

# Learners' perceptions of Mathematical Literacy

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## **ABSTRACT**

South African education system has undergone phases of curriculum reforms in recent years with the aim of improving its quality and increasing access to education to all South Africans. In the heart of these reforms came the birth of Mathematical Literacy, a subject that was adopted in our Further Education and Training (FET) band as an alternative compulsory subject to pure Mathematics. A great concern is how this subject is perceived by different stakeholders, most importantly by the learners. The literature review of this study focused on factors that affect Mathematical Literacy in the South African context and explored various research findings done by previous research on the subject of Mathematical Literacy. It also looked at what contributes to learners' perception of this subject. Various sources were used to emphasise the facts in order to complete this study.

The main objective of this study was to determine what perception there is of learners towards Mathematical Literacy. An empirical research was done by means of quantitative research in order to answer this research question. The researcher looked at various factors that have an effect on perception formulation of Grade 11 learners of Mathematical Literacy in Gauteng province, specifically in Midvaal and Ekurhuleni municipalities.

The study showed that learners have a positive perception towards Mathematical Literacy as a subject and their teachers and parents were very influential when they chose Mathematical Literacy over pure Mathematics. The study also showed that learners have a positive perception about their Mathematical Literacy teachers and believed that their teachers are committed to teaching the subject. It was also found that learners understand that Mathematical Literacy has an effect on their future studies and overall, Mathematical Literacy does affect the quality of our education system in the sense that since its inception there has been a great exodus of learners from pure Mathematics to Mathematical Literacy and that deprives the country of more engineers and scientists. To address this shortcoming in our education system, the Department of Basic Education should invest more on career guidance to help learners understand the impact of subject selection in high school on their future career endeavours.

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## **KEYWORDS**

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Teachers

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Department of education

# DECLARATION



NORTH-WEST UNIVERSITY  
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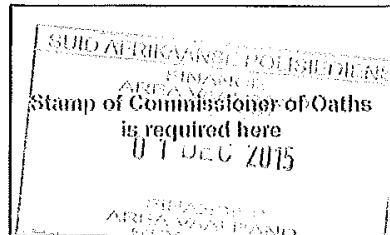
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## **CHAPTER 1: INTRODUCTION AND OVERVIEW**

### **1.1 INTRODUCTION**

In 2006, Department of Education (DoE) introduced Mathematical Literacy as an alternative subject for learners who do not want to pursue pure Mathematics in Grade 10 to 12 (Spangenberg, 2012:1). This new subject had a substantial influence on the decision that Grade 10 learners must make on the chosen subjects for the rest of the senior phase. Most learners had the perception that Mathematic Literacy is an easy subject although Morkel (2014) indicates that this is not the case. Solomon (2008:22) believes that perception and beliefs about mathematics normally affect learners' achievement in numeracy and often amplified in classroom discourse. If the perception of Mathematical Literacy affects learners' performance in the subject, it is therefore important to understand the genesis of this problem and how their performance in this subject affects the overall quality of education system.

### **1.2 BACKGROUND**

Post 1994, the South African education system has undergone three phases of curriculum reforms in order to accelerate transformation within the education system (Jansen, 1998:321). These reforms include first the Outcome-Based Education (OBE), followed by the Curriculum 2005 (C2005) and later the National Senior Certificate (NSC). Van der Berg (2007:871) believes that OBE was introduced with the aim of achieving an equitable access to quality of education for all South Africans and was also concerned at modelling change at classroom level.

This curriculum was then replaced by the C2005 which was described as a new form of OBE aimed at empowering teachers to achieve the intent of OBE and also focusing on continuous assessment in schools, but it was not directive and was complex to implement in schools (Van der Berg, 2007:871). Due to the complexity of C2005, the curriculum was reviewed and that gave birth to a Senior Certificate Examination (SCE). The SCE was later replaced by NSC derived from the National Curriculum Statement (NCS) in 2008 (Nel & Kistner, 2009:954). According to NCS, one of the general principles that drive Grades 10 -12 is the ability of the learner to be able to identify and solve problems and make decisions using critical and creative thinking (DoE, 2005). This led to the introduction of Mathematical Literacy as a school subject in 2006 (Botha *et al.*, 2013:180).

Nel and Kistner (2009:954) state that the new NSC required Mathematical Literacy or pure Mathematics to be adopted as one of the required subjects for learners in the Further Education and Training (FET) band. According to Julie (2012) the interest of learners in this subject might

be enhanced if they experience the use of Mathematics in real-life situation. Therefore, learners' thinking style or perception about this subject can influence their subject selection, and the perception that pure Mathematics is difficult might be the reason why more learners choose Mathematical Literacy as an alternative subject than taking pure Mathematics (Spangenberg, 2012:1).

### **1.3 LITERATURE REVIEW**

The Department of Basic Education (DBE) introduced Mathematical Literacy as a compulsory alternative subject in 2006 for all learners in the FET band as an alternate subject for those learners who do not wish to take pure Mathematics as a subject (Mbekwa, 2006). Bowie and Frith (2006:29) believe that the introduction of Mathematical Literacy as a school subject in schools presented both opportunities and challenges for the DBE.

Educational commentators have different definitions of the subjects. Clark (2012) defines Mathematical Literacy as a subject that uses Mathematical concepts and applies them into everyday situation and should not be viewed as an alternative to Standard Grade Mathematics. Whereas another commentator define the subject as a specific form of academic knowledge which integrates theory, skills and values (Spangenberg, 2012:1), but some learners and parents perceive this subject as an inferior type of Mathematics designed for people who cannot do Mathematics (Venkatakrishnan & Graven, 2006:26).

Botha *et al.* (2013:181) and Houston *et al.* (2014:26) further define the subject as the competence of individuals demonstrated in word problems to a critical or democratic competence. Mthethwa (2007:3) added by associating it with real-world contexts with high level of Mathematics knowledge. His definition is supported by NCS published in 2005 by DBE, which defined Mathematical Literacy as a subject characterised by numbers, numerically based arguments and data representation that intent to equip learners with competencies to be able to reason, make decisions and contribute effectively in the twenty-first century world (DBE, 2011).

Although the DBE believes that Mathematical Literacy has the potential of providing learners beyond Grade 9 with practical Mathematics skills that will help them to participate effectively in modern world (Bowie & Frith, 2006:29), Graven and Venkatakrishnan (2006:7) suggest that many of this learners did not willingly take this subject in order to equip themselves, but they were forced by their teachers to take it because of their poor Mathematics results in Grade 9. Graven and Venkatakrishnan (2006:7), further state that there is a perception amongst learners that Mathematical Literacy is for those who cannot do Mathematics and that has created a problem in the education system and as a result many Mathematical Literacy classes in both

private and state schools across Gauteng have few or no students with strong levels of confidence in Mathematics Literacy. To make matters worse, other students and parents perceive Mathematical Literacy classes as meant for mathematically challenged learners (Graven & Venkatakrishnan, 2006:7).

Pasensie (2012) indicates that more attention is given to learners who passed Mathematics in Grade 12 and little is being said about those who passed Mathematical Literacy. Mji and Makgato (2006:257) believe that this has created a problem in the education system because learners are not motivated to study Mathematical Literacy due to the high failure rate and are therefore scared off. On the other hand, this subject has also not been well received by some higher education institutions; one example is the decision of the University of Western Cape in 2010 not to accept students with Mathematical Literacy into their science programme (Makoni, 2010).

According to Pasensie (2012) the government praises its achievements of getting more learners through their 12 year schooling with a certificate that may help them be admitted into a tertiary institution, while education experts and other stakeholders are lamenting the poor quality of those learners who have passed matric with Mathematical Literacy as one of their subjects while admission into universities for science studies cannot be guaranteed. Pasensie (2012) further believes that getting learners through 12 years of schooling should not be used as an indicator of good quality of education but the ratio of learners passing well enough to pursue a university degree or diploma should give an indication about the health of our education system. On the other hand Smith and Ngoma-Maema (2003:352) indicate that researchers and educators have come to a realisation that education quality in South Africa is more extensive and understated, as a result policy makers are looking at developing a more comprehensive system of defining and evaluating school quality, and therefore the NCS would be addressing this problem.

#### **1.4 PROBLEM STATEMENT**

The Curriculum and Assessment Policy Statement (CAPS), derived from NCS documents, defines Mathematical Literacy as a subject that should equip learners with skills to enable them to contribute and participate effectively in a developing democracy (DBE, 2011). But Julie (2006:) believes that Mathematical Literacy in the FET phase has been a subject of many discussions and debates whereby some view it as an entry level into Mathematics. On the other hand Madongo (2007:9) believes that Mathematical Literacy is understood differently by various scholars within the Mathematics education fraternity.

NCS defines Mathematical Literacy as a subject driven by life-related applications of Mathematics (Venkatakrishnan & Graven, 2006:14); whereas Botha *et al.* (2013:181) state that Mathematical Literacy should be defined in context of individual competence demonstrated in word problems instead of mathematical formulas. According to Bowie and Frith (2006:29) it is important for the educational fraternity in South Africa to develop a clear shared understanding of what Mathematical Literacy is. According to Venkatakrishnan and Graven (2006:7) the challenge facing teachers is a high influx of learners moving into Mathematical Literacy classes after failing their mid-year examination in Mathematics because of the perception that Mathematical Literacy is basically watered down Mathematics.

This has created a selective attention on the part of learners because of the perception that Mathematical Literacy is easier than pure Mathematics (McShane & Von Glinow, 2010:68) and selective attention often leads to perception because people form beliefs systems on what they think should be the norm or a new paradigm. Julie (2006) believes that Mathematical Literacy is full of myths, omissions and unwarranted ambitions and the context of what should be taught within the subject may be difficult. Despite Mathematical Literacy being defined as a link to application of Mathematics, Singh *et al.* (2002:323) indicate that factors such as learners' ability, attitudes and perceptions influences how learners perform in this subject.

According to Pickens (2005:54), perception is a process in which a meaningful experience of the world is produced by organising and interpreting a sensation that is formed as a result of learning, modelling others or from our direct experience with people and situations. Therefore learners who do not do well in grade 9 Mathematics often choose Mathematical Literacy in grade 10 (Spangenberg, 2012:1) because of past experience with Mathematics and this has then led to a perception that Mathematical Literacy is easier than pure Mathematics (North, 2013:149). However Morkel (2014) believes that this is not the case and the evidence seen by the Grade 12 Mathematical Literacy results of 2014 which were worse than any previous years.

According to Campbell and Prew (2014) a 58% increase in the number of learners writing Mathematical Literacy between 2009 and 2013 and at the same time a 17% decline in learners who wrote Mathematics in grade 12 indicate the existence of a problem within our education system. This is as a result of the perception that Mathematical Literacy is easier than Mathematics (Sidiropoulos, 2008:89). Campbell and Prew (2014) further indicate that the declining number of learners who chose Mathematics means our pool of learners who are able to do a degree which requires Mathematics is very limited and this affects the quality and robustness of our education system.

The concern of an increasing number of learners taking easier subjects such as Mathematical Literacy is reiterated by Wilkinson (2014) and links this behaviour to the deteriorating quality of our education. Howie (2003:2) also indicates that a number of reports have been written and lamenting the poor quality of the education system in high school before the adoption of NSC in 2006 and most of these factors were reported based on classroom observations and discussions with teachers and other stakeholders.

There are many factors that affects learners' performance at school and among these factors learners' attitude and perceptions towards Mathematical Literacy were identified as the leading factors that contributes to learners not doing well in the subject (Singh *et al.*, 2002:323). According to Singh *et al.* (2002:323) previous researchers also believes that attitude towards Mathematical Literacy affect learners' perceptions, abilities and interest in the subject; therefore it is important to investigate what the perception of learners are towards Mathematical Literacy.

## **1.5 OBJECTIVES**

### **1.5.1 Main Objectives**

The primary objective of this study is to determine what the perception of learners is towards Mathematical Literacy.

### **1.5.2 Secondary Objectives**

In order to achieve the primary objective the following secondary objectives were formulated:

- What is the perception of Gr 11 learners on Mathematical Literacy as a subject?
- What influences learners to choose Mathematical Literacy over pure Mathematics?
- To what extent do learners understand the impact of choosing Mathematical Literacy on their future studies?
- Do the results of Mathematical Literacy predict the quality of the South African education system?
- How these learners perceive their Mathematical Literacy teachers.

## **1.6 RESEARCH METHODOLOGY**

### **1.6.1 Literature study**

In order to conduct the literature study, scholarly articles, relevant books, subject specific journals and websites, such as the business journal, SAGA dictionary and research

methodology sites were used. Articles and journals were obtained from different databases which include EbscoHost, SAEpublications, Emerald, Nexus, ProQuest and SACat. Electronic search engines, such as Google and Google Scholar ([www.google.com](http://www.google.com)) were used to familiarise the researcher with current informal trends regarding the concepts at hand.

## **1.6.2 Empirical research**

### *1.6.2.1 Research Design*

For the purpose of the study, a quantitative, exploratory and descriptive study was used with the primary aim to investigate the perception of Mathematical Literacy learners towards the subject. According to Singh (2007) a descriptive research is used to describe an event or happening and to provide a truthful and accurate description about the population. In a descriptive study the phenomenon being measured does not need any intervention from the researcher (Singh, 2007). Apart from choosing a research design, the method of data collection needs to be chosen to adhere to the purpose of the study. Therefore, this study's primary data was collected by using a quantitative research design. A quantitative research method is used where primary data is collected from large numbers of individuals with the intention that results are projected to a wider population (Tustin *et al.*, 2005).

### *1.6.2.2 Research Population*

For the purpose of this research, the population from which the sample was collected was the high schools in Gauteng province, specifically from Ekurhuleni and Midvaal municipalities. These areas were chosen because they are convenient and gave a more representation of learners from different races. A convenient sampling technique was used because the study was a survey based research. Convenience sampling refers to situations where population elements are selected, based on the fact that they are easily and conveniently available (Saunders *et al.*, 2009). The problem with these samples is that on such a small scale, results cannot be generalised and applied across the whole population. For the purpose of this study the information was not generalised or seen as representative for the whole of South Africa.

### *1.6.2.3 Data collection*

Participation in this study was voluntarily and data was collected via questionnaires. To guarantee the return of questionnaires, the researcher appointed field workers to help distributing and collecting the questionnaires at different schools. These fieldworkers were trained prior to the distribution of the questionnaires so that they could handle any possible problem that might arise. The anonymity and confidentiality of participants' remained first

priority, a secure box was given to the field workers and the submission of the completed questionnaires could be placed into the box. Each questionnaire took approximately 30 minutes to complete and adequate time (2 weeks) was given to the participants to complete the questionnaires.

#### *1.6.2.4 Research instruments*

##### *1.6.1.4.1 Self-administrated questionnaire*

A self-administrated questionnaire was used to collect data from the respondents. The questionnaire was made up of five sections as well as the biographic information section. The biographic section included information, such as participants' gender, home language and who influenced them to take Mathematic Literacy.

Section A collected data from the respondents regarding their perception of Mathematical Literacy. Section B collected data from the respondents relating the influence on them for choosing Mathematical Literacy as a subject.

Section C collected data from the respondents relating their understanding of Mathematic Literacy's impact on their future studies, while section D collected data from the respondents relating to the effects of Mathematical Literacy on the quality of education. Section E collected data on learners' perception of Mathematical Literacy teachers. .

##### *1.6.2.5 Data analysis and reporting*

After completion of the data collection process, data analysis was carried out using different tools. The North-West University's Statistical Services assisted in the data analysis and also the determination of the appropriate amount of questionnaires required for worthwhile analysis. The statistical service was consulted to conduct the data analysis and statistical processing to ensure the validity and reliability of the collected data.

Descriptive statistics might be necessary to explore and analyse the data and to make judgements about the participants' characteristics and help in generalising findings from the sample to the larger population. Pearson correlation and simple linear regression might also be necessary to measure the strength of the relationship between the constructs and to determine which independent variables predict dependent variables (Berenson *et al.*, 2012:523). The Cronbach alpha coefficient was also necessary in order to determine the reliability of the constructs measured in the research.

### **1.6.3 Validity and reliability**

According to Morse *et al.* (2002:18) data should be systematically checked and verified to incrementally contribute in ensuring reliability and validity. Construct as well as content validity were measured. Saunders *et al.* (2009:276) indicates that the validity of data collection methods, such as survey data, is easier to assess by examining the questions by which the data was collected and help gain further indication of the validity of such data. Reliability was measured by using the Cronbach alpha coefficient as measuring instrument.

### **1.6.4 Ethical considerations**

According to Welman *et al.* (2011:181) ethical behaviour is very important in any research work, as this concerns issues such as honesty and respect for the rights of individual. These ethical considerations came into play in three stages of this research work; when the participants were recruited, during the intervention and/or the measurement procedure to which they were subjected and in the release of the results obtained.

- The ethical considerations that were taken into account to ensure that the research project was fair and ethical are as follows: The researcher was honest, respectful and fair in any way towards participants of this study.
- The research was preceded by a thorough review of literature to ensure as far as possible that this research had not already been done elsewhere.
- The research was not subjecting the participants to embarrassment, harm or any other material disadvantages.

The participants were informed of what the study consisted of. They were assured that their responses would be anonymous and would never be linked to them personally. They were also assured that their participation was entirely voluntary. If there were items they did not feel comfortable answering, they were free to leave them out. They were also informed that they were free to leave the research at any time they like.

## **1.7 OVERVIEW**

The mini dissertation was structured like follows:

### **Chapter 1: Nature and scope of the study**

This chapter gives an overview of the research to be done. It includes a short background, literature review followed by stating the problem to be researched. The primary and secondary

objectives of the study are also stated. It also includes the research design and provides detail regarding the empirical research, including of whom the research population/target consisted and how they were selected. The chapter also includes research tools that were developed and used and how the information was gathered and interpreted.

## **Chapter 2: Comprehensive Literature review**

This chapter deals with the writing of a literature review. The main purpose of this chapter is to set the study within wider context and also show how this study supplements the work done by previous research.

## **Chapter 3: Research Methodology**

This chapter contains the empirical study and discusses the relevant research methodology used for the study. The method the researcher used to collect data and how this data would be analysed and what statistical tools would be most suited to analyse the data are also included in this chapter. The researcher highlights the research approach to be used in this study.

## **Chapter 4: Analysis of Results and discussion**

The results of the questionnaires are analysed, interpreted and discussed in this chapter. Tables and graphs are also included and the main purpose of this is to present the analysed data in a systematic manner.

## **Chapter 5: Conclusion, limitations and recommendations**

This chapter shows insight in reaching my conclusions. It also shows the originality of thoughts that were used to make judgement on the results findings. It offers the conclusion to the whole research project and also presents the researcher with the opportunity to be creative and to support the research hypothesis. The chapter also gives recommendations to what future research should focus on.

This chapter offers conclusions, limitations and recommendations on the research findings derived from the questionnaires. It provides possible solutions that the Department of Education, school management teams and school governing bodies can take into consideration.

