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An investigation of how language affects the teaching and learning of mathematics for English second language learners in five FET schools within Mtubatuba district, in Northern KwaZulu-Natal: A particular focus on word problems.

Supervisor: Dr V. Mudaly

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An investigation of how language affects the teaching and learning of mathematics for English second language learners in five FET schools within Mtubatuba district, in Northern KwaZulu-Natal: A particular focus on word problems.

by

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Supervisor: Dr Vimolan Mudaly

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Date submitted: March 2013

SUPERVISOR'S STATEMENT

The dissertation has been submitted with / without my approval.

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Dr Vimolan Mudaly

March 2013

DECLARATION

I, Maureen Phathisiwe Sithole, declare that

- The work described in this dissertation was carried out in the School of Science, Mathematics and Technology Education, University of KwaZulu-Natal, under the supervision of Dr V. Mudaly (appointed supervisor) and the assistance of B. Goba (appointed co-supervisor).
- The research reported in this dissertation represents my original work. Where use has been made of the work of others, it is duly acknowledged in the text.
- The dissertation has not been submitted in any form for any degree or examination to any tertiary institution.

Signed: .....

Maureen Phathisiwe Sithole

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DEDICATION

This dedication goes to the loving memory of the following individuals:

- My late parents, Qondaphi MaBhengu and Dija Mtshali, for their unconditional love and care. Moreover, I thank them for giving me a chance to go to school, despite all odds.

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ABSTRACT

The purpose of this study was to investigate how language affected the teaching and learning of mathematics for English second language (ESL) learners in five Further Education and Training (FET) schools in Northern KwaZulu-Natal, with a particular focus on word problems (WPs).

In 2010, fifteen learners (nine boys and six girls) doing mathematics grade 11 from five different FET schools from Mtubatuba District in Northern Kwazulu-Natal participated in the study. Five teachers teaching the same learners from these five schools were also the participants in this study. The researcher's teaching experience of eleven years as an FET mathematics teacher had taught her that many English second language learners were not able to correctly translate word problems into mathematical equation. This was what motivated the researcher to conduct a study on the impact of English to the teaching and learning of mathematics, especially Word Problems.

The study was mostly framed around theory of Social Constructivism. The research instruments used in the study were: learner worksheets, learner interviews (individual and group interviews), teacher questionnaires and lesson observations.

Some common challenges in the teaching of WPs were drawn from the analysis of the teachers' responses:

- Many learners are unable to translate English statements into mathematical equations.
- The manner in which WPs are phrased generally pose some problems for many learners.
- There is lack of mathematics vocabulary such as 'consecutive', 'twice as much as', 'doubled and then added to', 'squared'.

From the learners' responses, the following could be deduced as challenges in learning WPs:

- There is very little exposure of learners to word problems.
- Failure to write English statements mathematically.
- Less exposure to English due to teachers accepting the use of isiZulu more than English during teaching and learning.

- Too much wording in the WPs which ends up confusing.
- Little exposure to mathematical terms such as ‘consecutive’, ‘integers’.

Both teachers and learners gave some strategies that they thought could help in the teaching of WPs, namely:

- Giving more time for learners to construct mathematical statements on their own.
- Engaging in one-on-one teaching with some struggling learners.
- Code-switching from English to isiZulu when necessary.
- Letting learners work through the worked examples first for proper understanding.
- Rephrasing the problem and breaking it into sections.
- Use of diagrams and illustrations.
- Giving learners more activities on WPs.

ACRONYMS

DoE: Department of Education

ESL: English Second Language

FET: Further Education and Training

HL: Home Language

HSRC: Human Sciences Research Council

KZN: KwaZulu-Natal

LoLT: Language of Learning and Teaching

LOs: Learning Outcomes

NCS: National Curriculum Statement

OBE: Outcomes-Based Education

SEM: Superintendent Education Management

TIMSSR: Third International Mathematics and Science Study Repeat

WP: Word Problems

ZPD: Zone Proximal Development

CHAPTER ONE

INTRODUCTION AND OVERVIEW

1.1 Introduction

This chapter is an outline of the study. The motivation for undertaking this study is discussed and the research questions are introduced. Furthermore, aims and significance of the study have been briefly discussed. Both local and international literature on impact of second language on teaching and learning Mathematics was reviewed. Theory of social constructivism was used in the study. The following is how the other remaining chapters are outlined in this study: Chapter 2: Literature review. In this chapter, I looked at what literature had to say about Mathematics and language. Chapter 3: Theoretical framework- discussion on the theories underpinning the study. Chapter 4: Research design and methodology- research tools and sampling methods used in this study were discussed. Chapter 5: Data analysis and findings-discussion on analysis and findings of the research. Chapter 6: Some concluding comments-an outline of how the results from each research instrument answered the research questions.

