested to facilitate workshops throughout the year, allowing Mathematical Literacy teachers to share challenges and successes with other

teachers more frequently. Currently, workshops are only held at the beginning of the school year, which limits teachers from sharing and discussing strategies, methods, and resources.

- Teacher training institutions should include content in undergraduate modules that highlight innovative, practical teaching strategies that may be used to support the teaching and learning of Mathematical Literacy. Currently, limited teacher training institutions offer Mathematical Literacy at the undergraduate level. Most teacher training institutions in South Africa offer Mathematical Literacy at the postgraduate level (for example, Postgraduate Certificate in Education: PGCE).

6.5. Conclusion to the study

This research study focused on teachers' espousal of teaching conversions and measurement in Grades 10 and 11 Mathematical Literacy. The findings of this study reveal that teachers selected and used teaching strategies to teach conversions and measurement in Grade 10 and 11 Mathematical Literacy in the way they did due to the challenges they faced in their classrooms. These challenges include the lack of resources, limited teaching time, the need to complete syllabus, diverse learners, large class sizes, poor learner performance, and inadequate teacher training. The study provides practical recommendations for relevant stakeholders to consider. These stakeholders include but are not limited to Mathematical Literacy teachers, the Department of Basic Education, policymakers, and teacher training institutions. These recommendations may assist in alleviating the challenges faced by Mathematical Literacy teachers, as discussed in this chapter.

Regarding what strategies teachers use when teaching conversions and measurement, it was concluded that the strategies that teachers used were more or less the same, viz. by delivering teacher-centred lessons and by using the "chalk and talk" strategy. These strategies were chosen due to convenience and availability of limited resources. How teachers teach conversions and measurement was addressed by analysing lesson plans, resources and lesson observations. It was concluded that teachers introduce the lessons based on conversions and measurement by explaining relevant vocabulary and then illustrating examples of conversions on the chalkboard.

Why teachers teach conversions and measurement in the way that they do was justified by the responses from semi-structured and focus group interviews, where all participants agreed that they faced challenges in terms of resource support materials and were faced with time constraints.

In conclusion, this study suggests that it is important to consider further research possibilities, including conducting similar studies in other provinces in South Africa. In addition, a mixed-method study may also be conducted with a larger sample size of Mathematical Literacy teachers. Moreover, a comparative study may compare learner performance in Mathematical Literacy between adequately resourced and inadequately resourced schools. These further research possibilities will add knowledge to the field to improve the teaching and learning of Mathematical Literacy nationally.

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Appendices

Appendix 1: Ethical clearance certificate



24 November 2021

Krishnavani Govender (200304636)
School Of Education
Edgewood Campus

Dear K Govender,

Protocol reference number: HSSREC/00003623/2021

Project title: Teachers' espousal of teaching conversions and measurement in Grades 10 and 11 Mathematical Literacy

Degree: Masters

Approval Notification – Expedited Application

This letter serves to notify you that your application received on 10 November 2021 in connection with the above, was reviewed by the Humanities and Social Sciences Research Ethics Committee (HSSREC) and the protocol has been granted **FULL APPROVAL**.

Any alteration/s to the approved research protocol i.e. Questionnaire/Interview Schedule, Informed Consent Form, Title of the Project, Location of the Study, Research Approach and Methods must be reviewed and approved through the amendment/modification prior to its implementation. In case you have further queries, please quote the above reference number. PLEASE NOTE: Research data should be securely stored in the discipline/department for a period of 5 years.

This approval is valid until 24 November 2022.

To ensure uninterrupted approval of this study beyond the approval expiry date, a progress report must be submitted to the Research Office on the appropriate form 2 - 3 months before the expiry date. A close-out report to be submitted when study is finished.

All research conducted during the COVID-19 period must adhere to the national and UKZN guidelines.

HSSREC is registered with the South African National Research Ethics Council (REC-040414-040).