## **CHAPTER 2: MATHEMATICAL LITERACY IN THE SOUTH AFRICAN CONTEXT**

### **2.1 INTRODUCTION**

The National Senior Certificate (NSC) framework made it clear that Mathematical Literacy assessment should not be done on the bases of content without context but should reflect the interplay between content and context (DBE, 2005:7). However, the new curriculum view the competencies developed through Mathematical Literacy as essential skill for learners to make sense of their surroundings and be able to participate meaningfully in the modern world (Houston *et al.*, 2014:23). Botha *et al.* (2013:181) also argues that everyone should have sufficient Mathematical knowledge to make well-informed decisions in their everyday lives. However people have developed in some way a selective perception towards Mathematics related subjects, and they associated the word 'Mathematical' with Mathematics hence people confuse Mathematical Literacy or Mathematical knowledge as Mathematics (Botha *et al.*, 2013).

Pickens (2005:54) defines this selective perception as a process that occurs when people limit their processing of external stimuli by selectively interpreting what they see based on their beliefs, experience or attitude. If people believe Mathematics to be difficult, they then perceive anything that contains the word 'Mathematical' as difficult, including Mathematical Literacy as a subject. When defining "Selection-for action", Pickens (2005) suggested that 'filtering' should not be viewed as a consequence of lacking capacity or limitations to capacity but it is driven by goal directed action. The results obtained in Grade 9 should not be used to set apart learners who must not take Mathematics in Grade 10. Some learners still choose Mathematical Literacy as an alternative subject to Mathematics with the view of passing it even if they did well in their Grade 9 Mathematics. This is because of the perception that it as an inferior type of Mathematics.

According to Malle (2011:72) people infer traits from behaviour or ascribe blame to a person based on their surroundings. This process is better known as the attribution theory. This theory was developed by Heider in 1920 and later attribution researchers eliminated some of the concept developed by Heider but the entire theoretical proposition that man perceive behaviour as being caused, and that the causal locus can be either in the perceiver or in the environment is still the central of Heider's entire theoretical position of attribution theory (Malle, 2011:74). Therefore according to the attribution theory, learners might be choosing Mathematical Literacy with the aim of understanding the world around them or merely hoping to control the environment around them. Consequently these learners base their choice of doing

Mathematical Literacy on the beliefs that it is an easy subject and justify their decisions by cognitively constructing their reality (Pickens, 2005:56).

This literature study explores various research findings done by previous research on the subject of Mathematical Literacy as a school subject since its introduction in South Africa. However, it is very important to note that Mathematical Literacy was introduced in South Africa as a compulsory alternative subject to Mathematics for learners in Grades 10 to 12, the FET band, and therefore this literature review looks holistically at the sequence of processes.

## **2.2 THEORETICAL FRAMEWORK**

A theoretical framework within this context of the study provides a focused way in which this study can be understood. Many education commentators and researchers define Mathematical Literacy as a subject while others view it as a competency needed to participate effectively to our economy (Madongo, 2007). There are many factors that continue to influence learners' decision to choose Mathematical Literacy as a preferred subject to Mathematics in Further Education and Training (FET) band. Attitude and perception of learners are amongst other things that Pickens (2005) have identified as possible contributors in influencing learners' subject choice. Therefore the current study focuses on the learners' perceptions in reference to Mathematical Literacy and attempt to link their perception of Mathematical Literacy to how well they do in this subject. The conceptual framework for this study is presented in Figure 2.1. The literature is discussed in this chapter, in the following manner:

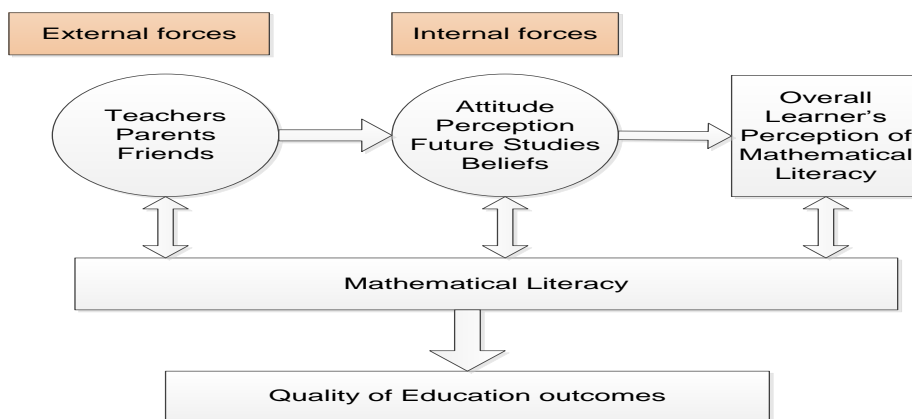
- Firstly it looks at the national perspective of Mathematical Literacy and seeks to analyse the context at which this subject can be applied nationally;
- Secondly, the literature review then highlights who the main role players are in this subject and their role in the subject, and the purpose that Mathematical Literacy plays in our education system;
- Thirdly, the chapter shares literature review on the perception of some role players and how these role players influence learners' choice of Mathematical Literacy.
- Fourthly, the literature review focuses on the findings of previous studies in the realm of Mathematical Literacy; here more attention is given to what previous studies were studying and what are their findings on the matter.
- Fifthly, the review attempts to link findings of previous research to the current study.

The literature review is followed by a comprehensive summary of what was discussed above and concludes by pointing the gaps that exist in literature and gives recommendations for future research on the subject to address those gaps.

The current study intends to answer the following questions:

- (i) What is the perception of learners in FET band on Mathematical Literacy as a subject and how these learners perceive Mathematical Literacy teachers?
- (ii) What influences learners to choose Mathematical Literacy over pure Mathematics?
- (iii) To what extent do learners understand the impact of choosing Mathematical Literacy on their future studies?
- (iv) Do the results of Mathematical Literacy predict the quality of South African education system? Therefore, this literature review is guided by these research questions.

**Figure 2. 1:** Conceptual framework



## 2.3 LITERATURE REVIEW

The following is an overview of the relevant literature on aspects of Mathematic Literacy. It will be done in an organised manner as explained in the theoretical framework.

### 2.3.1 National perspective on Mathematical Literacy

Although this study focuses on learners' perception of Mathematical Literacy a background literature to this study pertains to a national view relating to Mathematical Literacy as a school subject in the new education reform in South Africa. This position agrees with Gilmour (2013) who believes that every child must be guaranteed quality education that will assure them access to university and equip them with skills that will give them advantage to move through university and become more vibrant citizens of our young democracy. However Vithal and Bishop (2006:2) suggest that learners must also accept greater share of responsibility for what they learn and understand the implications Mathematical Literacy has on their career aspirations. They further indicate that, in the last decade, several different forces have led to

concerns with the quality of the Mathematical knowledge in South Africa and points out that the attitude of learners towards the subject can be a major concern that can affect the general schooling population.

Since Mathematical Literacy was adopted in South African schools, there has been an expanding body of literature on the subject. According to Jablonka (2003:75) some people in literature do not refer specifically to 'Mathematical Literacy but their work is still relevant because it addresses issues that involve the goals of Mathematical Literacy and their work also paints the image the public has created for Mathematical knowledge. Jablonka (2003:75) added that Mathematical Literacy should be viewed not in isolation but must connect to some social practices and learners should have the ability to derive some benefits from these practices; in his opinion, this is what should form the component of Mathematical Literacy teaching.

South African legislation, policy documents and daily political news are found on Polity\_ZA for easy access by general public and give a better understanding of our policies for an ordinary man. This website provides a platform for researchers to access information pertaining to South African policies and legislation. A better understanding of the development of Mathematical Literacy as a subject post its adoption in 2006 in our curriculum system is discussed thoroughly on this website. According to Polity\_ZA, Mathematical Literacy deals with the skills rather than content and the benefits that can be derived from this subject include basic skills such as understanding how bonds repayment amounts are calculated, how to calculate the transfer fees and also skills such as interpreting statistics in newspaper articles and calculating income tax to name few (Anon, 2013). Mathematical Literacy equips learners with basic skills and once graduated from the FET band; those learners become effective participants in the modern world (Bowie & Frith, 2006:29). Furthermore it develops problem solving skills and boosts confidence and improves chances of success in dealing with financial demands of the modern world (Botha, 2011).

### **2.3.2 Contexts of Mathematical Literacy**

According to Mthethwa (2007:3) when Mathematical Literacy was developed, the contexts of the subject were the pivot point and the focus was on addressing real issues in the everyday lives of learners. This position agrees with Botha (2011:207) who believes that context should be the focus of Mathematical Literacy learning. The DBE (2011:9) indicates that Mathematical Literacy context exposes learners to realistic situations that relate to real life context and learners are expected to make sense of the context by drawing on non-Mathematical skills and considerations. The DBE further indicates that the context of Mathematical Literacy does not

necessarily mean that learners will encounter those real issues sometime later in life but provide them with skills needed to solve any problem in any contexts that they may face in their lives.

In 2003, the Department of Basic Education made it clear that through Mathematical Literacy, learners should be able to use knowledge of numbers and their relationships to investigate a number of different contexts which include aspects of personal, business and national issues. The context of this Mathematical Literacy often depends on the stakeholders' philosophy and what views or principles they are guided by and that has a direct influence in teaching of the subject (Botha, 2011:30). In context, Mathematical Literacy should develop learners' skills and enable them to identify, pose and solve problems either individually or collaboratively in teams (Houston *et al.*, 2014:26). The syllabus should be set in such a way that learners are able to demonstrate interrelatedness of systems, use co-operatively strategies and engage responsibly with quantitative arguments whenever called upon (Houston *et al.*, 2014:26).

### **2.3.3 Role players in Mathematical Literacy education**

According to the NCS, learners are the most important role players within the Mathematical Literacy context. An ideal learner should be a learner graduating from FET band with skills necessary to enable him/her to act in the interests of the society and has the respect of democracy, equality, human dignity and social justice (DBE, 2003). Therefore to achieve that ideal learner, the Department of Basic Education suggest that Mathematical Literacy should provide the skills to condition a learner to think and analyse situations within the context of national interest. Amongst others, the skills obtained through years of Mathematical Literacy teaching as indicated by the NCS should help the learner to develop the ability and confidence in order to become a vibrant citizen. Therefore, to attain this envisaged learner through Mathematical Literacy learning, equally so, competent teachers are needed as another important role player of the subject. According to Botha *et al.* (2013:193), teachers who had no prior Mathematical knowledge are in the disadvantage when teaching the contents of Mathematical Literacy and learners will struggle to follow through on their teaching. This will then affect learners' ability negatively in learning the subject and hence affect the intention of what Mathematical Literacy as a subject is aiming to achieve.

Parents on the other hand are also important role players in Mathematical Literacy; they act as a supporting pillar for learners in this subject. Spinath and Spinath (2005:192) noted that parents' perception of their children's ability instils self-belief in them and as a result they do well at school. They further indicate that parents also act as expectancy reinforcers for their children's self-perception and that serve as a motivator for learners in dealing with complex learning issues.

The DBE (2003:11) indicates that higher education institutions are also role players in Mathematical Literacy education. According to DBE, learners who wish to further their studies within these institutions must be aware of career paths impacted by choosing Mathematical Literacy in their FET band. Mathematical Literacy affects many disciplines in South African universities and teachers of the subject in the FET band must prepare learners by including contexts or contents that will be needed in the universities to enhance learners' chances of doing well when they get to universities (Frith, 2009:3).

#### **2.3.4 The purpose of Mathematical Literacy in the South African education system**

According to the Department of Basic Education (2003:9) the high percentage of dropouts in our schooling system was as a result of learners who struggled with Mathematics, and the situation was worsening which forced the department to develop a system that could effectively and efficiently so, address this problem. It was then decided to introduce Mathematical Literacy in the FET band in 2006 as a compulsory alternative subject to Mathematics, to give learners who struggle with Mathematics an alternative subject that will still make them mathematically literate and help them engage meaningfully in relevant discussions (DBE, 2003:9).

The introduction of Mathematical Literacy as a subject was aimed at developing learners' ability to think quantitatively and spatially in order to interpret and critically analyse situations in personal, social and work life. The main purpose in adopting Mathematical Literacy as a compulsory subject was to equip these learners with skills that will enable them to use numbers and their relationships to estimate and calculate, investigate and monitor the financial aspects of personal, business and national life and to investigate and solve problems in other contexts (Christiansen, 2007:92).

In addition this subject was to equip learners with necessary skills to recognize, analyse, interpret, describe and represent various functional relationships in order to solve problems in real and simulated contexts (DBE, 2008). Furthermore, the Department of Basic Education argued that Mathematical literate learners will be armed with skills that enable them to deploy appropriate instruments and resources to estimate and calculate physical quantities. The subject should also equip learners with skills to enable them to collect data, summarize and apply the knowledge of statistics and probability and use that in communicating, justifying, predicting and critically interrogating findings and be able to draw conclusions from those findings (Houston *et al.*, 2014:23).

In the past, learners used to have an option of taking Mathematics either on higher or standard grade, before the introduction of NSC in 2008. According to Clark (2012), between 2000 and

2005, there were only 40% of learners taking Mathematics as a subject, meaning the other 60% of learners were either mathematically illiterate or had only basic Mathematical skills. Therefore, the introduction of NSC paved way for Mathematical Literacy as compulsory alternative, subject to Mathematics, exposing more learners to some form of Mathematics. The aim was to address skills needed to deal with workplace demands by equipping learners with fundamental skills to effectively and efficiently contribute to our economy (DBE, 2003:11).

### **2.3.5 General Perception of Mathematical Literacy**

The word perception has enjoyed different definitions in recent years in literature and Aque (2007), suggest that it owes its origin from the Latin word *perceptionem* which means ‘intuitive’ or apprehension with the mind. Though Barlow (1990) suggests that perception cannot be separated from learning because what we learn is constrained by what we perceive and that depends on our experiences.

According to Pickens (2005:52) perception is closely related to attitudes which results from learning or modelling others or formed from our personal experiences. Attitudes are a result of one’s feeling and beliefs and are translated to actions that people often call perceptions. Whereas Aloimonos (2013:1) believes that perception is what the perceiver relates to the task that he/she performs and often informed by assumptions. Therefore, when Mathematical Literacy was first introduced, it got negative publicity and people labelled it as a watered down Mathematics that doesn’t get you anywhere, while others thought it was an alternative to an old standard grade Mathematics (Pasensie, 2012). To make matters worse, Pasensie (2012) suggests that some people went as far as criticizing the language used in Mathematical Literacy; they think the language used is for learners who don’t command English as their mother tongue.

Jablonka (2003:76) supports and add to this argument by stating that culture and the context of the stakeholders who promote Mathematical Literacy often affects how this subject is integrated into the system.

#### ***2.3.5.1 Teachers’ perception and influence on learners’ choice of Mathematical Literacy***

According to the findings of Spangenberg (2012), teachers are influential in learners’ choice of Mathematical Literacy. They use the results of learners obtained in Grade 9 to influence subject choice in Grade 10. If a learner achieve below 60% in their Grade 9 Mathematics then he/she is advised to take Mathematical Literacy in Grade 10. Furthermore, Spangenberg (2012) argues that teachers believe that Mathematics is for the brainy and categorize learners according to

their level of intelligence and influence those that are more intelligent to take Mathematics and those that are considered less intelligent to take Mathematical Literacy. Subject combination package should be taken into consideration when choosing either Mathematics or Mathematical Literacy and must be in line with learners' future career aspirations. Teachers still advise learners on subject choice based on the results of the aptitude they are given before subject selection which might not be in line with what the learner wants to follow in their career moving forward (Spaull, 2013).

On the other hand, research findings by Wilkins and Ma (2002) proof that when teachers expect a particular learner to do well in Mathematics related subject, they are then given special treatment from the rest of learners and increase their chances of doing well in that subject while others don't get that special attention.

#### *2.3.5.2 Parents' perception and influence on learners' choice of Mathematical Literacy*

The role of a parent has been identified as the most crucial role in education and can affect or play an important role in improving learners' performance. This is supported by the findings of Mji and Makgato (2006:261) who found that parents have an indirect influence in subject selection even though parents themselves do not understand the content of the subject. This argument also supports the findings of Wilkins and Ma (2002:295) who indicates that parents have a great influence in learners' choice of subjects. According to Wilkins and Ma (2002) parents who encourage their kids in subject selections often support them in their studies and that has a positive bearing in terms of achieving success rates in those subjects. The findings of the above study is supported by research done by Awad (2008:18) which points to the same findings that parents play an important role in influencing learners' choice on taking Mathematics related subjects, and their influence draw inspiration from their different cultural backgrounds and different societies where they come from.

Parents are also important role players within the Mathematical Literacy context in the sense that they help learners' to develop self-belief and instil confidence in them. This argument was supported by the study of Spinath and Spinath (2005:192) who indicated that parents' perception of their children's ability is a major determinant of their self-beliefs. From the DBE (2010) perspective, Mathematical Literacy was introduced to improve the level of literacy in South Africa and prepare learners to be vibrant citizens who can contribute effectively to the economy. It must be noted that there are various factors that affect learners' choice of taking Mathematical Literacy as a subject. Amongst those that are influential are teachers and parents of the learners. Spangenberg (2012) believes that teachers are very influential whereas Wilkins

and Ma (2002), Mji and Makgato (2006) believe that parents are influential to learners' choice of Mathematical Literacy.

## **2.4 PREVIOUS STUDIES ON MATHEMATICAL LITERACY**

South African education has undergone several reforms since the birth of democracy and it is important for the purpose of this study to note the current position of our education to see if progress has been made in terms of quality improvement. Therefore a review of literature pertaining quality of education, where Mathematical Literacy was thought to be a contributor or a possible game changer, is drawn from the previous studies done on Mathematical Literacy.

To understand the development of Mathematical Literacy in South Africa and where we are now in terms of learners' participation, acceptance and achievements in this subject, a review on previous studies done on Mathematical Literacy was necessary. Studies of the following researches were investigated, Singh *et al.* (2002), Bowie and Frith (2006), Venkatakrisnan and Graven (2006), Julie (2006), Mbekwa (2006), Mthethwa (2007), Madongo (2007), Botha (2011) and Spangenberg (2012).

These research findings or these researchers provide us with much needed information on Mathematical Literacy as a school subject and will also share some light on the perception of learners, teachers and parents on this subject.

Singh *et al.* (2002) studied motivation, attitude and academic engagement on Grade 8 learners' achievements in Mathematics and Science. Although this study was not done in South Africa and not specifically on Mathematical Literacy, the findings indicate that attitudinal and motivational variables are influential in achieving good results in Mathematics related subjects. The study also indicates that those attitudes towards Mathematics and other school-related behaviours have an effect on learners' ability to do well at school and often link to other behaviours, such as coming to school late, unprepared and even coming to school without books. Singh *et al.* (2002) added that a lack of motivation and engagement on learners' side has been a concern to educators for some time and these learners' need to be supported and get more counselling and training on Mathematics related subject. This will improve learners' interest and remove the stigma that Mathematics related subjects are often difficult. Therefore, these findings and recommendations can be applied to learners doing Mathematical Literacy since this subject is Mathematics related and is thus making the findings relevant for this current study.