1.2 Purpose and motivation for the study

This study sought to investigate how language affected the teaching and learning of Mathematics for English second language (ESL) learners in five Further Education and Training (FET) schools- with a particular focus on word problems (WPs). From my eleven years of teaching experience I had observed that learners generally did not perform well in word problems, especially at FET level. This study was undertaken in order to try and investigate the problem. The study involved teachers who taught Mathematics in Grade Eleven and their learners. My own experience in teaching had motivated me to conduct this study.

During my years of teaching Mathematics to English second language learners in the FET phase, the section that gave many learners difficulty in algebra was „word problems". This was to such an extent that some learners did not even attempt to write a solution to the given word problem at all. One of the reasons for this was perceived to be the English language contained in the word problem. I concur with Ngcobo (1997) when he states that many learners are unable to convert

English language text into the Mathematics language, such as deriving the correct equation from the word problem. The language problem seems to exist for both learners and teachers. This was re-affirmed by De Corte and Verschaffel (1991) when stating that "…a large number of children and teachers find word problems very difficult to learn and teach, respectively…and that had led to the "word problem depression in educational practice" (De Corte & Verschaffel, 1991, p.117).

As the Head of Department of Mathematics at my school for over many years, I had witnessed situations where there was a high shortage of qualified Mathematics teachers. In many instances, the principal was forced to appoint unqualified or underqualified teachers. These teachers had indicated that they had not studied methods of teaching Mathematics at tertiary level. In addition, their content knowledge of Mathematics was not sufficient for them to teach adequately, let alone teaching word problems with so much English language text. Hence, in most cases they skipped this aspect in their teaching. Furthermore, even some qualified teachers had difficulty in teaching word problems as they themselves claimed not to have been properly taught since their teachers were incompetent in as far as the topic was concerned. Hence, learners had a challenge and did not perform well in WPs. Morgan (2001) re-affirmed this claim when arguing that one reason why many Mathematics teachers found it difficult to help their learners was that they themselves had never been taught explicitly how to write mathematically and hence lacked ways of communicating about the various mathematical procedures. Surely, this also has an impact for tertiary education in that these learners encountered many content challenges as they furthered their studies. When such a learner (the product of these teachers) pursued education studies at tertiary level to become a teacher, he or she encountered difficulty and therefore lacked interest in some topics. As a result, this had impact even in his or her teaching career. Eventually the student-teacher developed fear; anxiety and inferiority complex in his /her subject (Clarkson, 1991). When explaining this, Clarkson (1991) stated that because of the minimal pre-service training, teachers had a tendency to teach the way that they were taught as this became safe for them. Moreover, in this way they ensured that their authority was not challenged. Hence, these teachers" incompetency led them to provide learners with information of how something should be done, without learners discovering it themselves. (Clarkson, 1991; The Mathematical Association, 1987). From my experience it could be deduced that: (a) learners had developed an attitude that word problems were difficult and (b) Some teachers had difficulty teaching the word problems, hence no much knowledge was transferred to the learners.

1.3 Aims and objectives of the study

In attempting to work towards resolving the problem, I undertook a study to investigate how the English language influences understanding of word problems which are written in English. I hoped to get possible reasons why word problems posed such a challenge to the learners. Furthermore, the responses from both teachers and learners would suggest some possible ways in which teaching and learning of word problems could be improved. From the established possible reasons for poor performance in WPs, it was envisaged that teachers, researchers and other stakeholders would be more informed and they could establish ways in which learners could be assisted to improve their language usage in as far as the word problems were concerned.