Yours sincerely,



Professor Dipane Hlalele (Chair)

/dd

Humanities and Social Sciences Research Ethics Committee

Postal Address: Private Bag X54001, Durban, 4000, South Africa

Telephone: +27 (0)31 260 8350/4557/3587 Email: hssrec@ukzn.ac.za Website: <http://research.ukzn.ac.za/Research-Ethics>

Founding Campuses: Edgewood Howard College Medical School Pietermaritzburg Westville

INSPIRING GREATNESS

Appendix 2: Letter to the Gatekeeper



Letter to the Gatekeeper

2nd July 2021

To the principal...

My name is Mrs K Govender. I am currently enrolled as a Masters student studying at the University of KwaZulu-Natal. As part of my completion for my degree, I am expected to conduct a research study. My study is entitled :
Exploring the learning of measurement and conversions in grade 11 Mathematical Literacy: A study of one school in KwaZulu-Natal, South Africa.

This letter serves as a request to ask for your permission to conduct research at Ganges Secondary School. I have chosen your school due to the fact that I am an educator at the school who wishes to improve the quality of my teaching. Kindly attach your signature to allow permission for research to be carried out.

Please note that the information gathered will be treated with utmost confidentiality. The name of the school as well as the identities of the research participants will be protected. Data collection process is planned for June 2021.

Kindly contact me if you have any queries. Alternatively, you may wish to contact my supervisor, Prof Jayaluxmi Naidoo on [REDACTED] if you would like a reference or other information.

Thank You

Yours sincerely,

K Govender

[REDACTED]

Signature of Principal

[REDACTED]

Date

Appendix 3: Informed consent letter

School of Education, College of Humanities, University of KwaZulu-Natal,
Edgewood Campus

Dear Participant

INFORMED CONSENT LETTER

My name is Mrs K Govender I am a master's candidate studying at the University of KwaZulu-Natal, Edgewood campus, South Africa. My study is focused on *Teachers' espousal of teaching conversions and measurement in Grade 10 and 11 Mathematical Literacy*. I am interested in gathering data for research purposes. To gather the information, I am interested in asking you some questions.

Please note that:

- Your confidentiality is guaranteed as your inputs will not be attributed to you in person but reported only as a population member's opinion.
- The interview may last for about 30 minutes to 45 minutes.
- Any information given by you cannot be used against you, and the collected data will be used for purposes of this research only.
- Data will be stored in secure storage and destroyed after 5 years.
- You have a choice to participate, not participate or stop participating in the research. You will not be penalized for taking such an action.
- Your involvement is purely for academic purposes only, and there are no financial benefits involved.
- If you are willing to be interviewed, please indicate (by ticking as applicable) whether or not you are willing to allow the interview to be recorded by the following equipment:

Equipment	Willing	Not willing
Audio equipment		
Photographic equipment		
Video equipment		

I can be contacted at: Ganges Secondary School

Email: g[REDACTED]/200304636@stu.ukzn.ac.za

[REDACTED]

My supervisor is Prof J Naidoo who is located at the School of Education, Edgewood campus, University of KwaZulu-Natal (UKZN).

Contact details: Room CU 118, Main Tutorial Building, Edgewood Campus, UKZN.

email: naidooj2@ukzn.ac.za; Phone number: [REDACTED]

You may also contact the Research Office through:

Ms. Mariette Snyman (HSSREC Research Office)

Tel: 031 260 8350; [REDACTED]manm@ukzn.ac.za

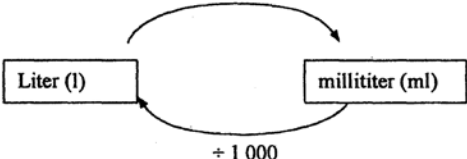

Appendix 4a: Semi-Structured Interview Schedule

1. How do your learners generally perform in measurement and conversion for ML?
2. Which ML grades have you been teaching in the past 3 years?
3. Do you use teaching resources when teaching ML? If so, what teaching resources do you use?
4. Why do you tend to use these teaching resources when teaching measurement and conversion in Mathematical literacy?
5. In general, what teaching strategies do you use when teaching measurement and conversion in ML?
6. Why do you tend to use these teaching strategies when teaching measurement and conversion in ML?
7. Are there any investigations or assignments based on conversions and measurement that you give to your learners that produced either very good or poor results?
8. If so, can you elaborate further on this?
9. Do you have any other comments or inputs about the teaching and learning of measurement and conversion in Mathematical literacy?