A study done by Bowie and Frith (2006) was mostly concerned on highlighting the importance of the educational community in South Africa and developing a shared understanding of what Mathematical Literacy is. They also discussed the importance of distinguishing between Mathematics and Mathematical Literacy and clarified the role of Technology in Mathematical Literacy. Most importantly, their study discussed a proper understanding of the context used to teach Mathematical Literacy and argued the need to integrate Mathematical Literacy teaching with other school subjects. Bowie and Frith (2006) further touched on the importance of teachers and learners in understanding the context used in Mathematical Literacy teaching and how they should quickly grasp these contexts in order to be able to mathematise it.

They concluded by emphasizing the three issues they identified as critical in developing Mathematical Literacy materials; those issues include:

- i. developing a shared understanding of what Mathematical Literacy is all about; the importance of addressing Technological issues within the Mathematical Literacy curriculum;
- ii. the importance of incorporating Mathematical and non-Mathematical points of view within Mathematical Literacy curriculum; and
- iii. the importance of clarifying what content and context in Mathematical Literacy should learners be familiar with because of a single National assessment for Mathematical Literacy in Grade 12 (Bowie & Frith, 2006).

A study done by Bowie and Frith (2006) discusses important issues that needs to be considered within the Mathematical Literacy curriculum but does not discuss the perception of learners, teachers and parents of Mathematic Literacy and how this link with quality of education in South Africa. However, their study influenced the current study in shaping an understanding of the importance of Mathematical Literacy in our society. This will help the current study when discussing the results obtained from the self-administered questionnaire and inference will be made to their study.

Venkatakrishnan and Graven (2006) also flagged a number of issues that concerned the Association of Mathematics Education in South Africa (AMESA) in terms of achieving goals of Mathematical Literacy. Among those concerns were the fact that Mathematical Literacy should not focus predominately to further learners' Mathematical 'content' learning but should rather focus on applications and developments. Above all, the focus should be on learners' ability and willingness to solve problems in increasing complex situations.

According to them, AMESA raised these concerns during the introduction phase of Mathematical Literacy, so that the subject should not be viewed as a 'watered' down academic Mathematics but rather as Mathematics with different emphases.

There were also fears from university vice-chancellors and Technicon principals that the introduction of Mathematical Literacy would cause an exodus of learners leaving pure Mathematics and enrolling for Mathematical Literacy which might cripple our education system (Venkatakrisnan & Graven, 2006).

By comparing Mathematical Literacy in South Africa and England, Venkatakrisnan and Graven (2006) indicate that in England Mathematical Literacy is a compulsory hurdle on the way for achieving Mathematics General Certificate of Secondary Education (GCSE) grade 'C' whereas in South Africa it is an alternate subject for Mathematics. This notion means that in the South African contexts, Mathematical Literacy is a somehow different from Mathematics.

Their research concluded by arguing that Mathematical Literacy was adopted due to an increasing pressure across the world for providing greater access to Mathematics and equally so by ensuring that more people are equipped with Mathematical skills to be able to participate and contribute effectively to the twenty-first century world.

Although the study of Venkatakrisnan and Graven (2006) shares much needed literature for the current study on Mathematical Literacy in South African context and compares it with England, it does not touch on the perception of learners and parents on the subject. However the study highlights the perception of other role players such as the University vice-chancellors, Technicon principals and the concerns of the AMESA on the introduction of this subject in our FET band.

A study by Julie (2006) on the myths, further inclusions and exclusions of Mathematical Literacy discusses constructs coming from literature and links it to the purpose of Mathematical Literacy. The first construct that Julie (2006) highlights is the absence of an action component of Mathematical Literacy. Under this topic attention is given to citizenship because it was emphasised that Mathematical Literacy was aimed at equipping learners with skills such as problem solving, the ability to calculate and interpret interest rates and bond calculations that will enable them to participate effectively in our young democracy.

His concerns were that citizens should be able to use statistics to support their arguments and also be able to develop action competencies in order to use Mathematical Literacy constructively and effectively. He concludes by indicating the need to expose learners to

qualitative ways of resolving every day's quantitative dilemmas, however, he does not touch on the perception of learners, parents and teachers on Mathematical Literacy, neither does he link Mathematical Literacy to the quality of education.

Mbekwa (2006) studied teachers' views on Mathematical Literacy and their experiences as students of the course and the findings of his study add much needed literature to the current study. According to Mbekwa (2006), 140 teachers in Western Cape attended a one year course in preparation of introducing Mathematical Literacy. The aim of the course was to train and educate more teachers to have a wider pool of teachers that can teach Mathematical Literacy at schools and the majority of those teachers recruited were coming from non-Mathematical background.

Mbekwa (2006) study's primary objective was to determine the level of understanding of Mathematical Literacy. The study answered the following relevant questions:

- i. What are teachers' motivations for registering for the ACE Mathematical Literacy?
- ii. What is the teachers' common sense understanding of Mathematical Literacy?
- iii. What are the teachers' views of their experiences as students of Mathematical Literacy?
- iv. How do the teachers evaluate the course?

Mbekwa (2006) study found that some of these teachers' understanding of Mathematical Literacy corresponds to contradicting conceptions of Mathematical Literacy and also there was a perception from other teachers that Mathematical Literacy content is difficult. Therefore the findings of Mbekwa (2006) study indicate that there is a perception from teachers as well that Mathematical Literacy as a subject is somehow difficult and learners should find the content challenging.

Mthethwa (2007) studied the role of context in Mathematical Literacy. His study was more concerned in the addressing the following concerns within the Mathematical Literacy context:

- i. the balance between content and context,
- ii. the relation between context and access to Mathematics,
- iii. links between context and interest,
- iv. context and language,
- v. context as a barrier in Mathematics.

As it can be seen, his study was more focused on the context of the subject, rather than looking at the role players within the subject. Therefore his study adds a significant portion to the literature in addressing the context of Mathematical Literacy.

The findings of Mbekwa (2006) revealed that teachers' personal beliefs in Mathematics affected the way they learned to teach Mathematical Literacy. The study also addressed some of the most important issues concerning the context of Mathematical Literacy and suggested that there should be a balance between Mathematics content and real-life context within the context of Mathematical Literacy. Furthermore, the study revealed that contexts of Mathematical Literacy should make the subject interesting, more meaningful and easy for learners to understand.

Mbekwa (2006) study was focused on the context of Mathematical Literacy and touched on how teachers perceive these contexts, its findings are useful in literature but are not in line with the current study, since the current study attempts to access the effect of learners' perception on Mathematical Literacy.

The controversy surrounding the concept of Mathematical Literacy during the implementation process encouraged Madongo (2007) to perform a study which was aimed at exploring the perceptions of role players on Mathematical Literacy and also looked at the competence of Mathematical Literacy as a subject of study.

Some of the research questions in Madongo's (2007) study are in line with the current study. The study undertaken tried to address issues such as the perception, beliefs and views of stakeholders of Mathematical Literacy and how these perceptions affected the implementation of Mathematical Literacy curriculum. The study also addressed the perception Mathematics teachers had of a mathematically literate person. The findings of Madongo's (2007) study somehow correlates to some extent with what the current study is investigating. The major findings from Madongo's (2007) study revealed that the South African curriculum portrayed Mathematical Literacy as a subject and that teachers also perceive it as subject that can be studied in our schools.

Madongo (2007) suggests that teachers perceive a person as mathematically knowledgeable if that person can do basic arithmetic calculations in their daily life. These findings are important to note while continuing with the current study because the current study will draw inference from such findings that address perception on Mathematical Literacy. Therefore Madongo's (2007) work can be regarded as in line with the current study and his findings are noted.

Botha (2011) studied the relationship between Mathematical Literacy teachers' knowledge and beliefs and their instructional practices. Botha's study somehow correlates with the findings of Mbekwa (2006) in terms of teachers' beliefs and perceptions of Mathematical Literacy. He indicated that to some extent teachers believe that Mathematical Literacy is the dumping ground

for learners who are struggling with pure Mathematics. The findings of Botha's (2011) study revealed another interesting aspect of teachers' beliefs and how their beliefs related to the way they taught the subject. According to Botha (2011) their experience and the way teachers were trained play an important role in their teaching of Mathematical Literacy. He further revealed that an adequate knowledge of Mathematical content was needed; however, the experience of teachers was still crucial in the development of content knowledge. Botha's (2011) study was more focused on teachers and their beliefs on Mathematical Literacy and did not focus on learners' perception and therefore it is not in line with the current study. However, the study did mention the effect of teachers' lack of content knowledge on learners' interest in the subject.

Spangenberg (2012) studied the thinking styles of Grade 10 learners for both Mathematics and Mathematical Literacy, with the aim of developing the guidelines on factors contributing to learners' subject choice either Mathematics or Mathematical Literacy. According to Spangenberg (2012) learners are heavily depending on parents and teachers in subject selection based on their future education endeavours, interests and achievements in lower grades. However Spangenberg (2012) further indicates that learner' thinking styles influences their choices when choosing subjects on higher grades. He states that his argument is supported by research which indicates that thinking styles plays an important role in learning, however; parents and teachers are very influential in channelling these learners' thinking styles. Spangenberg (2012) further indicates that learners and teachers should subconsciously consider the thinking styles of learners to enable learners to make the right choice in subject selection and learners who prefer working with people should be advised to choose Mathematical Literacy rather than Mathematics. According to Spangenberg (2012) teachers are influential in learners' choice between Mathematics and Mathematical Literacy, and these teachers use the following three methods to recommend Mathematical Literacy for learners going to Grade 10:

- i. Learners' marks obtained in Grade 9 are used as an indication of which subject between Mathematics and Mathematical Literacy should learners choose.
- ii. The results from the aptitude test are used as an indication of what subject to choose in grade 10.
- iii. Teachers also use the subject combination packages and career aspirations as indication of which subject learner should take.

One of the current study's objectives is to determine what influences the learners to choose Mathematical Literacy over pure Mathematics, therefore the above methods used by teachers to recommend learners to choose Mathematical Literacy is in line with what the current study is investigating.

## **2.5 SUMMARY**

Since its introduction in 2006 as a compulsory alternative subject to Mathematics, Mathematical Literacy has enjoyed adequate publications. From the National perspective, Mathematical Literacy's introduction has been viewed as a work in progress with more emphasis needed to address the context and align the subject with what it was intended to achieve. Jablonka (2003) believes that Mathematical Literacy should have some form of social connections and should not be viewed in isolation, whereas Vithal and Bishop (2006) believe that learners should also play their part and assume some form of responsibility for what they learn in this module as it ties with their future education progress.

Mathematical Literacy as a subject is context based. The DBE (2011) reiterated this and emphasise should be on real-life issues when teaching this subject. This position is supported by the studies done by Botha (2011) and Mthethwa (2007) that the context should be the focus of delivering this subject.

For the DBE to achieve what this subject was mandated to, all the role players should have a common understanding and common goal. Learners are perceived as the most important role players and for them to understand the subject, capable teachers are therefore needed who can simplify this subject for them. Botha *et al.* (2013) emphasised the importance of teachers to have some Mathematics background in order to understand and make sense of the context of Mathematical Literacy to simplify the learning process.

## **2.6 GAPS IN PREVIOUS RESEARCH**

Much was said about Mathematical Literacy in previous research and topics such as the context and content of the subject received enough attention, as did the beliefs and perceptions of teachers. But not much was said about how learners feel about the subject and what motivated them to choose this subject.

There is also not much body of literature that covers what learners need as support structures to enable high performance culture within the Mathematical Literacy syllabus. Focus was on developing teachers' content knowledge and context understanding but nothing was mentioned on how to equip parents with skills to be able to assist their children with Mathematical Literacy homework.

Therefore, the current study covers the perception of learners on Mathematical Literacy and also what factors influence these learners in choosing Mathematical Literacy over pure Mathematics. The study also covers learners' understanding of what role Mathematical Literacy

plays in their future educational aspirations. The study further investigates how learners perceive Mathematical Literacy teachers' knowledge of the subject and how passionate they are in teaching this subject.

## **2.7 CONCLUSION**

### **Pieces that are best considered in previous research argument**

The literature review reveals that context should be the focus of Mathematical Literacy syllabus. This position is supported by Mthethwa (2007) and Mbekwa (2006). These two studies consider context to be the pivot of Mathematical Literacy and support their argument by drawing on the definition of Mathematical Literacy as defined by the department of education.

However, Spangenberg (2012) thinks that thinking styles of learners affect their choice of the subjects, while Singh (2002) believes that motivation, attitude and academic engagement plays a role in learners' achievement. On the other hand Madongo (2007) thinks that teachers' perceptions and beliefs affect the way they present Mathematical Literacy to learners. His argument is supported by Botha (2011) who believes that teacher' beliefs and prior Mathematics knowledge plays a role in teaching methods.

Graven and Venkatakrishnan (2006) focused their study on the content of Mathematical Literacy and this was also the case with Julie's (2006) study, whereas Bowie and Frith's (2006) focus was on developing a shared understanding of what Mathematical Literacy was really all about.

### **Piece that are most convincing of their opinion**

Previous researchers on Mathematical Literacy, such as Christiansen (2006), Vithal & Bishop (2006) and Mthethwa (2007) are convinced that a lot of work still needs to be done to start seeing the benefits of this newly introduced subject within our education system. They all believe that Mathematical Literacy is a context focused subject and all stakeholders must play their part in helping the DBE to realize the intended purpose of this subject.

### **Pieces that make the greatest contribution to literature**

According to the analysis of this study, the studies done by Spangenberg (2012), Singh (2002) and Botha (2011) are pieces that make the greatest contribution to the current study. These studies presented much needed literature as they addressed issues such as thinking styles,

motivation, attitude and academic engagement of learners as well as the beliefs and perceptions of teachers towards Mathematical Literacy.

## **CHAPTER 3: RESEARCH METHODOLOGY**

### **3.1 INTRODUCTION**

Chapter 2 focused on the literature of Mathematical Literacy in a South African context. Chapter 3 presents the research methodology and processes used to investigate the research objectives as stated in Chapter 1 (see par. 1.5.1 and 1.5.2).

### **3.2 EMPIRICAL RESEARCH DESIGN**

This empirical research is based on measured phenomena and aims at deriving knowledge from the actual experience of learners in grade 11, rather than relying on theory or belief.

#### **3.2.1 Research design**

A quantitative, exploratory and descriptive study was used with the primary aim to investigate the perception of Mathematical Literacy learners towards the subject. The quantitative research method was chosen because it is an economical and practical way of assessing group opinions by means of a questionnaire (Punch, 2013). One important advantage of using a quantitative research approach is that it allows the flexibility in the treatment of data and data analysis in a relatively less time consuming. A further advantage is that it allows the researcher to understand the problem and also familiarizes the researcher with the concept that is being studied. It also indicates that quantitative research helps establish correlations between given variables and outcomes (Choy, 2014). This research approach gives the researcher an opportunity to interpret the data by comparing the results of the study with previous studies and draws its wider implications.

#### **3.2.2 Research instruments for data collection**

Research instruments are fact finding strategies, they are tools used in collecting data by (Murphy & Davidshofer, 2005:227-230). This study used a validated self-administered questionnaire as an instrument for data collection, which contained systematic, well compiled and organised questions intended to provide insight into the perceptions of learners in grade 11 on Mathematical Literacy.

##### *3.2.2.1 Self-administered questionnaire*

A self-administered, structured questionnaire based on the factors that influence the perception of learners, as identified in the literature review, was compiled to collect the data. Questionnaires are reliable instruments to collect factual, behavioural and attitudinal data about

the respondents which can then be interpreted statistically to make a generalized inference about the population (Dornyei, 2003). These self-administered questionnaires were thought to be a good tool to gather information from a larger number of respondents, and in this case it was used to gather information, perspectives attitudes, opinions, beliefs, interests and values of learners of Mathematical Literacy. Welman *et al.* (2011:174) further indicate that the advantage of using self-administered questionnaires is that it enables the researcher to collect a huge amount of information in less time and this process is efficient and financially viable. These questionnaires were constructed and administered in a standardised manner for the purpose of collecting data and proved to be the best fact finding strategy for this study.

#### 3.2.2.2 Layout of questionnaire

The questionnaire was divided into a biographic section which included the background of learners such as gender, home language as well as who influenced them to choose Mathematical Literacy and five other Sections representing various factors such as:

- Section A - Learners' perceptions on Mathematical Literacy
- Section B - Influences of choosing Mathematical Literacy
- Section C - Learners' understanding of Mathematical Literacy's impact on their future studies
- Section D - Effects of Mathematical Literacy on the quality of education
- Section E -Learners' perceptions on Mathematical Literacy teachers

A 5-point Likert scale was used where 1 = strongly Disagree; 2 = Disagree; 3 = Neutral view; 4 = Agree and 5 = Strongly Agree.

#### 3.2.3 Population and sample

The target population was high schools in Ekurhuleni and Midvaal municipalities in Gauteng. Due to a number of factors such as distance between schools, time constraints and cost involved a convenience sampling method was used. Saunders *et al.* (2009) say that convenience sampling refers to situations where population elements are selected, based on the fact that they are easily and conveniently available, and this method is generally used by researchers due to the fact that it is quick and cheap. The problem with these samples is that on such a small scale, results cannot be generalised and applied across the whole population.

The study population consisted of five high schools in Gauteng which were chosen on a geographical basis, since it allowed the researcher easy access to them. A total of 200 grade 11 learners were non-randomly selected to complete the questionnaires and a final number of 144

(n = 144) usable questionnaires were returned by 51 male and 92 female grade 11 Mathematical Literacy learners, yielding a response rate of 72%.

#### **3.2.4 Pilot study**

The researcher asked 10 independent Mathematical Literacy grade 11 learners who did not form part of the sample for the final study, to complete the questionnaire. After completion, the questionnaire was discussed with these respondents by the researcher to clarify any misunderstandings and uncertainties that they experienced. After this exercise, the questionnaire was adjusted and finalised before distribution

#### **3.2.5 Data collection**

The Head of Department (HOD) of Mathematical Literacy who were trained as fieldworkers handed out the questionnaires at a convenient time at the selected schools and explained the purpose of the research to the respondents. They also attended to problems that respondents encountered during filling in of the questionnaire, collected these after completion and handed them over to the researcher. A response rate of 60% can be used as a threshold of acceptability (Johnson & Wilsmar, 2012:1805). The acquired response rate of 72% was therefore acceptable.

### **3.3 DATA ANALYSIS AND REPORTING**

The researcher used the Statistic Consultant Services at the North West University, Potchefstroom campus with the help of the Statistical Package for the Social Sciences (SPSS) to capture, clean, edit and analyse the data obtained from the questionnaires. An exploratory factor analysis (EFA) was used as data reduction technique to determine the dimensions or factors underlying the construct, followed by confirmatory factor analysis (CFA). Reliability analysis was subsequently undertaken to determine the reliability of the five factors extracted through the exploratory factor analysis. The descriptive results for the individual statements measuring the different factors were reported thereafter. The report of the inferential statistics used the Spearman rho correlation coefficients for each pair of variables and was based on all the cases with valid data for the pair.