There are different reasons that can be attributed to learners having difficulty understanding the word problems. Included is the fact that learners confuse the mathematical terms (such as difference, product) with their everyday usage (Anghileri, 1991, Orton, 2004). As much as learners have difficulty with word problems, some teachers also have a challenge understanding and teaching WPs. This might be arising from the fact that they themselves were not explicitly taught how to solve WPs (De Corte & Verschaffel, 1991 and Morgan, 2001). This research tried to establish whether it was English language that impeded English second language learners‟ performance in WPs or the mathematization. The study also sought to find ways in which learners could be assisted so they could improve their performance.

1.4 **Research questions**

The specific research questions were:

- Why do some learners experience difficulty with interpreting certain English statements in a word problem and translating them into mathematical statements?
- What are some of the words in WPs that some English second language learners have difficulty with in Mtubatuba district?
- How can the learners be assisted with regards to interpreting these “difficult” words so that they can correctly translate word problems?

To try and answer the three questions, worksheets were answered and interviews conducted with the learners. In addition, questionnaires were administered and lesson observation made with the teachers. From the responses, I was able to derive the answers to these questions. More details of these are discussed in the fourth chapter: Research design and methodology.

1.5 The significance of the study

The following were the reasons why the study was important:

Firstly, to the body of knowledge the study would contribute on the teaching and learning of word problems in the FET phase in particular, but also to the other phases. Some of the issues that the study will address and make a contribution on are: identifying words that are a challenge when teaching and learning word problems in English second language FET classes, identifying some strategies that can be used to help with translation of word problems, and so on. Secondly, although sufficient South African and international material on the topic was used, I hope that the study will add to the literature around the topic. Even though the study was conducted in South Africa, the problems were applicable to the international arena since a lot of research has shown that there are challenges around the language of instruction (which is English in South African case) and learning of Mathematics, both locally and abroad (Costello, 1991). Therefore, the teachers and the researchers at large would benefit from the findings of the study as the results may provide an alternative to the international ways of teaching. Lastly, the study may contribute as a resource material especially to the upcoming generation of teachers in their advancement to seeking for the other ways of assisting English second language learners with language problems in the word problems.

1.6 Research design and methodology

This study is aligned with a qualitative approach within the interpretive paradigm since the researcher focuses on the real experiences of the participants. According to Lesh and Clarke (2000), qualitative research allows for interactiveness among the participants. In this study, I was not the only role-player but also engaged learners and teachers as active participants (Denzin and Lincoln, 2005). In the interpretivist paradigm the researcher gathers “as much information as possible about the problem, with the intent of analyzing, interpreting or theorizing about the phenomenon” (Merriam, 1998, p. 38). In the same way, active participation of the participants

helped me to get as much information as possible regarding word problems. Furthermore, the data generated from this study is qualitative in the sense that it is mostly made up of words (Aluko, 2006). The narratives were constructed of what the participants (teachers and learners) had said regarding their experiences in the teaching and learning of word problems.

Teachers and learners from five high schools around Mtubatuba district were involved in this study. Three of these were the township schools and two were rural schools. In each of the five schools, one grade 11 Mathematics teacher and three learners from the same grade were involved in the study. In selecting the participants, a purposive sampling was used since it was less time-consuming (Burger & Silima, 2006). The sample population comprised learners, both boys and girls, between the ages 16 and 18 years. It was acknowledged that the sample did not represent the wider population and therefore the findings would not be generalized (Cohen, Manion & Morrison, 2007). Different research tools were used to generate data from the participants. The tools used were teacher questionnaires, lesson observations, learner worksheets and learner interviews. The worksheet helped to identify the three learners to partake in the interview process. All Grade eleven learners from each school did the word problems on the worksheet. Thereafter, the top three learners from each school were involved in the interview.

1.7 Outline of Chapters

Chapter one

Chapter introduces the research study. The background of the study gives a brief explanation of the challenges experienced by both the teachers and learners with regards to the teaching and learning of the word problems. In this chapter, I presented the three critical questions for the study. The purpose and motivation of the study are presented and that is where I indicated my interest for conducting this research. Moreover, I outlined the Research design and Methodology for this study. This included the highlights of what comprised my sample.