Appendix 4b: Focus Group Interview Schedule

1. How do your learners generally perform in measurement and conversion for ML?
2. Which ML grades have you been teaching in the past 3 years?
3. Do you use teaching resources when teaching ML? If so, what teaching resources do you use?
4. Why do you tend to use these teaching resources when teaching measurement and conversion in ML?
5. In general, what teaching strategies do you use when teaching measurement and conversion in ML?
6. Why do you tend to use these teaching strategies when teaching measurement and conversion in ML?
7. Are there any investigations or assignments based on conversions and measurement that you give to your learners that produced either very good or poor results?
8. If so, can you elaborate further on this?
9. Comment on whether the time allocation and resources provided by the DBE for teaching conversions and measurement is sufficient or not.
10. Was there enough support provided in terms of peer involvement and facilitation of discussion when teaching conversions and measurement?
11. Are there any areas in which the management, DBE and peers could further assist in teaching conversions and measurement to Mathematical literacy learners and if so, how?
12. Do you have any other comments or inputs about the teaching and learning of measurement?

Appendix 5a: Lesson Plan Grade 10

Term	2	Week	4
Duration	Hours	Date	
TOPIC	MEASUREMENT		
SECTION	MEASURING VOLUME/CAPACITY		
LESSON OBJECTIVES	<ul style="list-style-type: none"> • Determine volume using appropriate measuring instruments, eg spoons, cups, T/spoons, t/spoons, jugs • Measure out quantities to complete a task, e.g. quantities of drinks needed for a function, monitor quantities, and e.g. measure rainfall over time. • Calculate the cost of a certain volume of a product, e.g. the cost of 2,5l of milk at R7.99/l 		
KEY CONCEPTS/ TERMINOLOGY/ VOCABULARY	Volume measures the amount of space taken up by an object. Capacity describes how much an object/ container can hold eg the amount of liquid that a container can hold		
PRIOR-KNOWLEDGE/ BACKGROUND KNOWLEDGE	<ul style="list-style-type: none"> • Units for volume • Conversion <p>Converting units of volume</p> <div style="text-align: center; margin: 10px 0;"> $\times 1\,000$  $\div 1\,000$ </div> <p>Volume is usually measured using measuring jugs, cups and spoons, but also bottles, buckets and even wheelbarrows. The units of mass are litre (ℓ) and millilitre (mℓ). The volume of a bucket could be 10ℓ, while the volume of a cup is about 250 mℓ. You need to be able to read values from a measuring jug. The values on this measuring jug are</p> <div style="text-align: center; margin: 10px 0;">  </div> <p>A: 350 mℓ (It is half way between 300 and 400) B: 300 mℓ (It is a quarter of the way between 250 and 350)</p>		