The researcher also used the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy. Large values for the KMO measure indicate that a factor analysis of the variable is a good idea. Field (2005) suggest that KMO measure should have a value greater than 0.5 and the closer it is to 1, the more pattern of correlation is relatively compact. Guideline for the KMO measure is as follows (Bair, 2007:134):

Table 3. 1: KMO values:

0.5 - 0.7	Considered to be mediocre
0.7 – 0.8	Considered to be good
0.8 – 0.9	Considered to be great
Above 0.9	Considered to be superb

The following data analysis is carried out:

- Frequency analysis of all the data collected by the self-administered structured questionnaire.
- Means and standard deviations are given in Tables 4.4 to 4.8.
- The validity of the measuring instrument is investigated by:
  - construct validity on the basis of confirmatory factor analysis and
  - content validity
- Reliability is determined by calculating Cronbach alpha coefficients.
- Ellis and Steyn (2003) effect size (d value) is used to calculate the practical significance of the differences.
- Ellis and Steyn suggest that d-values smaller than 0.15 can be regarded as practically non-significant, and between 0.15 - 0.35 as significant whereas d-value larger than 0.35 are practically important.
- Guideline for the effect size (d value) are as follows Ellis and Steyn (20013) classified:

Table 3. 2: Effect sizes (d)

$d > 0.15$	Small effect
$d = 0.15 - 0.35$	Medium effect
$d < 0.35$	Large effect

The Spearman Rank Test (correlation coefficient  $r$ ) is used to determine the statistical relationship between the five factors on the questionnaire as well as the three questions that did not load during the factor analysis. The p-value criterion for statistical significance used was as follows:

Table 3. 3: The p-value

p < 0.1	Small correlation
p < 0.3	Medium correlation
p < 0.5	Large correlation.

### **3.4 PSYCHOMETRIC PROPERTIES OF THE QUESTIONNAIRE**

To investigate the psychometric properties of the instrument, validity was examined by addressing content and constructs validity, while reliability was investigated by computing alpha coefficients (Delpont & Roestenburg, 2011:173-177). The findings are reported under results.

### **3.5 VALIDITY AND RELIABILITY OF INSTRUMENTS**

The psychometric properties of the measuring instrument were investigated for content and construct validity and reliability.

#### **3.5.1 Validity**

According to Punch (2013:287) validity is the second central measure of quality of measuring instruments in research, to determine the degree at which a questionnaire is able to measure what it was intending to measure.

##### *3.5.1.1 Content validity*

For the purpose of this study, content validity was determined by considering the degree to which the items in the questionnaire really measured the factors or concepts under contemplation.

Content validity is a subjective but systematic evaluation of how well the content of a scale represents the measurement task at hand (Malhotra, 2010:320). Punch (2013:239) also suggests that content validity should focus on the full content of a conceptual definition that is represented in the measure. All the test items seemed to measure the construct which appeared as the heading of each factor. Also, the total set of behaviours in this section was appropriate for measuring the characteristic behaviour of the specific respondents in this study, which is another requirement for content validity. Consequently the instrument was deemed content valid.

### 3.5.1.2 Construct validity

Construct validity addresses the characteristic or construct actually measure by the scale (Malhotra, 2010:320). It assesses whether the measuring scale does in fact measure what the researcher implied it to measure (Iacobucci & Churchill, 2010:257).

Construct validity was assessed by means of an exploratory factor analyses (EFA) and five factors were identified namely learners' perception of Mathematical Literacy, influence of choosing Mathematical Literacy, learners' understanding of Mathematical Literacy's impact on future studies, effects of Mathematical Literacy on education, and learners' perception of Mathematical Literacy teachers.

A few items which did not fit in with the main factors were discarded, after which a confirmatory factor analysis (CFA) was executed. The five factors identified in the EFA together explained a substantial proportion of the total variance (69.297%) of the subscales. Communalities on individual items varied between 0.165 and 0.86 in this study. The communality on each statement mostly comprised more than half of the total variance for most of the statements. The construct validity of this instrument was consequently found satisfactory.

### 3.5.2 Reliability

According to Cohen *et al.* (2007:506) a Cronbach alpha value greater than 0.7 indicates that an instrument is reliable although smaller values (0.5 and higher) can also be considered reliable. Items are considered to represent an acceptable level of internal consistency if the Cronbach's alpha value is between 0.5 and 0.7 (Yusoff, 2012:318).

In this study two of the factors (learners' perception of Mathematical Literacy and learners' understanding of Mathematical Literacy's impact on future studies) displayed Cronbach alpha values between 0.5 and 0.7 while three of the factors (influence of choosing Mathematical Literacy, effects of Mathematical Literacy on education quality and learners' perception of Mathematical Literacy teachers) displayed Cronbach alpha value of > 0.7. This measuring instrument was therefore deemed reliable.

## 3.6 ADMINISTRATION OF INSTRUMENT

The principals appointed the HODs for Mathematical Literacy as responsible for handing out the questionnaires to Grade 11 Mathematical Literacy learners. The HOD's handed the questionnaires to the Grade 11 learners at a convenient time to the classes and explained the purpose of the research to the respondents. They also attended to problems that respondents

encountered during filling in of the questionnaires and collected them after completion and handed them back to the researcher. The questionnaire was accompanied by a detailed leaflet answering most of the generic questions learners may have before completing it.

### **3.6.1 Access to schools and learners**

An application was submitted to the Gauteng Department of Education (GDE) asking permission to conduct the research at their schools. After careful consideration and the submission of required documentation to the GDE, permission was granted to approach the schools (See Annexure B).

According to GDE requirements, a letter to the principal and School Governing Body (SGB) accompanied by a copy of approval letter from the GDE had to be submitted to the schools (See Annexure E and D). These letters asked for permission to conduct the research at their schools. However, consent from parents/guardian and from the learners was essential due to the fact that we are engaging learners who are still under age (See Annexure F and C). The Ethical Committee of the NWU does not permit learners who are still under age to participate in research without consent from their parents/guardian. Therefore it was essential to obtain consent from parents/guardians before engaging the learners. The GDE also emphasized that it is the researcher's responsibility to obtain a written parental and learner consent before learners could engage in the research.

### **3.6.2 Confidentiality**

The consent letter to parents/guardian and learners assured them that the study is anonymous and the intention is not to collect or retain any information about learners' identity. The consent letters also indicated that the decision to participate in the study is entirely up to the learner and s/he may refuse to take part or withdraw from the study at any time without affecting relationship with the investigators or North –West University. Learners were also given the right not to answer any single question on the questionnaire if they wish not to do so.

Over and above, the school principal was also reassured that the role of the school is voluntary and the School Principal may decide to withdraw the school's participation at any given time without penalty.

## **3.7 CONCLUSION**

In this chapter a thorough discussion has been done on all the relevant aspects concerning an empirical research. This has been done to ensure an organised systematic procedure that

limited mistakes to a minimum. Quantitative research has been identified as a good tool especially in collecting large volumes of data as suggested by Cho (2014). One of the many advantages of this approach is that it allows flexibility in dealing with this large volume of data.

To collect this large volumes of data, Dornyei (2003) suggest that questionnaires are the appropriate instruments to achieve such. However Malhotra (2010) and Punch (2013) suggest that these questionnaires must be tested for validity and reliability, to test if they are measuring what the study is intending to measure. Based on the EFA and the Cronbach alpha value obtained when analysis the questionnaires, it was concluded that the questionnaire is reliable and valid for the purpose of this study. The questionnaire is indeed measuring what the study is intending to measure.

Permission from the GDE, the SGB, Principals and the consent from the parents of learners was obtained before the learners could be engaged in the study. This was in line with the requirements of the NWU Ethics committee. These conditions were met in order to obtain Ethical clearance to continue with the study. With the content of this chapter as background the data have been analysed and will be presented in Chapter 4.

## **CHAPTER 4: RESULTS AND DISCUSSION**

### **4.1 INTRODUCTION**

In the previous chapter the empirical process of the research was discussed and an outline of the method of data collection was provided. In this chapter the analysis and interpretation of quantitative data are presented in a systematic way. The main objective of this chapter is to attend to the research questions as stated in chapter 1, namely:

- What is the perception of Grade 11 learners on Mathematical Literacy as a subject?
- What influences learners to choose Mathematical Literacy over pure mathematics?
- To what extent do learners understand the impact of choosing Mathematical Literacy on their future studies?
- Do the results of Mathematical Literacy predict the quality of the South African education system?
- How these learners perceive their Mathematical Literacy teachers.

To ensure a logical sequence for the discussion the data is discussed under the following headings:

#### **4.1.1 Biographic information of the respondents:**

- Gender
- Home language
- Influence on taking Mathematical Literacy

#### **4.1.2 Factors contributing to learners' view on Mathematical Literacy**

- Learners' perception of Mathematical Literacy,
- Influence of choosing Mathematical Literacy,
- Learners' understanding of Mathematical Literacy's impact on future studies,
- Effects of Mathematical Literacy on education quality
- Learners' perception of Mathematical Literacy teachers.

### **4.2 BIOGRAPHICAL INFORMATION OF THE RESPONDENTS**

Respondents have been requested to enter their personal details, such as gender, home language and who influenced them on choosing Mathematical Literacy. This information was used to assist the researcher in drawing comparisons between learners and their perception of

Mathematical Literacy, in order to try and determine in what way their biographic information influences their frame of mind.

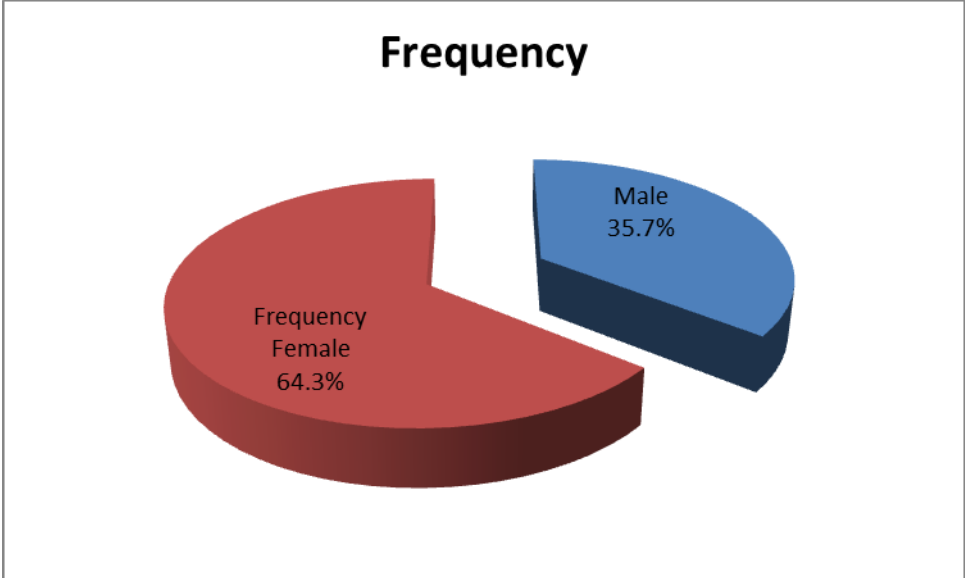
**4.2.1 Gender**

An analysis of the gender (see Table 4.1 and Figure 4.1) indicates that there is a clear female dominance in learners in Mathematical Literacy classes at the schools represented in this study. The data indicates that there are more female respondents (64.3%) than male respondents (35.7%).

**Table 4. 4:** Gender profile of respondents

Gender	Frequency	Percentage (%)
Male	51	35.7
Female	92	64.3
Missing	0	0.0
<b>Total</b>	<b>143</b>	<b>100.0</b>

**Figure 4. 1:** Pie Chart for the gender profile of the respondents



**4.2.2 Home Language**

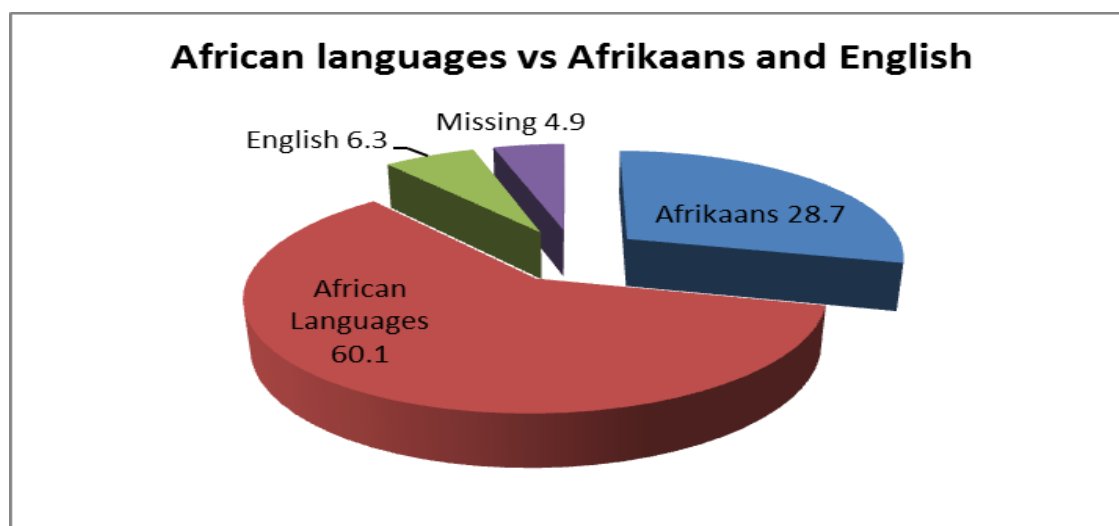
Table 4.2 and figure 4.2 present the home language of the respondents. The data indicates that there are more Africans language learners (60.1%) compared to Afrikaans (28.7%) and English

speaking learners (6.3%) while the missing respondents were 4.9% (this is due to the fact that certain questions were not completed). English learners (6.3%) and the missing learners (4.9%) are omitted from the rest of the discussion since they are a small percentage based on the gathered data. Therefore an African language compared to Afrikaans is used for the rest of the discussion.

**Table 4. 5:** African languages versus Afrikaans and English

Home Languages	Frequency	Percentage (%)
Afrikaans	41	28.7
African Languages	86	60.1
English	9	6.3
Missing	7	4.9
<b>Total</b>	<b>143</b>	<b>100.0</b>

**Figure 4. 2:** Pie Chart of African languages vs. Afrikaans and English



#### 4.2.3 Influence in choice of taking Mathematical Literacy

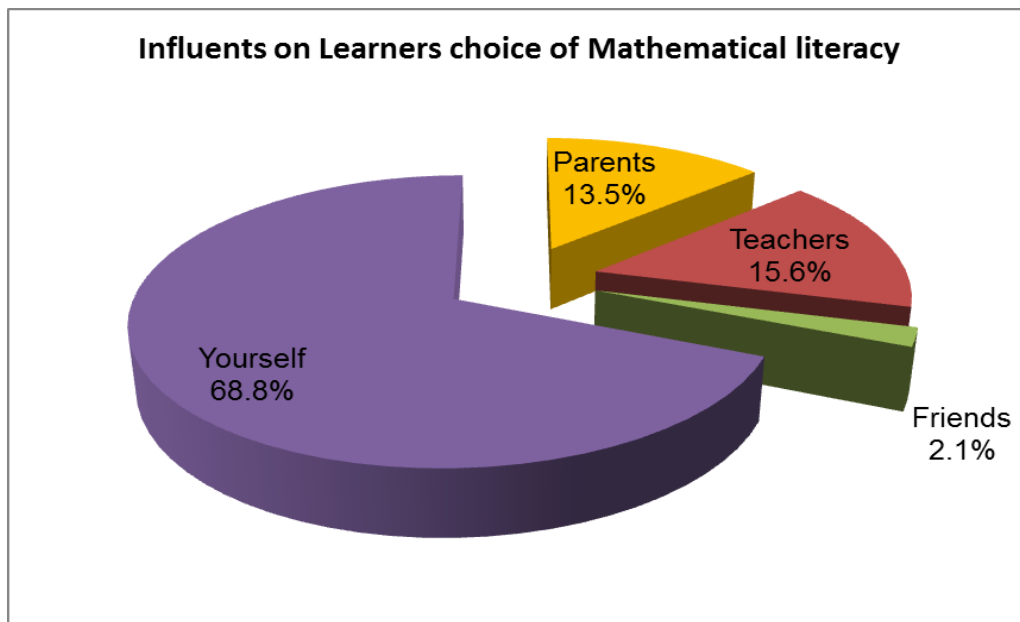
Table 4.3 and Figure 4.3 are representations of the influence on the learner's choice of Mathematical Literacy in the population sample. In this study learners were given an option to choose who had the most influence on them choosing Mathematical Literacy in grade 10. However, two learners out of 143 did not fill in this question and were omitted in the discussion. The valid percentage is therefore reported for this question. Based on the results, 13.5% of learners indicated that their parents influenced them in choosing Mathematical Literacy, while 15.6% indicated that teachers influenced them in the selection of this subject. However, the results indicate that the majority of learners in the sample population (68.8%) believed that they

chose Mathematical Literacy on their own, without any external influence, whereas only 2.1% indicated that their friends influenced them in choosing the subject.

**Table 4. 6:** Influents on Learners choice of Mathematical Literacy

		Frequency	Percent
Valid	Parents	19	13.5
	Teachers	22	15.6
	Friends	3	2.1
	Yourself	97	68.8
<b>Total</b>		<b>141</b>	<b>100</b>

**Figure 4. 3:** Pie Chat for the influents on Leaners' choice of Mathematical Literacy



### 4.3 VALIDITY

Content validity was determined by considering the degree to which the items in the questionnaire really measured the factors or concepts under contemplation. Content validity is a subjective but systematic evaluation of how well the content of a scale represents the measurement task at hand (Malhotra, 2010:320). All the test items seemed to measure the construct which appeared as the heading of each factor. The total set of behaviours in this section was also appropriate for measuring the characteristic behaviour of the specific respondents in this study, which is another requirement for content validity (Murphy & Davidshofer, 2005:158). Consequently the instrument was deemed content valid. Construct

validity addresses the characteristic or construct actually measured by the scale (Malhotra, 2010:320). It assesses whether the measuring scale does in fact measure what the researcher implied it to measure (Iacobucci & Churchill, 2010:257). Construct validity was assessed by means of an exploratory factor analyses (EFA) and five different factors were identified.

#### **4.4 ANALYSIS AND INTERPRETATION OF THE DATA**

Descriptive statistics were used to compute the mean and the standard deviation to interpret the different constructs classified by the factor analysis. The following is a discussion of the different constructs identified. The mean score and standard deviation for sections A - E were computed and reported below. The questions were answered on a 5 point Likert scale where the following indications were used: 1 = Strongly Disagree; 2 = Disagree; 3 = Neutral; 4 = Agree and 5 = Strongly Agree).

##### **4.4.1 Learner's perception of Mathematical Literacy**

The purpose of this section was to gather information from learners to determine their perception of Mathematical Literacy. An analysis of learners' perception of Mathematical Literacy is presented in table 4.4. Data reveals a relative neutral view amongst learners on whether Mathematical Literacy is inferior to pure Mathematics ( $\bar{x} = 3.07$ ; SD = 1.36) and whether teachers give pure Mathematics learners more attention than those studying Mathematical Literacy ( $\bar{x} = 3.31$ ; SD = 1.57). However, data reveals that learners believed that Mathematical Literacy would provide them with more real life skills ( $\bar{x} = 3.91$ ; SD = 0.89) and help them solve problems in their daily life ( $\bar{x} = 3.97$ ; SD = 1.01). The learners mostly agreed that they had a clear understanding of what Mathematical Literacy was all about ( $\bar{x} = 4.22$ ; SD = 0.87). The overall mean score for this factor is close to 4 ( $\bar{x} = 3.67$ ; SD = 1.13), indicating that the respondents agreed that their perceptions on Mathematical literacy were slightly positive.