Chapter Two

This chapter reviews both local and international literature that is highlighting the relationship between language and Mathematics. It is also noted that sometimes there is ambiguity in the manner in which the problem statement is presented. The chapter therefore brings forward the

ambiguities (lexical ambiguities) noted in as far as the language usage in Mathematics is concerned. Lexical ambiguities discussed are Homonymy, Polysemy, Homophony and Impression or Sloppiness on the part of the language. Words that bring about challenges to learners in learning word problems are highlighted and briefly discussed. Moreover, Reading and learning some symbols in Mathematics can confuse some learners, hence „Semiotics" is briefly discussed in this chapter. Furthermore, the relationship between language, culture and Mathematics is discussed. Language is the vehicle through which one expresses one"s thoughts (Vygotsky, 1978). Therefore it is important that the learner be able to fluently express his / her ideas. Lastly, a brief discussion as to what word problems are is presented. A few examples of such are given.

Chapter Three

This chapter elaborates on the theory underpinning the study. Constructivist theory was used in this study to understand the effects of English language in learning of word problems in Mathematics classes for English second language learners. This study was framed within the theory of constructivism and, in particular, social constructivism. Within the broad context of social constructivism, the theory of situated cognition was the lens used to collect and analyze data. The emphasis on this theory is that what is being learned cannot be isolated from the context in which it is learned, instead, the context forms an integral part of what is learned.

Chapter Four

In this chapter, a detailed explanation of the research design and methodology used to generate data is discussed. The study was underpinned by the interpretivist paradigm and the qualitative approach was employed. The details of how sampling was done and the contexts under which the study was conducted are discussed. I was aware that in qualitative research, human behavior is is described to be bound with context. Hence, the chapter gives clear description of where the research takes place (Aluko, 2006). The research tools used to generate data were: Worksheets for the learners, Interviews with the learners, Questionnaires for the teachers and Lesson observations.

Chapter Five

This chapter provides a discussion on the data analysis and findings on the study conducted. Analysis was done on the learner worksheets, learner interviews, teacher questionnaires and lesson observations. The themes were generated from teacher questionnaires and learner interviews. Under each theme, issues are identified and discussed and supported by the extracts from the participants‟ responses.

Chapter Six

In this chapter, the summary, implications for further study and conclusion is presented. The summary to the answers to the three research questions is given. The summary was according to: Difficulties experienced in the teaching and learning of word problems; Strategies to improve teaching and learning of word problems; Some words posing a challenge in translating word problems. Also, limitations to the study are discussed in this chapter. Among other limitations is the fact that the sample was small and therefore it was not possible to make generalizations from the findings of the study. Nonetheless, the study provided an in-depth understanding of the effect of English language in the learning of Mathematics.

CHAPTER TWO

LITERATURE REVIEW

2. 1 Introduction

This chapter brings together the other researchers‟ views on the impact of language in the teaching and learning of Mathematics. My present study particularly focused on how the English language affects the teaching and the learning of word problems to the English second language speakers in the FET phase. As stated by Bless and Achola (1990), reading the published material relevant to the topic enabled me to obtain the background information from which to base my argument. The following sub-topics are discussed in this chapter: Previous research relating to language in Mathematics, Lexical ambiguity (which includes homonymy, polysemy, homophony and impression), Some ambiguous words in Mathematics, Metaphors in Mathematics, Reading Mathematics, Semiotics, Communicating meaning, Word problems, Language, Culture and Mathematics,.

2.2 Previous research relating to language in Mathematics

The purpose of the literature review was to firstly, familiarize the researcher with the research previously conducted on learners‟ difficulty in learning word problems. Secondly, it was to explore the aspects of English language that make learning word problems to be difficult.

The literature was reviewed against the title of the study:

An investigation of how language affects the teaching and learning of Mathematics for English second language learners in five FET schools within Mtubatuba district, in Northern KwaZulu-Natal: A particular focus on word problems.

Research indicated that some teachers have limited knowledge with regards to word problems (WPs). When elaborating on some of the reasons for this, De Corte and Verschaffel (1991) stated that some teachers had poor language background, some were under-qualified in Mathematics, and some had never taught this topic as it was previously considered by many teachers to be difficult.