METHODOLOGY	
Teacher should ensure that	
<ul style="list-style-type: none"> Learners must clearly understand the difference between capacity and volume Learners must be able to correctly express the units for Volume <p>1 cup = 250ml, 1 T/spoon = 15ml, 1 t/spoon = 5ml</p>	
EXAMPLES	
<p>1 Consider a measuring jug that has a capacity of 1,5liters of water.</p> <p>1.1 How many teaspoons of water are there in this jug?</p> <p>1.2 How many cups of water are in the jug?</p> <p>1.3 If you want to mix some juice in the jug and the instructions say that you must dilute the juice as follows: four parts water and one part juice, how much juice and how much water would be in the jug, if the jug is full.</p> <p>SOLUTIONS</p> <p>1.1 $1,5L \times 1000 = 1\ 500ML$ $1\ t/spoon = 5ml$ So $1\ 500/5 = 300$ teaspoons.</p> <p>1.2 $1\ cup = 250\ ml,$ So $1\ 500/250 = 6$ cups</p> <p>1.3 Four parts water to one cup juice means there are five parts altogether. So, $1\ 500/5 = 300$ We will use 300ml of orange juice (one part), and $4 \times 300\ ml$ of water (1200 ml of water) which is four parts.</p>	
LEARNER ACTIVITIES/ ASSESSMENT	
Worksheet on conversions and measuring	
Classwork, Homework and Informal tests KZN Step Ahead Learner Document	
RESOURCES:	
<ul style="list-style-type: none"> Baking measures (spoons/cups) Baking recipes Conversion tables 	
KZN STEP AHEAD Learner Document Platinum Mathematical Literacy Grade 10 Calculator Grade 10 ATP CAPS document Answer Series 10	
ERRORS/MISCONCEPTIONS/ PROBLEM AREAS	Learners are unable to: <ul style="list-style-type: none"> .

Appendix 5b: Lesson Plan Grade 11

SECTION: MEASURING AND ESTIMATING VOLUME: MEASURING TEMPERATURE			
Term 1	2	Week	6-7
DATE:			
Duration	1 HOUR	Weighting	20% (±5)
LESSON OBJECTIVES	learners must be able to : <ul style="list-style-type: none"> - To determine volume using appropriate measuring instrument including: - measuring spoons and cups - jugs bottles and / or canisters - buckets and wheel burrows Measuring volume (be able to convert volume into capacity) <ul style="list-style-type: none"> - Convert from degrees Celsius to degrees Fahrenheit using given formula. -interpret temperature values to plan trips.		
KEY CONCEPTS/ TERMINOLOGY/VOCABULARY	<ul style="list-style-type: none"> • Volume • Capacity • degrees Celsius : • degrees Fahrenheit 		
EAC STRATEGY	Reading , Writing, Listening, Speaking and Comprehension		
PRIOR-KNOWLEDGE/ BACKGROUND KNOWLEDGE	Convert between metric systems, <ul style="list-style-type: none"> • Conversion using a given conversion required cooking. • radius • diameter Probability		
INTRODUCTION	<ul style="list-style-type: none"> • Volume: the amount of space that can be occupied by an object. can be measured in ³ e.g. m³ cm³ • Capacity: the amount that something can hold. e.g. milliliters, liters 		

Appendix 6: Letter from Language Editor

Angela Bryan & Associates

[REDACTED]
Westville
3639

Date: 3 April 2024

To whom it may concern

This is to certify that the Master's Dissertation:

Teachers' espousal of teaching conversions and measurement in Grades 10 and 11
Mathematical literacy – 2023

Written By Krishnavani Govender (200304636)

A dissertation submitted in fulfilment of the academic requirements for the degree of
Master of Mathematics Education, School of Education, University of KwaZulu-Natal

has been edited by me for language.

Please contact me should you require any further information.

Kind Regards

Angela Bryan

E [REDACTED] | [REDACTED]

Appendix 7: Turnitin Certificate

Teachers' espousal of teaching conversions and measurement in Grades 10 and 11 Mathematical literacy

ORIGINALITY REPORT			
8%	7%	3%	1%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS
PRIMARY SOURCES			
1	hdl.handle.net Internet Source		1%
2	core.ac.uk Internet Source		<1%
3	researchspace.ukzn.ac.za Internet Source		<1%
4	www.saarmste.org Internet Source		<1%
5	uir.unisa.ac.za Internet Source		<1%
6	repository.up.ac.za Internet Source		<1%
7	docshare.tips Internet Source		<1%
8	eprints.staffs.ac.uk Internet Source		<1%
9	www.amesa.org.za Internet Source		<1%