**Table 4. 7** Learners' perception of Mathematical Literacy

	<b>LEARNER'S PERCEPTION OF MATHEMATICAL LITERACY</b>	<b>n</b>	<b><math>\bar{x}</math></b>	<b>SD</b>
A1	Mathematical Literacy will provides me with real life skills	141	3.91	0.89
A2	Mathematical Literacy is inferior to Pure Mathematics	137	3.07	1.36
A3	I have a clear understanding of what Mathematical Literacy is all about	143	4.22	0.87
A4	Mathematical Literacy will help me in future to solve problems in my daily life	142	3.97	1.01
A5	I treat Mathematical Literacy as more important than other subject	142	3.51	1.08
A6	Teacher give Pure Maths learners more attention than Mathematical Literacy learners	143	3.31	1.57
<b>Average Score</b>			<b>3.67</b>	<b>1.13</b>

#### 4.4.2 Influence of choosing Mathematical Literacy

Table 4.5 reflects the influence of choosing Mathematical Literacy on learners. The item that obtained the highest score ( $\bar{x} = 3.84$ ; SD = 1.24) states that the learners had difficulties with pure Mathematics. The second highest score ( $\bar{x} = 3.62$ ; SD = 1.50) indicates that learners were relatively confident that they were responsible for selecting Mathematical literacy in grade 10. The results also indicates that learners disagree that they were influenced by their teachers and parents in choosing Mathematical Literacy in Grade 10 ( $\bar{x} = 2.50$ ; SD = 1.57 & 1.52). However, the majority of learners would not choose pure Mathematics if given a second chance to choose between the two subjects. The results indicate a disagreement to a neutral view ( $\bar{x} = 2.64$ ; SD = 1.56) on choosing Mathematical Literacy over pure Mathematics if given a second chance. Learners neither agree nor disagree on rushing in decision making on choosing Mathematical Literacy ( $\bar{x} = 2.77$ ; SD = 1.60). Thus learners do not think that if given more time they would have made a different choice on their subject selections. The overall score ( $\bar{x} = 2.98$ ; SD = 1.50) indicates a neutral view on the influence of choosing Mathematical Literacy by the external factors.

**Table 4. 8:** Influence of choosing Mathematical Literacy

	<b>INFLUENCE OF CHOOSING MATHEMATICAL LITERACY</b>	<b>n</b>	<b><math>\bar{x}</math></b>	<b>SD</b>
B1	I was responsible for selecting Mathematical literacy in grade 10	141	3.62	1.50
B2	My teacher influenced me to take Mathematical literacy	138	2.50	1.57
B3	My parents influenced me to take Mathematical literacy	140	2.50	1.53
B4	If given a second chance to select my subjects I would choose Pure Mathematics instead of Mathematical literacy.	140	2.64	1.56
B5	I wish I had more time to think before choosing Mathematical literacy	141	2.77	1.60
B6	I had difficulties with Pure mathematics	141	3.84	1.24
Average Score			2.98	1.50

#### 4.4.3 Learners understanding of the impact of Mathematical Literacy on future studies

The purpose of this section was to determine whether learners had an understanding of the influence of Mathematical Literacy on their future studies. The analysis of learners' understanding of Mathematical Literacy's impact on future studies is presented in Table 4.6. According to the results the highest score ( $\bar{x} = 4.43$ ;  $SD = 0.797$ ) indicates that learners agreed that they had a good knowledge of what they wanted to study. The lowest score ( $\bar{x} = 3.53$ ;  $SD = 1.10$ ) designated that learners were slightly neutral on the question that Mathematical Literacy is an important subject for their future studies, indicating that learners were not sure whether Mathematical Literacy was an important subject for their future studies or not. The results also indicate that learners agreed that they knew what subjects would be needed for future studies ( $\bar{x} = 4.11$ ;  $SD = 0.92$ ).

The overall mean for this section ( $\bar{x} = 3.92$ ;  $SD = 1.00$ ), signposts that learners to some extent agreed that they understand that Mathematical Literacy would have an impact on their future studies.

**Table 4. 9:** Learners' understanding of Mathematical Literacy's impact on future studies

	<b>LEARNERS' UNDERSTAND OF MATHEMATICAL LITERACY'S IMPACT ON FUTURE STUDIES</b>	<b>n</b>	<b><math>\bar{x}</math></b>	<b>SD</b>
C1	I know what I want to study	140	4.43	0.80
C2	My Mathematical literacy teacher mentions future courses that need Mathematical literacy.	139	3.61	1.19
C3	I know which subjects will be needed for future studies	138	4.11	0.92
C4	Mathematical Literacy is an important subject for my future studies	139	3.53	1.10
<b>Average Scores</b>			<b>3.92</b>	<b>1.00</b>

#### 4.4.4 Effects of Mathematical Literacy on the quality of education

This section measured the effect of Mathematical Literacy on the quality of education. The data for the effects of Mathematical Literacy on the quality of education is presented in table 4.7. The highest score for this section was ( $\bar{x} = 4.49$ ;  $SD = 0.70$ ), which indicates that learners positively agreed that getting a good mark in Mathematical Literacy was important to them. Although the lowest score ( $\bar{x} = 3.69$ ;  $SD = 1.00$ ) indicates that they were slightly neutral that they knew the objectives of Mathematical Literacy. The results indicate that the learners mostly agreed that Mathematical Literacy improved the Matric pass rate ( $\bar{x} = 4.22$ ;  $SD = 0.87$ ). There was a slight agreement between learners that the contents of Mathematical Literacy provided them with skills needed to be a better citizen ( $\bar{x} = 3.80$ ;  $SD = 1.02$ ). There was also a slight agreement from the learners that Mathematical Literacy provided them with skills needed to engage in meaningful decisions ( $\bar{x} = 3.87$ ;  $SD = 0.96$ ). The overall mean score for this section ( $\bar{x} = 4.11$ ;  $SD = 0.88$ ) indicates that learners believed that Mathematical Literacy had an impact on the quality of education.

**Table 4. 10:** Effects of Mathematical Literacy on quality of education

	<b>EFFECTS OF MATHEMATICAL LITERACY ON EDUCATION QUALITY</b>	<b>n</b>	<b><math>\bar{x}</math></b>	<b>SD</b>
D1	Getting a good mark in Mathematical literacy is important to me	143	4.49	0.70
D2	Mathematical Literacy improves Matric pass rate	142	4.22	0.87
D3	Mathematical literacy is important to my education	142	4.07	0.84
D4	More learners pass Mathematical literacy in grade 12 than pure maths.	143	4.31	0.90
D5	I am working hard to get a good mark in Mathematical Literacy	143	4.41	0.72
D6	The contents of Mathematical Literacy is empowering me to be a better citizen	141	3.80	1.02
D7	Mathematical Literacy provides me with skills needed to engage in meaningful decisions	143	3.87	0.96
D8	I know Mathematical literacy objectives	140	3.69	1.00
<b>Average Scores</b>			<b>4.11</b>	<b>0.88</b>

#### 4.4.5 Learner perception of Mathematical Literacy teachers

The purpose of this section was to determine how learners perceived their Mathematical teachers. The data for learners' perception of their Mathematical teachers is presented in table 4.8. According to the results, the highest score ( $\bar{x} = 4.34$ ;  $SD = 0.90$ ) indicates that learners agreed that their teachers gave all learners equal opportunity to participate in class discussions and activities. The lowest score ( $\bar{x} = 3.92$ ;  $SD = 0.99$ ) indicates that learners believed that their Mathematical Literacy teachers related slightly the contents of Mathematical Literacy with real life situation. The results also indicates that ( $\bar{x} = 4.28$ ;  $SD = 0.93$ ) teachers showed passion when teaching the subject. The data also reveals that Mathematical teachers spent enough time to explain the topics of this subject to all the learners ( $\bar{x} = 4.31$ ;  $SD = 0.96$ ). The overall mean for this section ( $\bar{x} = 4.21$ ;  $SD = 0.94$ ) signposts that learners have a positive perception of their Mathematical Literacy teachers.

**Table 4. 11:** Learners' perception of Mathematical Literacy teachers

	<b>LEARNERS' PERCEPTION OF MATHEMATICAL LITERACY TEACHERS</b>	<b>n</b>	<b><math>\bar{x}</math></b>	<b>SD</b>
E1	The teacher relates the contents of Mathematical Literacy with real life situations	142	3.92	0.99
E2	My teacher shows passion when teaching Mathematical Literacy	143	4.28	0.93
E3	My teacher gives all learners an equal opportunity to participate in class discussions and activities	143	4.34	0.90
E4	My teacher spend enough time to explain the topics in Mathematical literacy	143	4.31	0.96
<b>Average Scores</b>			<b>4.21</b>	<b>0.94</b>

#### **4.5 VALIDITY AND RELIABILITY OF THE MEASURING INSTRUMENT**

The psychometric properties of the measuring instrument were investigated for content and construct validity and reliability.

##### **4.5.1 Factor analysis**

To determine the construct validity of the instrument, a Principal Component factor analysis with the Oblimin Rotation Method was used. This factor analysis was done for each section of the questionnaire (refer to Appendix A). The following five factors have been identified and are discussed below:

- Section A - Learners' perception of Mathematical Literacy.
- Section B - Influence of choosing Mathematical Literacy.
- Section C - Learners' understanding of Mathematical Literacy's impact on Future studies.
- Section D - Effects of Mathematical Literacy on quality of education.
- Section E - Learners' perception of Mathematical Literacy teachers.

##### *4.5.1.1 Total variance and the Kaiser, Meyer and Olkin measure*

The correlation matrix for all the sections as appearing on the questionnaire is presented in table 4.9. A discussion of each follows:

Section A's factor analysis yields a total of 30.70% of variance extracted through one factors of the six items. The Kaiser, Meyer Olkin measure is 0.63 which means that the data are sufficient to draw a factor analysis (Field, 2005:17). However, Question A6 (refer to Appendix A) did not load during factoring, indicating that this question does not correlates with other questions in this section. The other questions in this section are closely correlated to each another.

Section B's factor analysis yields a total of 54.53% of variance and was also extracted through six factors. However the data indicates that question B1 and B6 (refer to Appendix A) are not correlating with the rest of the questions in this section whereas the rest of the questions are closely correlating with each other. The Kaiser, Meyer and Olkin's measure for this section indicates that the data are 0.78 which means that the data are sufficient to draw a factor analysis.

Section C's factor analysis yields a total of 52.72% of variance and has been extracted through four factors. The Kaiser, Meyer and Olkin measure indicates that the data are 0.65 while Section D's factor analysis yields a total variance of 43.77% of variance and has been extracted through eight factors. The Kaiser, Meyer and Olkin measure indicates that the data are 0.77. This means that the data for Section C and D is sufficient enough to draw a factor analysis.

Section E's factor analysis yields a total of 69.30% of variance and has also been extracted through four factors. The Kaiser, Meyer and Olkin measure for section E indicates that the data is 0.80, which means that the data for section E is sufficient to draw a factor analysis.

**Table 4. 12:** Total variance and Kaiser, Meyer and Olkin Measure

	Topic	Total Variance %	Kaiser, Meyer & Olkin Measure	N Factors
Section A	Learners' perception of Mathematical literacy	30.70	0.63	6
Section B	Influence of choosing mathematical Literacy	54.53	0.78	6
Section C	Learners' understanding of Mathematical Literacy's impact on Future studies	52.72	0.65	4
Section D	Effects of Mathematical Literacy on the quality of education	43.77	0.77	8
Section E	Learners' perception of Mathematical Literacy teachers	69.30	0.80	4

#### 4.5.1.2 Spearman's rho Correlations

Spearman's rho Correlations ( $\rho$ ) for all the sections as appearing on the questionnaire (see appendix A) are reported in table 4.10. The sections marked with stars on table 4.10 mean that there are correlations between the data and these data is statistically and practically important, while the sections without stars mean that there are no statistically nor any practical correlations. However, one star means small correlations, while two stars mean medium to large correlations. A value of 0.1 also indicates that there is small correlation and 0.3 represents a medium correlation while 0.5 represents a large correlation (Steyn, 2009).

The data indicates that question A6 (Teacher give Pure Mathematics learners more attention than Mathematical Literacy learners),  $\rho = 0.178$  slightly correlates to section B which is the influence of choosing Mathematical Literacy. This indicates that the influence of choosing Mathematical Literacy correlates with how teachers give more attention to learners doing Mathematics than those doing Mathematical Literacy. According to the data, question B1 (I was responsible for selecting Mathematical Literacy in grade 10),  $\rho = 0.540$  strongly correlates with the influence of choosing Mathematical Literacy (Section B), learners' understanding of Mathematical Literacy's impact of their future studies (Section C), and learners' perception of their Mathematical Literacy teachers (Section E).

The data on Table 4.10 also indicates that question B6 (I had difficulties with Pure mathematics),  $\rho = 0.212$  slightly correlates with learners understanding of Mathematical Literacy's impact on their future studies (Section C). This means those learners' experiences with pure Mathematics in Grade 9 correlate with their understanding of Mathematical Literacy's impact on future studies. The data also indicates that section A has a medium to large correlation ( $\rho = 0.378$ ) with their understanding of the impact Mathematical Literacy has on their future studies, section C. This can be an indication that learners' perception of Mathematical Literacy is correlated to their understanding of its impact on their future studies. The data also indicates that learners' influence of choosing Mathematical Literacy, Section B ( $\rho = 0.552$  is strongly correlated to learners' perception of Mathematical Literacy teachers, Section E. The data also reveals a slight correlation ( $\rho = 0.172$ ) between learners' understanding of the impact of Mathematical Literacy on their future studies (Section C) and the way they perceive their Mathematical Literacy teachers (Section E).

**Table 4. 13:** Spearman's rho correlation

			A6	B1	B6	SectionA	SectionB	SectionC	SectionD	SectionE	
<b>Spearman's rho</b>	<b>A6</b>	Correlation Coefficient	1.000	-0.026	-0.044	0.004	.178*	0.065	0.095	-0.132	
		Sig. (2-tailed)		0.760	0.608	0.959	0.035	0.443	0.259	0.116	
		N	143	141	141	143	141	140	143	143	
	<b>B1</b>	Correlation Coefficient	-0.026	1.000	0.029	0.111	-0.540	0.088	.270**	.387**	
		Sig. (2-tailed)	0.760		0.734	0.191	0.000	0.302	0.001	0.000	
		N	141	141	141	141	141	140	141	141	
	<b>B6</b>	Correlation Coefficient	-0.044	0.029	1.000	-0.132	-0.122	0	-0.116	0.066	
		Sig. (2-tailed)	0.608	0.734		0.119	0.151	0.012	0.171	0.440	
		N	141	141	141	141	141	140	141	141	
	<b>SectionA</b>	Correlation Coefficient	0.004	0.111	-0.132	1.000	-0.004	.378**	.432**	0.138	
		Sig. (2-tailed)	0.959	0.191	0.119		0.959	0.000	0.000	0.101	
		N	143	141	141	143	141	140	143	143	
	<b>SectionB</b>	Correlation Coefficient	.178*	.540**	-0.122	-0.004	1.000	0.081	-0.163	.552**	
		Sig. (2-tailed)	0.035	0.000	0.151	0.959		0.339	0.054	0.000	
		N	141	141	141	141	141	140	141	141	
	<b>SectionC</b>	Correlation Coefficient	0.065	0.088	.212*	.378**	0.081	1.000	.369**	.172*	
		Sig. (2-tailed)	0.443	0.302	0.012	0.000	0.339		0.000	0.042	
		N	140	140	140	140	140	140	140	140	
	<b>SectionD</b>	Correlation Coefficient	0.095	.270**	-0.116	.432**	-0.163	.369**	1.000	.354**	
		Sig. (2-tailed)	0.259	0.001	0.171	0.000	0.054	0.000		0.000	
		N	143	141	141	143	141	140	143	143	
	<b>SectionE</b>	Correlation Coefficient	-0.132	.387**	0.066	0.138	.552**	.172*	.354**	1.000	
		Sig. (2-tailed)	0.116	0.000	0.440	0.101	0.000	0.042	0.000		
		N	143	141	141	143	141	140	143	143	
	* . Correlation is significant at the 0.05 level (2-tailed).										
	** . Correlation is significant at the 0.01 level (2-tailed).										
	Grey . shaded cells are negative										

### 4.5.2 Cronbach's Alpha

Cronbach's Alpha values have been computed to test the reliability of each factor. According to Tavakol and Dennick (2011:53) the reliability is concerned with the ability of an instrument to measure consistently and can be noted that it is closely related to the instrument' validity. Therefore the computed Cronbach's Alpha values will tell us the level of reliability of our data. Tavakol and Dennick (2011:53-54) further indicates that Cronbach's Alpha is expressed as a number between 0 and 1, and the closer it is to one the more reliable the data is. However, they report acceptable values of Alpha range from 0.70 to 0.90, where a value under 0.70 could be attributed to a low number of questions pertaining to the specific subject or poor inter-relativity,

though it will still be considered acceptable. On the other hand values above 0.95 may suggest that items are redundant, as they are testing the same question, but in a different appearance. The Cronbach's Alpha for the different sections is presented in table 4.11.

**Table 4. 14:** Cronbach's Alpha Value

	Topic	Cronbach's Alpha	N of items	Items removed
Section A	Learners' perception of Mathematical literacy	0.54	5	A6
Section B	Influence of choosing mathematical Literacy	0.88	4	B1,B6
Section C	Learners' understanding of Mathematical Literacy's impact on Future studies	0.67	4	
Section D	Effects of Mathematical Literacy on the quality of education	0.81	8	
Section E	Learners' perception of Mathematical Literacy teachers	0.85	4	

The following is a discussion of the different values for each section.

#### *4.5.2.1 Learners' perception of Mathematical Literacy*

The first factor is aimed at testing the perception of learners towards Mathematical Literacy. In the grouping, Cronbach's Alpha gave a value of 0.40, which shows a poor inter-relativity between questions. This was as a result of question A6 which did not load during the factor analysis. Question A6 was therefore removed in computing the Cronbach's Alpha value for this section and will be discussed separately under data analysis and interpretation, later in this chapter. Therefore the Cronbach's Alpha value for this section, excluding A6, is 0.54, which is below 0.7 but still acceptable due to poor correlation between items (Tavakol and Dennick, 2011:55).

#### *4.5.2.2 Influence of Choosing Mathematical Literacy*

The second factor aims to test the influence of various stakeholders had on learners' choice of Mathematical Literacy. Questions B1 and B6 also did not load during factor analysis and were affecting the total Cronbach's Alpha for this section and were therefore excluded in computing the Cronbach's Alpha value for this section. These questions are discussed separately under the data analysis and interpretation, later in this chapter. Therefore the overall Cronbach Alpha for this section has a value of 0.88, which shows a good inter-reliability between the questions.