> *"For a long time, word problems… have constituted an important part of Mathematics education in the primary school. Their role dates back to antiquity. …. On the other hand, the international literature on Mathematics education shows that, despite this long tradition, a large number of children and teachers find word problems very difficult to learn and to teach, respectively"* (De Corte & Verschaffel, 1991, p. 117).

Morgan (2001) re-affirmed the above statement and stated that:

> *"One of the reasons that many Mathematics teachers find it difficult to help their learners is that the teachers themselves have never been taught explicitly how to write mathematically and therefore lack ways of analyzing and communicating about the various mathematical genres"* (pp. 240-241).

Surely, when learners of these teachers pursued tertiary studies to become teachers, they might have encountered difficulty with such topics. Moreover, the problem could not have been solved easily since the topic was dealt with only for a short period of time at tertiary level. In the same way, the student teacher would lack confidence in the topic in his or her teaching career since he or she would have developed fear; anxiety and inferiority complex (Clarkson, 1991). When explaining this, Clarkson (1991) stated that:

> *"Most teachers have had a minimal amount of pre-service training, ...Hence, teachers have tended to teach how they were taught, and in a mode which is safe for them and ensures their authority is not challenged"* (p. 244).

This might be one reason why some learners would not write anything on WPs during the final examinations, since they had encountered it for the first time in the examination room. Even in this study, there are some learners who had left some questions unanswered. Furthermore, the teachers" incompetency might have lead them (teachers) to provide a "watered down" version of mathematical language (The Mathematical Association, 1987, p.2) or, "handed down" version (Clarkson, 1991, p. 244). That is, providing learners with information of how something should be done, without learners discovering it themselves.

Over and above the handed down version, many difficulties in the word problems lay with the English language contained within the statement itself (Clarkson, 1991; De Corte & Verschaffel,

1991; Setati, 1998). English is used as the language of learning and teaching (LoLT) at school, hence it is the language in which Mathematics is taught. English second language learners (ESLs) experienced difficulties since they had to cope with the new language of Mathematics as well as the new language in which Mathematics was taught (Setati, 2002). This might be one reason why English second language learners experience difficulty with interpretation of English statements into Mathematics. Similarly Donaldson (1978) claimed that the difficulty that the learners experienced in Mathematics was at least partly because of the problem of interpretation of the language. Word problems require that the learners first translate the word problem, written in English language, into a mathematical statement, which was a challenge for many learners. Orton (2004) further stated that when communicating meaning, this frequently involved the interpretation by the receiver_ in this case, it was the learner. In this way, teachers should be aware that messages might frequently be incorrectly interpreted by learners. It could be even worse for the learners whose primary language was not English since they had to translate into their primary language first, thereafter into mathematical statement (Barnett-Clarke & Ramirez, 2004). The translation might include writing symbols (=; <; >; ≥; ≤); writing correct equations and inequalities; solving simultaneous equations and drawing the correct mathematical conclusions. Moreover, many learners were unable to understand the English attached in the problem statement (Adler, 2001; Essien & Setati, 2006; Setati, Adler, Reed & Bapoo, 2002; Setati, 1998, 2008). Hence, they were unable to correctly interpret and translate the English into the mathematical language. As a result, Mathematics teachers had a dual task that they continuously needed to teach both Mathematics and English at the same time (Setati *et al*, 2002).

Teaching mathematical language involves teaching mathematical symbols which many learners do not understand. Costello (1991), re-affirmed this when stating that

> *"there are no doubt situations in learning Mathematics where „failure" is attributable not to lack of understanding of the Mathematics but to an inability to communicate this understanding in appropriate words and symbols"* (p.169).

This statement included cases where the learner was unable to design a word problem in his or her own words when given the equation. An example of this was illustrated in a study conducted by Ngcobo (1997), where a sample of 432 Grade 9 learners were required to translate two linear simultaneous equations by writing a real-life situation in words. In his analysis, Ngcobo

observed that 59% of the learners omitted the question. Another example of this was illustrated by The Mathematical Association (1987) where the learner was required to make a number story given 10 cubes comprising 6 blue and 4 red ones. The story could have been: "I went to the shop and bought some bubble gum for 4 pence. I got 6 pence change from a 10 pence piece" (p. 8). While enhancing the learners‟ mathematical thinking, such translations could also help the learners to improve their language skills.

Although Ernest (1996) stated that the impact of (English) language in Mathematics education was being given much attention in educational research, the language still hugely affects the learning of Mathematics. Moreover, not much improvement is being observed in as far as the use of language, particularly in word problems. I concurred with Ernest‟s statement that more instruction and learning took place through the medium of language. But, this had to be the language that the learner was *au fait* with. Piaget (1972) and Donaldson (1978) emphasized that learning occurred in a social context of meaning and it was mediated by language and the associated socially negotiated understanding. Moreover, one made meaning of the social contexts through language (Schultz, 1972; Berger & Luckmann, 1967). This implies the significance of language to learning.

Language barriers could cause learners to perform poorly. Generally, underachievement in Mathematics (especially in South Africa) is of concern. The research conducted by the Human Science Research Council (HSRC) revealed that Grade Eight South African learners, who participated in the Third International Mathematics and Science Study repeat (TIMSSR), were at the bottom of the list of thirty eight countries (Howie, 1999). One of the reasons for such high failure rate could be attributed to the English language usage in the problems.

2.3 Lexical ambiguity

In Mathematics education and mathematical education research it had been established that there were ambiguities in as far as the language usage in Mathematics was concerned (Durkin & Shire, 1991). Some words are ambiguous in that they are used differently in Mathematics as compared to their use in everyday language - they have different meaning when used in Mathematics as compared to their use in everyday English. It is worse with word problems as they are packed

with a lot of language cues. This ambiguity in words (as used differently in Mathematics than used in daily life) is referred to as "lexical ambiguities" (Durkin & Shire, 1991, p. 71). Durkin and Shire (1991) differentiated among four main types of ambiguities that the linguists had identified, namely: **homonymy; polysemy; homophony and imprecision or sloppiness on the part of the language.**

2.3.1 Homonymy

Homonymy refers to the property of some words sharing the same form but different meanings (Durkin & Shire, 1991). An example of this could be the word „power". In everyday language usage, this refers to the strength (for example: Sipho has the power to lift the 50kg bag of rice or the power of persuasion or even power in terms of electricity) and in mathematical terms this refers to the degree of a certain number (for example: the third power of 2 is 8). Another example of the homonymous word is „leaves". In everyday English, „leaves" refers to the outgrowths of tree whereas mathematically speaking it refers to the subtraction process (Durkin & Shire, 1991). Also, „times" would be a relevant homonymous word. It would, generally speaking, refer to periods in history and mathematically speaking it would refer to the operation of multiplication.

According to Nesher and Katriel, cited in Anghileri (1991), children often associate certain „cue" words with the operation in arithmetic. For example, „altogether" would be associated with addition. However, Anghileri (1991) argued that in many word problems there were no „cue words" to assist the learners to find the relevant operation, which might be one of the causes for them not to do well in this section of Mathematics. The example that is given is the problem: "My dog eats 4 biscuits every day. How long will a packet of 64 biscuits last?" (Anghileri, 1991, p. 100). In this example, there are no „cue words" indicating that the operation to be used is division. Hence, teachers need to be aware of the possible consequences of the absence and the presence of these cue words. There are many other cases involving multiplication and division where the learner is expected to be able to identify the operations associated with each. Furthermore, Anghileri (1991) argued that the interpretation of the multiplication symbol as „times" was not associated with a concrete operation by the learners, as they (learners) often do

with the other operations: add; subtract and divide. According to Anghileri, the learners interpret symbols as follows: „+" means „and" or „add"; „–" means „take away"; „÷" means „share" and „×" means „times" (p. 103). Anghileri claimed that the difficulty that learners experience in identifying multiplication as the appropriate operation in solving word problems might be attributed to the fact that they are unable to associate „times" with any of the operations, in addition to the linguistic constructions that are associated with the phrases (Anghileri, 1991).