#### *4.5.2.3 Learners' understanding of Mathematical Literacy's impact on future studies*

The third factor aimed to test the understanding of learners on how Mathematical Literacy can affect their future studies. In this grouping of questions, the Cronbach's Alpha for this section has a value of 0.67, although it's below 0.7, it still can be deemed as an acceptable inter-reliability between questions. This could have been that Section C only had four questions and this reasoning is supported by Tavakol and Dennick (2011:53-54) who believe that a small number of questions in a topic can give a smaller number of Cronbach's Alpha.

#### *4.5.2.4 Effects of Mathematical Literacy on the quality of education*

The fourth factor was aimed to test the effect of Mathematical Literacy on the quality of education. In this grouping of questions, the Cronbach's Alpha has a value of 0.808, which shows a good inter-reliability between the questions.

#### *4.5.2.5 Learners' perception of Mathematical Literacy teachers*

The fifth factor aimed to test the perception of learners towards Mathematical Literacy teachers. In this grouping of questions, the Cronbach's Alpha gave a value of 0.85, which shows a good inter-reliability between the questions

### **4.6 DATA ANALYSIS AND INTERPRETATION: COMPARISON BETWEEN BIOGRAPHICAL INFORMATION AND SECTION A – E, A1, B1 AND B2**

In this section the researcher compare the biographical information collected from the respondents and the questions answered by the respondents under each factor. The P-values and effect sizes are used to do a comparison with the biographical information of the different groups, as per factor analysis. There were three questions, A6, B1 and B6, that had an influence on the reliability and were excluded from the calculation of the Cronbach's Alpha values, and therefore they are discussed separately. The following biographical information is used to compare data collected from the respondents:

- Gender
- Home language
- The influence of choosing Mathematical Literacy

The researcher believes that each factor play an important role in determining the difference between respondents and also play an important role in determining the perception of learners on Mathematical Literacy.

It is important to note that a convenient sampling method was done and therefore the results cannot be generalised for the entire population of Grade 11 learners across the country. The sample was only a small representation of the schools in Gauteng province, more specifically in Ekurhuleni and Midvaal municipalities.

Statistics comprehension should be done by looking at correlation between the variables. To determine if there is correlation between the variables, the researcher made use of p-values. According to Ellis and Steyn (2003) statistical significant tests tend to yield small p-values (indicating significant and it can be noted that a p-value smaller than 0.05 is sufficient evidence that the result is statistically significant. If a p-value is bigger than 0.05, it is seen as non-significant.

The researcher also made use of the effect size to determine the practical significance. Practical significance can be understood as a large enough difference to have an effect in practice. For the purpose of reporting these results, the researcher used the difference between the means of two populations. Table 4.12, as suggested by Ellis and Steyn (2003), is used in as a yard stick to compare the obtained results and gauge whether the results are practically significant or not. This table is used as a reference for the discussion below.

**Table 4. 15:** Effect size

Effect size ( $f^2$ )	Effect	Values of $R^2$	Conclusions on $R^2$
Smaller than 0.15	Small	Smaller than 0.13	Non-significant
0.15-0.35	Medium	0.13-0.25	Significant
Larger than 0.35	Large	Larger than 0.25	Practically important

Source: Ellis and Steyn (2003)

#### 4.6.1 Comparison between gender and Section A – E, A1, B1 and B6

Section A – The p-value for Section A ( $p = 0.31$ ) in table 4.13, learners' perception of Mathematical Literacy is bigger than 0.05. This indicates that it is statistically non-significant. The effect size is between 0.15 – 0.35 (with a value of 0.18) indicating that it is medium but still not practically important. Therefore the results suggest that gender had no influence on learners' perception of Mathematical Literacy.

Section B – The p-value for Section B ( $p = 0.58$ ) in table 4.13, learner's influence on choosing Mathematical Literacy is bigger than 0.05. The results also indicates a small difference in means, effect size of 0.09 which is smaller than 0.15. The bigger p-value indicates that the results are statistically non-significant while the smaller effect size indicates that they are also practically non-significant. This means that gender had no influence on learners in choosing Mathematical Literacy.

Section C – The p-value for section C ( $p = 0.81$ ) in table 4.13, learners' understanding of Mathematical Literacy' impact on their future studies, is bigger than 0.05. The results also indicate a small effect size of 0.04 which is smaller than 0.14. This means that gender was statistically and practically non-significant. Therefore, this indicates that the gender of learners had no effect on learners' understanding of the impact Mathematical Literacy had on their future studies.

Section D – The P-value for section D ( $p = 0.80$ ) in table 4.13, the effects of Mathematical Literacy on quality of education are bigger than 0.05 and a medium effect size (effect size = 0.18). The bigger p-value indicates that the results are statistically non-significant and the medium effect size is so close to 0.15, indicating that the results have no practical significance. Therefore, this indicates that gender had no statistical and practical importance on what learners thought on how Mathematical Literacy would affect their future studies.

Section E – The p-value for section E ( $p = 0.89$ ) in table 4.13, learners' perception of Mathematical Literacy teachers is bigger than 0.05. The results also indicate a smaller effect size of 0.02, indicating that gender had no statistical and practical significance on learners' perception of their Mathematical Literacy teachers.

**Question A6** – The p-value for **Question A6** in table 4.13, teacher gives Pure Mathematics learners more attention than Mathematical Literacy learners, is bigger than 0.05, with a value of 0.99 and an effect size of 0.00 . This indicates that gender had no statistical and practical significance on what learners think about teachers giving pure Mathematics learners more attention than Mathematical Literacy learners.

**Question B1** – The p-value for **Question B1** in table 4.13, "I was responsible for selecting Mathematical Literacy in grade 10" is bigger than 0.05, with a value of 0.57 indicating that gender has no statistical significance when learners chose Mathematical Literacy. The effect size is also smaller than 0.15 (effect size = 0.1), indicating that gender had no practical significance for this question.

**Question B6** – The p-value for **Question B6** in table 4.13, “I had difficulties with Pure mathematics” is smaller than 0.05, with a value of 0.03. This indicates that gender is statistically significant. There is also a big difference between the male and female with the effect size of 0.36 which is bigger than 0.35, indicating a bigger difference between the male and female when it comes to Pure Mathematics. The female learners ( $\bar{x} = 4.01$ ; SD = 1.14) indicated that their choice of Mathematical Literacy had something to do with them having difficulties with pure Mathematics, which is in contrast with what male learners believed.

**Table 4. 16:** Gender dependent variables

Factor	Gender	n	$\bar{x}$	SD	p-Value	Effect sizes (d)
SectionA	Male	51	3.81	0.62	0.31	0.18
	Female	92	3.70	0.62		
SectionB	Male	50	2.69	1.24	0.58	0.09
	Female	91	2.57	1.38		
SectionC	Male	50	3.90	0.81	0.81	0.04
	Female	90	3.93	0.67		
SectionD	Male	51	4.04	0.64	0.80	0.18
	Female	92	4.15	0.53		
SectionE	Male	51	4.20	0.89	0.89	0.02
	Female	92	4.22	0.71		
A6 - Teacher give Pure Maths learners more attention than Mathematical Literacy learners	Male	51	3.31	1.62	1.00	0.00
	Female	92	3.32	1.55		
B1 - I was responsible for selecting Mathematical literacy in grade 10	Male	50	3.52	1.53	0.57	0.10
	Female	91	3.67	1.49		
B6 - I had difficulties with Pure mathematics	Male	50	3.52	1.36	0.33	0.36
	Female	91	4.01	1.14		

#### 4.6.2 Language dependent variables

Learners were asked to indicate their home language on the questionnaire to help the researcher to compare different thinking styles from different ethnic groups. However, the researcher decided to group all the African languages together and compare them with the Afrikaans. There were only 9 respondents who indicated English as their home language and they were omitted from comparison since they only represent a small percentage of the sample, 6.3%. The influence of African language and Afrikaans language is presented in table 4.14.

Section A - Learners' perception of Mathematical Literacy proves to be statistically significant with p-value 0.05 as indicated in table 4.14. However, Afrikaans speaking learners tended to agree more with Section A than their Africans counterparts with the  $\bar{x} = 3.88$  as compared to

African with a  $\bar{x} = 3.66$ . This Section is practically important as well ( $d = 0.37$ ). Afrikaans learners answered more positively on section A indicating that they perceived Mathematical Literacy more positively than the African learners ( $\bar{x} = 3.66$ ).

Section B - Learner's influence on choosing Mathematical Literacy has a statistical significance with a p-value of 0.02 as indicated in table 4.14. The Afrikaans learner has a  $\bar{x} = 2.06$  indicating that they disagreed with the external influence on them for choosing Mathematical Literacy, while the Africans learners ( $\bar{x} = 2.64$ ) are leaning towards a neutral view on this matter. The effect size for this section is ( $d = 0.46$ ) indicate that this section is practically significant.

Section C - learners' understanding of Mathematical Literacy' impact on their future studies is statistically non-significant. The p-value as presented in table 4.14 has a value of 0.15 which is higher than 0.05. The effect size is also medium with a value of 0.28 indicating that the section might be practically significant. Both Afrikaans and African speaking learners ( $\bar{x} = 4.06$  and 3.86 respectively) indicated that they knew about the impact Mathematical Literacy had on their future studies.

Section D – The p-value for section D in table 4.14, the effects of Mathematical Literacy on quality of education is bigger than 0.05, with a value of 0.22 indicating that both languages have no statistical significance on this Section. However, both language groups agreed positively that Mathematical Literacy did have an effect on the quality of education. Data on table 4.14 also indicates that Section D is practically non-significant with the effect size of 0.21 which is smaller than 0.35. According to the data on table 4.14, language does not have any significance statistically. Learners were not affected by their ethnic group for them to understand that Mathematical Literacy had an effect on the quality of education.

Section E - learners' perception of Mathematical Literacy teachers is statistically significance ( $p = 0.00$ ). Both Afrikaans and African learners agreed positively ( $\bar{x} = 4.53$ ; 4.14 respectively) with the way they perceive their Mathematical Literacy teachers. This section is also practically significant, with the effect size of 0.83. The data suggest that both Afrikaans and African learners believed that Mathematical Literacy teachers related the contents of the subject to real life situation and learners were encouraged to participate more in class discussions, while enough time was spend on topics in Mathematical Literacy by the teachers.

**Question A6** – Teachers give Pure Mathematics learners more attention than Mathematical Literacy learners is statistically significant ( $p = -0.00$ ). However, Afrikaans learners tended to disagree with the question ( $\bar{x} = 2.49$ ) while the Africans learners agreed that teachers gave Pure Mathematical learners more attention ( $\bar{x} = 3.76$ ). This question is also practically significant,

with an effect size of 0.83. The results indicate that language had statistical and practical significance on what learners thought about teachers. The data suggest that, African languages speaking learners believe that teachers, to some extent, give pure Mathematics learners more attention than Mathematical Literacy learners.

**Question B1** – The p-value for **Question B1** in table 4.14, "I was responsible for selecting Mathematical Literacy in grade 10" is bigger than 0.05, with a value of 0.11 indicating that language has no statistical significance when learners chose Mathematical Literacy. The effect size is also smaller than 0.35 ( $d = 0.31$ ), indicating that language had no practical significance. However, Afrikaans learners responded positively to the question ( $\bar{x} = 4.03$ ), while African learners were slightly more neutral ( $\bar{x} = 3.57$ ) about this question.

**Question B6** – "I had difficulties with pure mathematics" is statistically not significant, with a p-value of 0.87. Both Afrikaans and African learners agreed that they had difficulties with pure mathematics ( $\bar{x} = 3.82$ ; 3.78, respectively). This indicates that language is statistically and practically non-significant.

**Table 4. 17:** Language dependent variables

Language	n	$\bar{x}$	SD	p-Value	Effect sizes (d)
SectionA	Afrikaans	41	3.89	0.05	0.37
	African	86	3.66		
SectionB	Afrikaans	39	2.06	0.02	0.46
	African	86	2.64		
SectionC	Afrikaans	39	4.06	0.15	0.28
	African	85	3.86		
SectionD	Afrikaans	41	4.19	0.22	0.21
	African	86	4.06		
SectionE	Afrikaans	41	4.53	0.00	0.53
	African	86	4.14		
A6 - Teacher give Pure Maths learners more attention than Mathematical Literacy learners	Afrikaans	41	2.49	0.00	0.83
	African	86	3.76		
B1 - I was responsible for selecting Mathematical literacy in grade 10	Afrikaans	39	4.03	0.11	0.31
	African	86	3.57		
B6 - I had difficulties with Pure mathematics	Afrikaans	39	3.82	0.87	0.03
	African	86	3.78		

#### 4.6.3 Learners' influence on choosing Mathematical Literacy depend variables

Learners were given four choices to indicate who influenced them the most for choosing Mathematical Literacy in grade 10. The frequency distribution, as presented in table 4.4,

indicates that there were only 3 learners who indicated that they were influenced by their friends. This represents only 2.1% of the respondents and they were therefore excluded in the comparison below. Table 4.15 presents an analysis of the influence on learners for choosing Mathematical Literacy and how this affected their overall perception of Mathematical Literacy.

Section A, C, D, and questions A6 and B6 had p-values bigger than 0.05, indicating that these sections have no statistical significant. However, Section B, E and question B1 had p-values of 0.00, indicating that these sections have statistical significant.

When comparing the effect size of parents, teachers and the learner in Section A as presented in table 4.15, it is noted that the effect size is smaller than 0.15, indicating that the influence on learners to choose Mathematical Literacy is practically non-significant. The mean values for Section A ( $\bar{x} = 3.78$ ) indicate that learners agreed slightly more to the fact that their perception of Mathematical Literacy was affected by the influence of their parents.

Section B ( $\bar{x} = 3.87$ ) indicates that learners believed that the influence of their parents and teachers on Mathematical Literacy contributed to the overall influence on them for choosing Mathematical Literacy in Grade 10. On the other hand, comparing the effect size of parents and learners, the data indicates that this comparison is practically important ( $d = 1.79$ ). When comparing teacher's influence with learners, the results shows a high effect size ( $d = 1.60$ ), indicating that the comparison is also practically significant.

Section C has a p-value of more than 0.05 ( $p = 0.19$ ) presented in table 4.15, indicating that this section is statistically non-significant. The results indicates that the influence on learners by their parents, teachers and themselves when choosing Mathematical Literacy had an effect on their understanding of how Mathematical Literacy would affect their future studies ( $\bar{x} = 4.10$ ; 3.68; 3.92). The effect size for parents compared to teachers is 0.46, which is higher than 0.35, meaning it is practically significant, whereas the effect size of learners ( $d = 0.27$ ) is below 0.35 suggesting that it is not practically important.

Section D has a p-value ( $p = 0.27$ ) of more than 0.05 and a relatively smaller effect size ( $d = 0.2$ ; 0.15; 0.34), meaning that this section is statistically and practically non-significant. The means results, as presented in table 4.15 for this section ( $\bar{x} = 4.06$ ; 3.94; 4.15), indicate that the influence of parents and teachers on learners' personal views shows that Mathematical Literacy has an effect on the quality of education.

The mean scores for Section E as presented in table 4.15 ( $\bar{x} = 4.03$ ; 3.67; 4.38) indicates that learners agreed positively that their parents' and teachers' influence in choosing Mathematical

Literacy positively affected how they perceived their Mathematical Literacy teachers. The p-value ( $p = 0.00$ ) and the effect sizes indicate ( $d = 0.36, 0.39; 0.73$ ) that this section is statistically and practically significant.

The mean scores for question A6 as presented in table 4.15 ( $\bar{x} = 3.42; 3.59; 3.21$ ) indicates a relatively neutral view from learners about the influence from parents and teachers about teachers giving pure Mathematics learners more attention than those doing Mathematical Literacy. The p-value ( $p = 0.55$ ) as well as the effect size ( $d = 0.12; 0.13; 0.23$ ) which is less than 0.35 suggests that the influence on learners in choosing Mathematical Literacy is statistically and practically non-significant.

According to the results for question B1, "I was responsible for selecting Mathematical Literacy in grade 10" as presented in table 4.15, ( $\bar{x} = 2.53; 2.38$ ) learners believed that they were not influenced by teachers and parents in choosing Mathematical Literacy in Grade 10. They indicated that they chose Mathematical Literacy all by themselves ( $\bar{x} = 4.14$ ). The p-value ( $p = 0.00$ ) also suggest that this question is statistically significant and the high effect size of learners ( $d = 1.16; 1.12$ ) compared to their parents and teachers also suggest that this question is practically important.

When it comes to difficulties with Mathematics in Grade 9, question B6 as presented in table 4.15 reports a very large p-value ( $p = 0.90$ ), meaning that this question is not statistically significant. However, the mean scores ( $\bar{x} = 3.79; 3.71; 3.84$ ) suggest that learners believed that the influence of their teachers and parents made them believe that they had difficulties with Mathematics in Grade 9 and that had an impact on their subject choice is Grade 10. The effect size for this question is smaller than 0.35, meaning that this question is not practically important.

**Table 4. 18:** Influence on the learner for choosing Mathematical Literacy

Influence on the learner for choosing Mathematical Literacy		n	$\bar{x}$	SD	p-Value	Effect sizes (d)	
						1 with	2 with
SectionA	Parents	19	3.78	0.52	0.96		
	Teachers	22	3.74	0.61		0.06	
	Yourself	97	3.73	0.66		0.07	0.01
	Total	138	3.74	0.63			
SectionB	Parents	19	3.87	1.04	0.00		
	Teachers	21	3.87	1.16		0.00	
	Yourself	96	2.02	0.95		1.79	1.60
	Total	136	2.56	1.30			
SectionC	Parents	18	4.10	0.68	0.19		
	Teachers	21	3.68	0.91		0.46	
	Yourself	96	3.92	0.67		0.27	0.26
	Total	135	3.90	0.72			
SectionD	Parents	19	4.06	0.46	0.27		
	Teachers	22	3.94	0.64		0.20	
	Yourself	97	4.15	0.58		0.15	0.34
	Total	138	4.11	0.58			
SectionE	Parents	19	4.03	0.92	0.00		
	Teachers	22	3.67	0.98		0.36	
	Yourself	97	4.38	0.65		0.39	0.73
	Total	138	4.22	0.79			
A6 - Teacher give Pure Maths learners more attention than Mathematical Literacy learners	Parents	19	3.42	1.46	0.55		
	Teachers	22	3.59	1.22		0.12	
	Yourself	97	3.21	1.68		0.13	0.23
	Total	138	3.30	1.58			
B1 - I was responsible for selecting Mathematical literacy in grade 10	Parents	19	2.53	1.39	0.00		
	Teachers	21	2.38	1.36		0.10	
	Yourself	96	4.14	1.24		1.16	1.29
	Total	136	3.64	1.49			
B6 - I had difficulties with Pure mathematics	Parents	19	3.79	1.18	0.91		
	Teachers	21	3.71	1.31		0.06	
	Yourself	96	3.84	1.27		0.04	0.10
	Total	136	3.82	1.25			

#### 4.7 CONCLUSION

It is evident from the analysis of the data collected that gender had no influence on the perception of Mathematical Literacy. But gender did play a role on learners with regards to their experience with Mathematics in Grade 9 and that affected their choice of Mathematical Literacy in Grade 10.

It is also clear from the analysis of results that language had influenced learners' perception of Mathematical Literacy. Afrikaans learners perceived Mathematical Literacy more positively than African learners. The results also suggest that language had an effect on the influence of choosing Mathematical Literacy as well as the perception of Mathematical Literacy. Language also had an effect on how learners thought about teachers giving Mathematics learners more preference than Mathematical Literacy.

It is further obvious from the analysis of results that learners believed that they were influence by neither teachers nor parents, but the choice of Mathematical Literacy was their own.

## **CHAPTER 5: SUMMARY, FINDINGS AND RECOMMENDATIONS**

### **5.1 INTRODUCTION**

This Chapter's main purpose is to revisit the objectives of this study to determine if they have been achieved. The primary objective of this study, as discussed in Chapter 1, was to determine learners' perception of Mathematical Literacy. The secondary objectives were:

- What is the perception of Gr 11 learners on Mathematical Literacy as a subject?
- What influences learners to choose Mathematical Literacy over pure Mathematics?
- To what extent do learners understand the impact of choosing Mathematical Literacy on their future studies?
- Do the results of Mathematical Literacy predict the quality of the South African education system?
- How these learners perceive their Mathematical Literacy teachers.

The researcher examined various studies done on Mathematical Literacy since its adoption in our schools in 2006 and also studied the CAPS documents and collected data from learners to determine their perception towards Mathematical Literacy.

The researcher collected sufficient data from Grade 11 Mathematical Literacy learners in relation to the research topic. Therefore the main objective of this chapter was to assess whether the literature review and the data that was collected during the study did have a meaningful contribution to what the researcher was investigating.

In determining that, the researcher would like to discuss the objective of the study by following the sequence below:

- Summary of the study;
- Findings from literature review;
- Findings from the empirical research
- Findings in relation to the objectives of the study;
- Recommendations;
- Conclusion.

### **5.2 SUMMARY OF THE STUDY**

To understand the current study, the researcher provides a brief summary of each chapter with emphasize on the objectives of the study.

### **5.2.1 Chapter one**

Chapter one was problem identification and defining. In this chapter the researcher identified a problem in the FET band of our education system in South Africa. The problem was in particular with Mathematical Literacy as an alternative compulsory subject to Mathematics. Since its inception in the South African education system in 2006, learners' perceive Mathematic Literacy as water washed Mathematics, other researchers thought it was designed for those who did not want to take pure Mathematics (Mbekwa, 2006:63) and force them somehow to be Mathematically literate. Teachers were also experiencing a huge number of learners opting to do Mathematical Literacy instead of pure Mathematics (Graven & Venkatakrisnan, 2006:7). This has led to learners' perception or misperception that Mathematical Literacy is easier than pure Mathematics, resulting in a decline in the number of learners taking Mathematics which according to Campbell and Prew (2014) is a serious problem for our education system.

### **5.2.2 Chapter two**

Chapter two presented a literature review, whereby previous studies and their statistical findings were discussed. This was done in order for the researcher to emphasise the existence of the problem and also emphasise its seriousness. The chapter looked at the problem from the national perspective and focused on the context, where Mthethwa (2007) and Mbekwa (2006) believed that it was the pivot of Mathematical Literacy. The chapter also looked at role players in Mathematical Literacy education and what role they played in influencing the learners to study this subject. Teachers and parents appeared to be the important role players who spent time with the learners and had a great influence, directly and indirectly, on learners to pursue this subject (Mji & Makgato, 2006; Spangenberg, 2012).

### **5.2.3 Chapter three**

Chapter three discussed how the research was designed and carried out. This included the method the researcher used to collect data and how this data was going to be analysed and what statistical tools were most suited to analyse the data to be collected. The researcher used a quantitative approach and gather sufficient amount of data. The data was collected through the distribution of self-administered questionnaires to the five participating schools in Gauteng Province. The participating schools were from the Ekurhuleni and Midvaal municipalities and the choice of these municipalities was to gather a more race representative of learners to help the researcher to have a representation of the South African learners mix.

## **5.2.4 Chapter four**

In this chapter, the researcher had the data analysed by the North-West University's Statistical Department. The data was large enough to do a factor analysis and it was discovered that all the five factors could be reported in comparison with the biographical information of the learners to have a clear picture of how gender and home language affects the thinking style of the Mathematical Literacy learners in Grade 11.

## **5.3 FINDINGS FROM THE LITERATURE REVIEW**

The findings of previous studies discussed in Chapter 2 are summarised below:

### **5.3.1 Influence of teachers on Mathematical Literacy**

Spangenberg's (2012) findings indicate that teachers are influential in learners' choice of Mathematical Literacy. They normally use the results obtained by learners in Grade 9 to influence them to choose Mathematical Literacy in Grade 10. Teachers also use the results from the aptitude test as an indication of what subject learners should choose in grade 10. He further states that teachers use the subject combination packages and career aspirations as indication of which subject learner learners should take in Grade 10.

### **5.3.2 Influence of Parents on Mathematical Literacy**

Wilkins and Ma (2002) found that parents have a great influence in learners' choice of subjects, and those parents who are influential in subject choices are also very supportive in their studies. Their findings are supported by Awad (2008), who indicates that parents play an important role in influencing their children in choosing Mathematical related subjects. Mji and Makgato (2006) also support this statement. Their findings indicate that parents are influential to learners' choice of Mathematical Literacy.

### **5.3.3 Contexts of Mathematical Literacy**

Bowie and Frith (2006) emphasise that the South African educational community needs to develop a shared understanding of what Mathematical Literacy is and how technology should be integrated into Mathematical Literacy curriculum. They also suggest that a Mathematical and non-mathematical viewpoint should form part of the Mathematical Literacy curriculum and the importance of clarifying what content and context in Mathematical Literacy learners should be familiar with, because of a single National assessment for Mathematical Literacy in Grade 12.

Julie (2006) highlighted the lack of an action component of Mathematical Literacy and his concerns were that citizens should be able to use statistics to support their arguments and also be able to develop action competencies in order to use Mathematical Literacy constructively and effectively. He further emphasised that Mathematical Literacy should equip learners with skills to enable them to participate effectively in our young democracy.

Mbekwa's (2006) study addresses some of the most important issues concerning the context of Mathematical Literacy and suggests that there should be a balance between Mathematics content and real-life context within the context of Mathematical Literacy and the context should make the subject more interesting, more meaningful and easy for learners to understand.

#### **5.3.4 Attitude and Motivation of learners**

Singh *et al.* (2002) state that attitudes towards Mathematics related subjects has an effect on the ability of the learners to do well at school; the attitudinal and motivational variables are very influential on achieving good results in Mathematics related subjects

#### **5.3.5 Perception of Mathematical Literacy**

The findings of Botha (2011) indicate that some teachers' belief that Mathematical Literacy is the dumping ground for learners who struggle with pure Mathematics, whereas Mbekwa's (2006) study revealed that teachers think Mathematical Literacy is difficult and there is a perception from teachers that learners will find this subject challenging. The major findings from Madongo's (2007) study reveal that the South African curriculum portrayed Mathematical Literacy as a subject and also that teachers perceive it as subject that can be studied in our schools, however, he states that teachers perceive someone as mathematically literate if he can do basic arithmetic calculations in their daily lives.

Venkatakrishnan and Graven (2006) state that AMESA raised the concerns during the introduction phase of Mathematical Literacy that the subject should not be viewed as a 'watered' down academic Mathematics but must be viewed as Mathematics with different emphasises. Their study revealed that Mathematical Literacy was adopted due to an increasing pressure across the world for providing greater access to Mathematics and equally so by ensuring that more people are equipped with Mathematical skills to be able to participate and contribute effectively to the twenty-first century world.

The findings of Mbekwa (2006) revealed that teachers' personal beliefs in Mathematics affected the way they learned to teach Mathematical Literacy.

## **5.4 FINDINGS FROM THE EMPIRICAL STUDY**

Data collected was sent to the North-West University statistical department for analysis. The analysis shows some interesting findings, and those findings are discussed below:

### **5.4.1 Learners' perception of Mathematical Literacy**

In this study, it has been discovered through the data collected from the empirical study, that in general, the overall learners' perception of Mathematical Literacy is slightly positive, meaning learners have a positive perception towards Mathematical Literacy as a subject

#### **Gender**

In this study, the data analysis showed that gender has no influence on how the learners perceive Mathematical Literacy.

#### **Language**

In this study, it has been exposed that the respondents showed a statistically significant difference on the effect that language has on the perception of learners towards Mathematical Literacy. It has been discovered that Afrikaans speaking learners perceive Mathematical Literacy more positively than African languages speaking learners and it is practically significant.

#### **External influence**

Although learners showed a neutral response to question B1 ( $\bar{x} = 2.53$ ; 2.38), indicating that their choice of Mathematical Literacy was not influenced by their teachers and parents, the study showed that their perception on Mathematical Literacy was affected by the influence their parents had on them about the subject ( $\bar{x} = 3.78$ ).

### **5.4.2 Influence of choosing Mathematical Literacy**

The empirical study revealed that, in general, the learners agreed that they had difficulties with pure Mathematics in Grade 9. As a result they decided to choose Mathematical Literacy in Grade 10.

## **Gender**

The empirical study proved that, in general, gender has no influence on learners choosing Mathematical Literacy. However, the study showed that most female learners indicated that they had difficulties with pure Mathematics in Grade 9 and that influenced them to take Mathematical Literacy in Grade 10.

## **Language**

In this study, it has been discovered through the data collected that language has a role in the influence on choosing Mathematical Literacy. Most of Afrikaans learners indicated that they were not influenced by their teacher or parents.

## **External Influence**

Although the study showed that most Afrikaans speaking learners were not influenced by their teachers and parents in choosing Mathematical Literacy in Grade 10, the study also showed that in general, learners believed that the influence of their parents and teachers on Mathematical Literacy contributed to their overall influence on them for choosing Mathematical Literacy in Grade 10.

### **5.4.3 Learners' understanding of Mathematical Literacy's effects on their future studies**

The empirical study revealed that learners, to some extent, agreed that they understood that Mathematical literacy would have an impact on their future studies.

## **Gender**

In this study, it had been discovered through data collected that gender has no statistical significant on learners' understanding of Mathematical Literacy' effect on their future studies.

## **Language**

The empirical study through the collected data shows that both Afrikaans and African language speaking learners understand that Mathematical Literacy will have an impact on their future studies.

## **External influence**

In this study, it has also been shown through the data analysis from the empirical study that learners believe that the influence by their parents and teachers when choosing Mathematical Literacy has no effect on their understanding of how Mathematical Literacy will affect their future studies.

### **5.4.4 Effects of Mathematical Literacy on the quality of Education**

Data analysis in this study indicates that learners believe that Mathematical Literacy has an impact on the quality of education.

## **Gender**

The empirical study proved that in general, gender has no influence on how learners think on the effect of Mathematical Literacy on the quality of education.

## **Language**

The data analysis in this study proved that language does not have any significance statistically. Learners are not affected by their ethnic group for them to understand that Mathematical Literacy has an effect on the quality of education. However both Afrikaans and African speaking learners agreed positively that Mathematical Literacy did have an effect on the quality of education.

## **External influence**

The empirical study proved through data analysis that the influence of parents and teachers on learners is statistically significant, meaning there is an influence from teachers and parents on learners to form a perception that Mathematical Literacy does affect the quality of education system.

### **5.4.5 Learners' perception of Mathematical Literacy teachers**

In this study, it has been exposed that the respondents showed a statistically significant prove that learners have a positive perception towards their Mathematical Literacy teachers.

## **Gender**

Data collected from the empirical study showed that in this study, gender has no influence of how learners' perceive their Mathematical Literacy teachers.

## **Language**

In this study, data suggests that both Afrikaans and African learners believe that Mathematical Literacy teachers relate the contents of the subject to real life situation and learners are encouraged to participate more in class discussions, while teachers spend enough time on topics in Mathematical Literacy.

## **External influence**

The results from the empirical study proved that the influence of parents and teachers' on learner had a positive effect on how they perceive their Mathematical Literacy teachers.

## **5.5 FINDINGS IN RELATION TO THE OBJECTIVES OF THE STUDY**

### **5.5.1 Primary objective**

The primary objective of this study was to determine the perception of learners towards Mathematical Literacy. This was aimed at determining whether learners' has a positive or negative perception about Mathematical Literacy. To determine this, the researcher considered different role players in Mathematical Literacy education. The influence of parents and teachers was paramount for understanding how learners perceive this subject. Therefore, the researcher collected data to the elements of perception of Mathematical Literacy from Grade 11 learners in Gauteng province, specifically in Ekurhuleni and Midvaal municipalities. In the data analysis in Chapter four, it was found that the overall learners' perception of Mathematical Literacy was slightly positive. Thus, it can be said that learners in these particular schools have a positive perception towards Mathematical Literacy as a subject.

### **5.5.2 Second objectives**

The secondary-objectives of this study were the following:

#### *5.5.2.1 What is the perception of Grade 11 learners on Mathematical Literacy as a subject?*

The researcher completed an empirical study to determine the overall perception of Grade 11 learners on Mathematical Literacy as a subject. The researcher looked at how gender, language

and external factors influence learners in Mathematical Literacy. This objective was obtained through the use of data analysed by the Statistic Consultation Services at the North-West University, Potchefstroom-campus, with the help of the SAS-computer system (Statistical Analysis System).

It was thus found that learners in Grade 11 have a positive perception towards Mathematical Literacy as a subject. The data showed that gender has no influence on how the learners form their perception; however, language has a statistical significant importance on how learners perceive this subject. Therefore this objective was met and the researcher managed to determine the perception of learners in Grade 11 Mathematical Literacy class towards the subject.

#### *5.5.2.2 What influences learners to choose Mathematical Literacy over pure Mathematics?*

Literature review in Chapter two suggest that parents and teachers play an influential role on learners' choice of subjects at school. The researcher also used data analysed by the Statistic Consultation Services at the North-West University to determine if there are any influences affecting the choice of learners to choose Mathematic Literacy as a subject. It was found through the statistical analysis that parents and teachers had an influence on learners before choosing Mathematical Literacy. Thus it can be said that this objective has been met.

#### *5.5.2.3 To what extent do learners understand the impact of choosing Mathematical Literacy on their future studies?*

The data analysis was used to get some insight in if the learners understand the impact of choosing Mathematic Literacy on their future studies. It was consequently found through the data analysis that learners understand that Mathematical Literacy might have impact on their future studies. This is an indication that this objective has been met.

#### *5.5.2.4 Do the results of Mathematical Literacy predict the quality of the South African education system?*

Literature review in Chapter two is vivid on the effect of Mathematical Literacy's effect on the quality of education. The researcher looked at various trends in literature that suggest that Mathematical Literacy could affect the quality of education nothing could be found that directly implies that this is a fact. The data analysis in Chapter four found that the learners agreed positively that Mathematical Literacy has an impact on the quality of education, and therefore this objective was met.

#### *5.5.2.5 How learners perceive their Mathematical Literacy teachers.*

The literature review in Chapter two suggests that some teachers believe that Mathematical Literacy is designed for learners who struggle with pure Mathematics. The objective of this question was to determine how these learners perceive their Mathematical Literacy and to what extent given the fact that they give pure Mathematics learners more attention as suggested by literature in Chapter two. To determine this, the researcher made use of the data analysis in Chapter four. It was then found that the learners had a relatively positive perception about their Mathematical Literacy teachers. Learners believe that teachers are fully committed and engaged in delivering Mathematical Literacy, and therefore are satisfied with their teachers' commitment. This objective has been met subsequently.

### **5.6 RECOMMENDATIONS IN RELATION TO THE STUDY**

As early as 2005 when Mathematical Literacy was introduced in South African education as a compulsory alternative subject to Mathematics, a number of researches have been done on this subject. Previous studies focused on the context and content of the subject as well as teachers. But little is said on what learners' think about the subject and what kind of support structure they need to enable them to succeed in the subject.

When considering the findings derived from the empirical study, the researcher then recommends the following for future research:

Not much is said about learners who graduate from FET band with Mathematical Literacy as a subject and how they are coping in the real world with skills that were promised to make them vibrant citizens.

Therefore my recommendation for future research is to give attention on how learners of Mathematical Literacy apply skills learnt from the subject to the corporate world or how they are able to use these skills acquired from the subject in their daily lives.

### **5.7 CONCLUSION**

There are various factors that contribute to the perception of learners towards Mathematical Literacy. The study managed to confirm that there is a positive perception of Mathematical Literacy from the learners and managed to link this perception with the influence of teachers and parents.

Given the fact that the perception is slightly positive, it means that more work needs to be done to improve how Mathematical Literacy is perceived by all the stakeholders. The researcher concludes that all stakeholders should work together to improve the way Mathematical Literacy is taught at schools and how it is received by the broader public. The Department of Education should focus on developing career guidance for Mathematical Literacy learners to guide them on what career paths will be impacted by Mathematical Literacy.

School principals should develop the alumni programmes to track the success of learners who attended their schools and use them as motivational speakers to encourage learners that the grass is greener after matric. Teachers should focus more on relating the context of Mathematical Literacy with real life issues. Teachers in Grade 9 should tell learners what career paths will need Mathematics and where will Mathematical Literacy will be needed so that learners go into Grade 10 already knowing what subject combination they should take for their future studies. This will in turn encourage learners to choose subjects wisely and love what they chose and if it ties in with their future endeavours then they will stay committed.

## **5.8 LIMITATIONS OF THE STUDY**

- The researcher used a convenience sampling method to gather the data and therefore the results gained from this study cannot be applied to all the schools in South Africa.
- Although the sample is considered big enough, more participants could give a better understanding on the research.
- Some learners might have been dishonest in answering the questionnaire with a fear of being linked to the questionnaire, given that, the researcher used the HODs as field workers for distributing the questionnaires and collecting them from learners.

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## APPENDIX A: QUESTIONNAIRE

**INTRODUCTION:** The purpose of this study is to investigate the perception of grade 11 Mathematical Literacy learners towards the subject and what the effect thereof on the quality of education. Your responses will be anonymous and will never be linked to you personally. Your participation is entirely voluntary. If there are items you do not feel comfortable answering, please skip them. The following information is needed to enable meaningful data analysis. We appreciate your help in providing this important information

### BIOGRAPHICAL INFORMATION:

Mark the applicable block with a cross (X). Complete all questions.

F1	Gender	Male:	Female:
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F2	Home language:	
----	----------------	--

F3	Who influenced you to take Mathematical literacy, please choose one	1 Parents	2 Teacher	3 Friends	4 Yourself
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**SECTION A:** This section relates to your general views of Mathematical Literacy. Indicate the degree to which you agree with each statement by using the following scale:

1	2	3	4	5
Strongly Disagree	Disagree	Neutral view	Agree	Strongly Agree

<b>LEARNERS' PERCEPTION OF MATHEMATICAL LITERACY</b>						
A1	Mathematical Literacy will provides me with real life skills	1	2	3	4	5
A2	Mathematical Literacy is inferior to Pure Mathematics	1	2	3	4	5
A3	I have a clear understanding of what Mathematical Literacy is all about	1	2	3	4	5
A4	Mathematical Literacy will help me in future to solve problems in my daily life	1	2	3	4	5
A5	I treat Mathematical Literacy as more important than other subjects	1	2	3	4	5
A6	Teacher give Pure Maths learners more attention than Mathematical Literacy learners	1	2	3	4	5

**SECTION B:** This section relates to the influence on you for choosing Mathematical Literacy as a subject. Indicate the degree to which you agree with each statement by using the following scale:

1	2	3	4	5
Strongly Disagree	Disagree	Neutral view	Agree	Strongly Agree

<b>INFLUENCE OF CHOOSING MATHEMATICAL LITERACY</b>						
B1	I was responsible for selecting Mathematical literacy in grade 10	1	2	3	4	5
B2	My teacher influenced me to take Mathematical literacy	1	2	3	4	5
B3	My parents influenced me to take Mathematical literacy	1	2	3	4	5

B4	If given a second chance to select my subjects I would choose Pure Mathematics instead of Mathematical literacy.	1	2	3	4	5
B5	I wish I had more time to think before choosing Mathematical Literacy.	1	2	3	4	5
B6	I had difficulties with Pure mathematics	1	2	3	4	5

**SECTION C:** This section relates to your general understanding of your future studies and what role Mathematical Literacy will play. Indicate the degree to which you agree with each statement by using the following scale:

1	2	3	4	5
Strongly Disagree	Disagree	Neutral view	Agree	Strongly Agree

**LEARNERS' UNDERSTAND OF MATHEMATICAL LITERACY'S IMPACT ON THEIR FUTURE STUDIES**

C1	I know what I want to study	1	2	3	4	5
C2	My Mathematical literacy teacher mentions future courses	1	2	3	4	5

	that need Mathematical literacy.					
C3	I know which subjects will be needed for future studies	1	2	3	4	5
C4	Mathematical Literacy is an important subject for my future studies	1	2	3	4	5

**SECTION D:** This section relates to your general views on Quality of education and how Mathematical Literacy affects it.

Indicate the degree to which you agree with each statement by using the following scale

1	2	3	4	5
Strongly Disagree	Disagree	Neutral view	Agree	Strongly Agree

<b>EFFECTS OF MATHEMATICAL LITERACY ON QUALITY EDUCATION</b>						
D1	Getting a good mark in Mathematical literacy is important to me	1	2	3	4	5
D2	Mathematical Literacy improves Matric pass rate	1	2	3	4	5
D3	Mathematical literacy is important to my education	1	2	3	4	5
D4	More learners pass Mathematical literacy in grade 12 than pure maths.	1	2	3	4	5
D5	I am working hard to get a good mark in Mathematical Literacy	1	2	3	4	5
D6	The contents of Mathematical Literacy is empowering me to be a better citizen	1	2	3	4	5
D7	Mathematical Literacy provides me with skills needed to engage in meaningful decisions	1	2	3	4	5
D8	I know Mathematical literacy objectives	1	2	3	4	5

**SECTION E:** This section relates to your general views on Mathematical Literacy. Indicate the degree to which you agree with

1	2	3	4	5
Strongly Disagree	Disagree	Neutral view	Agree	Strongly Agree

<b>LEARNERS' PERCEPTION OF MATHEMATICAL LITERACY TEACHERS</b>						
E1	The teacher relates the contents of Mathematical Literacy with real	1	2	3	4	5

	life situations					
E2	My teacher shows passion when teaching Mathematical Literacy	1	2	3	4	5
E3	My teacher gives all learners an equal opportunity to participate in class discussions and activities	1	2	3	4	5
E4	My teacher spend enough time to explain the topics in Mathematical literacy	1	2	3	4	5

## APPENDIX B: GDE RESEARCH APPROVAL LETTER



### GAUTENG PROVINCE

Department: Education  
REPUBLIC OF SOUTH AFRICA

For administrative use:  
Reference no: D2016 / 237  
enquiries: Diane Buntting 011 843 6503

### GDE RESEARCH APPROVAL LETTER

Date:	24 August 2015
Validity of Research Approval:	24 August 2015 to 2 October 2015
Name of Researcher:	Lekota M.L.
Address of Researcher:	6 Peacock; Meyerton Farms; Meyerton; 1961
Telephone / Fax Number/s:	073 116 7954
Email address:	lerato.lekota@sasol.com
Research Topic:	Learners' perception of Mathematical Literacy and its effect on the quality of education
Number and type of schools:	FIVE Secondary Schools
District/s/HO	Ekurhuleni North

#### **Re: Approval in Respect of Request to Conduct Research**

This letter serves to indicate that approval is hereby granted to the above-mentioned researcher to proceed with research in respect of the study indicated above. The onus rests with the researcher to negotiate appropriate and relevant time schedules with the school/s and/or offices involved. A separate copy of this letter must be presented to the Principal, SGB and the relevant District/Head Office Senior Manager confirming that permission has been granted for the research to be conducted. However participation is VOLUNTARY.

The following conditions apply to GDE research. The researcher has agreed to and may proceed with the above study subject to the conditions listed below being met. Approval may be withdrawn should any of the conditions listed below be flouted:

#### ***CONDITIONS FOR CONDUCTING RESEARCH IN GDE***

1. The District/Head Office Senior Manager/s concerned must be presented with a copy of this letter;
2. A copy of this letter must be forwarded to the school principal and the chairperson of the School Governing Body (SGB);

*Makhado*  
2015/08/25


1

*Making education a societal priority*

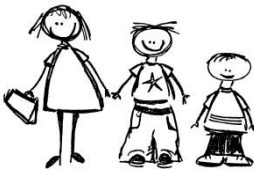
#### **Office of the Director: Knowledge Management and Research**

9<sup>th</sup> Floor, 111 Commissioner Street, Johannesburg, 2001  
P.O. Box 7710, Johannesburg, 2000 Tel: (011) 355 0506  
Email: David.Makhado@gauteng.gov.za  
Website: www.education.gpp.gov.za

## APPENDIX C: PARTICIPANT INFORMATION LEAFLET AND ASSENT FORM

 <p>NORTH-WEST UNIVERSITY YUNIBESITHI YA BOKONE-BOPHIRIMA NOORDWES-UNIVERSITEIT POTCHEFSTROOM CAMPUS</p>	NORTH-WEST UNIVERSITY
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## PARTICIPANT INFORMATION LEAFLET AND CONSENT FORM



**TITLE OF THE RESEARCH PROJECT:** *Learners' Perception of Mathematical Literacy*

**RESEARCHERS NAME(S):** LUCAS LEKOTA

**ADDRESS:** 6 PEACOCK STREET

MEYERTON

1961

**CONTACT NUMBER:** 073 116 7954

### 1. What is RESEARCH?

Research is something we do find **NEW KNOWLEDGE** about the way things (and people) work. We use research projects or studies to help us find out more about learners and the things that affect their lives, their schools, their families and their health. We do this to try and make the world a better place!

### 2. What is this research project all about?

*This research is about investigating the perception of Grade 11 learners towards Mathematical Literacy`.*

### 3. Why have I been invited to take part in this research project?

You are hereby invited to be part of this study, to help us understand your perception towards Mathematical Literacy and how does your perception of the subject affect the overall quality of our education system

#### **4. Who is doing the research?**

*I'm an MBA student from North-West University business school and currently working for Sasol Technology as a Manager technologist. The reason I chose to do this study is because of my passion in Mathematics. I want to understand how learners perceive Mathematical Literacy and what kind of future professionals a subject like Mathematical Literacy can offer to companies like Sasol.*

#### **5. What will happen to me in this study?**

*The study requires you to answer certain questions indicating the degree to which to agree or disagree with the given statement concerning Mathematical Literacy. This will be done on a questionnaire.*

#### **6. Can anything bad happen to me?**

*This study is risk free and there is no physical, emotional or personal harm that can be afflicted by this stud.*

#### **7. Can anything good happen to me?**

*This study will benefit you in the sense that I will give you more understanding of what Mathematical literacy is all about and how will it affect your future studies.*

#### **8. Will anyone know I am in the study?**

Your responses will be anonymous and will never be linked to you personally. Your participation is entirely voluntary. If there are items you do not feel comfortable answering, please skip them.

#### **9. Who can I talk to about the study?**

*If you have any questions or concerns about the research, please feel free to contact **Lucas Lekota on 016 960 5654** or **Dr Louis Van Staden on 018 285 2313** during the day or **Lucas Lekota on 073 116 7954** after hours.*

#### **10. What if I do not want to do this?**

You can choose whether to be in this study or not. If you volunteer to be in this study, you may withdraw at any time without consequences of any kind. You may also refuse to answer any questions you don't want to answer and still remain in the study.

Do you understand this research study and are you willing to take part in it?

 YES NO

Has the researcher answered all your questions?

 YES NO

Do you understand that you can STOP being in the study at any time?

 YES NO

\_\_\_\_\_

\_\_\_\_\_

Signature of Child

Date

## APPENDIX D: TO THE SGB



### Request Letter to do Research to School

#### Governing Body

20 August 2015

The Chairperson

School Governing Body

Dear Sir/Madam

#### RESEARCH PROJECT

I hereby apply for approval to collect data in your school.

I am a final year MBA student at the University of Potchefstroom business school and currently working for Sasol Technology. I am busy with my Master's Degree in Business Administration and would like to conduct a research study in your school. The title for my mini dissertation is ***learners' perception of Mathematical Literacy***.

The GDE has approved my request to collect data for this project at five secondary schools of which your school is one of them. The collection of data will happen in one phase with learners in Grade 11 Mathematical Literacy class completing a questionnaire. Permission will be sought from parents of the targeted learners as well as from participating learners.

The purpose of the study is firstly to complete my MBA but also to indicate to learners, parents, teachers and all education stakeholders the perception of learners towards Mathematical Literacy as a subject and how does this affect our education quality.

The five participating schools and all the respondents will be totally anonymous.

I firmly believe that both your school and I will benefit from this research relationship and that you therefore will agree on the approval. Attach please find:

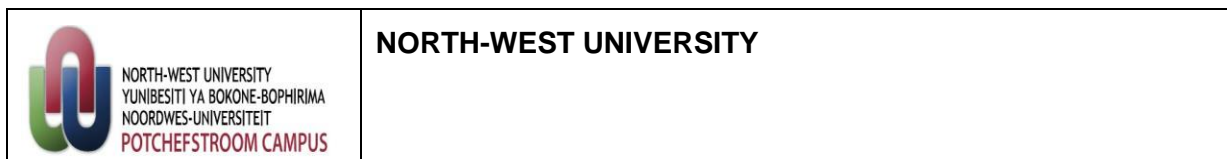
(1) Letter of approval from the GDE

King regards

Lucas Lekota

073 116 79544

## APPENDIX E: TO THE PRINCIPAL



**TITLE OF THE RESEARCH PROJECT:** Learners' Perception of Mathematical Literacy.

**RESEARCHERS NAME(S):** Lucas Lekota

**CONTACT NUMBER:** 073 116 7954

Name of School: \_\_\_\_\_

Name of Principal: \_\_\_\_\_

### **Project Information Statement/Letter of Invitation to School Principals**

My name is Lucas Lekota, and I am an MBA student at the North-West University (NWU) Business school. I am conducting research on Mathematical Literacy under the supervision of Dr Louis Van Staden. The Provincial Department of Education has given approval to approach schools for my research. A copy of their approval is contained with this letter. I would like to get permission from you to conduct my research at your school. This study will meet the requirements of the Research Ethics Committee of the NWU.

Aims of the Research

The research aims to:

Understand learners' perception of Mathematical Literacy.

Link the perception of these learners with the quality of education.

Significance of the Research Project

The research is significant in three ways:

It will provide information about learners' perception in Mathematical Literacy

It will provide information about what influences these learners' perception

It will provide schools and teachers with greater understanding about the influence learners' on subject selections.

#### Benefits of the Research to Schools

The results will promote and encourage career guidance and subject selections

#### Research Plan and Method

Permission will be sought from the learners and their parents prior to their participation in the research. Only those who consent and whose parents consent will participate. I would therefore request that a grade 11 Mathematical Literacy teacher administer the questionnaires to the learners for data collection and would allow 2 weeks for the collection of those survey questionnaires and analyse the data. All information collected will not be treated in strictest confidence and the school nor will individual learners be identifiable in any reports that are written. Participants may withdraw from the study at any time without penalty. The role of the school is voluntary and the School Principal may decide to withdraw the school's participation at any time without penalty. If a learner requires support as a result of their participation in the survey steps can be taken to accommodate this.

#### **School Involvement**

Once I have received your consent to approach learners to participate in the study, I will arrange for informed consent to be obtained from participants' parents obtain informed consent from participants

Attached for your information are copies of the Parent Information and Consent Form and also the Participant Information Statement and Consent Form.

#### Invitation to Participate

If you would like your school to participate in this research, please complete and return the attached form.

Thank you for taking the time to read this information.

---

Researcher

---

Supervisor

## APPENDIX F: TO THE PARENT



### Parental Consent to Participate in a Research Study

**TITLE OF THE RESEARCH PROJECT:** Learners' Perception of Mathematical Literacy.

**RESEARCHERS NAME(S):** Lucas Lekota

**CONTACT NUMBER:** 073 116 7954

**Parent/Guardian Name:** \_\_\_\_\_

### Introduction

- Your child is being asked to be in a research study to understand the perception of learner in Mathematical Literacy and how that affects the quality of education.
- S/he was selected as a possible participant because s/he is in grade 11 and we are studying the perception of Mathematical Literacy in that grade.
- We ask that you read this form and ask any questions that you may have before allowing your child to participate in this study.

### Purpose of Study

- The purpose of the study is to understand what learners' **perception of Mathematical Literacy** is and how does it link to the quality of our education in high schools.
- Ultimately, this research may be *published as part of a journal on education or presented as a paper.*

### Description of the Study Procedures

- If you decide to allow your child to participate in this study, s/he will be asked to do the following things: To complete a simple questionnaire that will be used to collect data for this study.

### **Risks/Discomforts of Being in this Study**

- There are no reasonable foreseeable (or expected) risks in participating in this study.

### **Benefits of Being in the Study**

This study will benefit your child in the sense that I will give him/her more understanding of what Mathematical literacy is all about and how will it affect his/her future studies.

### **Confidentiality**

- This study is anonymous. We will not be collecting or retaining any information about your child's identity.

### **Payments**

- You/your child will not receive any payment/reimbursement for participation in this study

### **Right to Refuse or Withdraw**

- The decision to participate in this study is entirely up to you and your child. Your child may refuse to take part in the study *at any time* without affecting your relationship with the investigators of this study or North –West University. Your child has the right not to answer any single question on the questionnaire.

### **Right to Ask Questions and Report Concerns**

- You have the right to ask questions about this research study and to have those questions answered by me before, during or after the research. If you have any further questions about the study, at any time feel free to contact me, **Lucas Lekota** at [lerato.lekota@sasol.com](mailto:lerato.lekota@sasol.com) or by telephone at 016 960 5654. If you like, a summary of the results of the study will be sent to you. If you have any other concerns about your rights as a research participant that has not been answered by the investigators, you may contact **Dr. Louis Van Staden**, my supervisor at 018 285 2313.

### **Consent**

- Your signature below indicates that you have decided to allow your child participate as a research subject for this study, and that you have read and understood the information provided above. You will be given a signed and dated copy of this form to keep, along with any other printed materials deemed necessary by the study investigators.

Parent/Guardian Name:

Parent/Guardian

Signature:

Date:

Investigator's Signature:

Date:

## APPENDIX G: ETHICAL CLEARANCE



NORTH-WEST UNIVERSITY  
YUNIBESITHI YA BOKONE-BOPHIRIMA  
NOORDWES-UNIVERSITEIT  
POTCHEFSTROOM CAMPUS

### FACULTY OF ECONOMIC AND MANAGEMENT SCIENCES

#### Registration and amendments of title and appointments of examiners

Registration of: (mark applicable with x)	New title			Ethics Number:	EMS15/02/31-1/16		
	Amendment of title		X		Intended submission date:	16 NOVEMBER 2015	
	Appointment of functionary						
	Amendment of functionary						
Degree student is enrolled for:	MA		Is it a:	Dissertation			
	MCom			Mini-dissertation	X		
	MBA	X		Thesis			
	PhD						

#### Curriculum

**Course (subject):** MBA      **Qualification code:** 508 102 3      **code:** E784P  
**School:** NWU PBS      **Research Unit:** WorkWell: Research Unit for Economic and Management Sciences

#### Information of student:

<b>Title:</b>	MR	<b>Student number:</b>	24747750	<b>Date of birth:</b>	12/24/1984
<b>Surname &amp; Initials:</b>	LEKOTA, ML				
<b>Current Title:</b> (OLD TITLE - if title amendment)	Learners' perceptions of Mathematical Literacy and its effect on the quality of the education system				
<b>New Title:</b> (If previous title was already approved)	Learners' perceptions of Mathematical Literacy				
<b>Signature of language editor (C van Zyl) and date:</b> (To be signed at the Faculty Meeting)					

**PLEASE NOTE:** It is the student's responsibility to request a title registration. The student have to complete this document up to his/her signature. The remaining document is **confidential** and should be completed by the study leader/promoter.

**Student's Signature:** .....

FOR OFFICE USE ONLY					
Study leader/Promoter <i>(Please also supply personnel number)</i>	Dr L Van Staden	Internal Box:		Extension No:	
Co-study leader/Co-promoter <i>(Please also supply personnel number)</i>		Internal Box:		Extension No:	
Assistant study leader/Assistant		Internal		Extension	

promoter <i>(Please also supply personnel number)</i>		Box:		No:		
Internal Examiner from NWU <i>(Please also supply personnel number)</i>		Internal Box:		Extension No:		
External Examiner outside NWU <i>(Please supply the physical address, contact numbers and e-mail address)</i>  Did this person agree to act as examiner? <table border="1" style="display: inline-table; vertical-align: middle;"> <tr> <td>YES</td> <td><input type="checkbox"/></td> </tr> </table>	YES	<input type="checkbox"/>		Employer: Tel Nr: Cell Nr: E-mail:		
YES	<input type="checkbox"/>					
External Examiner outside NWU <i>(Please supply the physical address, contact numbers and e-mail address)</i>  Did this person agree to act as examiner? <table border="1" style="display: inline-table; vertical-align: middle;"> <tr> <td>YES</td> <td>NO</td> <td><input type="checkbox"/></td> </tr> </table>	YES	NO	<input type="checkbox"/>		Employer: Tel Nr: Cell Nr: E-mail:	
YES	NO	<input type="checkbox"/>				

.....

Study leader\Promoter

.....

Research program leader/School Director

.....

Director: Research Unit

Approved on .....

## APPENDIX H: LANGUAGE EDITTING DECLARATION

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### *DECLARATION*

*I, Clarina Vorster (ID: 710924 0034 084), Language editor and Translator, and member of the South African Translators' Institute (SATI member number 1003172), herewith declare that I did the language editing of the mini-dissertation of ML Lekota (student nr 24747750) from the Northwest-University.*

*Title of the mini-dissertation: Learners' Perception of Mathematical Literacy*

*C Vorster*

*1 Dec. 2015*

C Vorster

Date

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