Other homonymous words would be difference, table, volume, and so on. In an interview with a nine year old, Pimm (1987) indicated that a learner could not understand what the word „difference" meant in mathematical terms. When responding to the question: "What's the difference between 24 and 9?", the learner responded that "one has two numbers in it whilst the other one has one" (p.67). Two points of significance arise out of the learner's response:

1. The learner saw difference in the everyday usage (comparing physical structure) and
2. The learner saw 24 as comprising two numbers instead of 2 digits.

Furthermore, Orton (2004) demonstrated an example of the same word „difference" and stated that in a fortnightly mental arithmetic test for a primary school class a question of the type: "What is the difference between 47 and 23" was regularly included. He found that at first, one learner thought that question was rather odd, but answered it and said, "One of the numbers is bigger than the other" (Orton, 2004, p. 156). To the learner's surprise, when the test papers were returned, he was marked wrong. When the next test came with the same question, the learner tried a different answer and wrote "One number is about twice the other" (*ibid*, p. 156). Again, as one would anticipate, it was marked wrong. The next time he tried, he wrote "One number contains a 4 and a 7 but the other number doesn't" (Orton, 2004, p. 156). Over many tests the learner tried different „wrong" answers until such time that he asked for a correct answer from a friend, as he was very intimidated to approach the teacher right from the beginning. It is said that the teacher had generated fear among the learners as he [teacher] told the learners that "…there was no question of going to ask him why it was wrong" (*ibid*, p. 156). Combined with this fear was the misunderstanding of the language which eventually created an unhappy learning environment for the child. This example demonstrates that there is a problem with the language when teaching and / or learning Mathematics. With the learners' responses in this study, many

learners did not experience much problems answering questions on „difference". In their working, they used the operation „minus" (-), showing an understanding of what „difference" meant. The only challenge was mostly on mathematization, especially in the word problems whose expressions involved the use of the variables.

In another case, Hart (1981) stated that one secondary school learner was being interviewed and the interviewer was probing during the interview. The interview transcript went as follows:

Interviewer: Do you know what volume means?

Child: Yes

Interviewer: Could you explain to me what it means?

Child: Yes, it"s whatis on the knob on the television set.

From the previous examples, it seems that one word may have different meanings and learners are usually only familiar with the meanings that are used in everyday life. Hence, this might lead to more confusion to some learners when words are used in Mathematics. These examples suggest that the difficulties encountered with lexical ambiguities are widely experienced, and not all of these come to the teachers" attention. Whilst this may seem to be a silly misunderstanding, it seems to be common in Mathematics classrooms. Most often, it may be that teachers use the language of Mathematics whilst learners interpret the same words using the language used in their homes and communities. It is a challenge to teachers to be able to select, explain and discuss words that may have more than one meaning to the learners. This is not a difficult task for experienced teachers and it should be easily determined by careful questioning and probing.

Due to the problems that learners experience in translating WPs, obstacles can be placed in the path of the learners so that eventually their progress in Mathematics performance gets hindered. The fact that there are problems that some learners experience due to the lack of understanding of some words such as the examples given earlier, the introduction of the Mathematics vocabulary becomes of paramount importance (Austin & Howson, 1979). Although the vocabulary may be appropriate but at times learners might fail to interpret the statements literally and "…change the meaning into what they think the teacher intended to say" (Orton, 2004, p. 157). Simply stated, teachers should ensure that the learners understand what they are saying.

Moreover, this might suggest that teachers should be aware and should consider the possibility that the learners might give the wrong answers in Mathematics. The reason is not that they cannot do their Mathematics, but because they fail to understand the language inherent in the problem. However, one may not neglect the fact that whilst some learners might not have a problem with English language, but they might have problems with mathematization.

Therefore, I concurred with Orton‟s statement that on top of the problems that learners experience as a result of the English language, the introduction of mathematical symbols as the extension of the mathematical language further poses problems to the learners. Moreover, Orton stated that since reading Mathematics was not the same as reading any other text or literature, even more difficult when learning Mathematics in a second language. In addition, he argued that sometimes these difficulties were not experienced by the first language speakers but only the second language learners. He further stated that for any concept to be acquired or formed in learners‟ minds, it called for them (learners) to use appropriate language. Hence, there is a very crucial relationship between the development of English language and the learning of Mathematics. It is essential in Mathematics to ensure that "the underlying concepts and processes are communicated, [and] whether the meaning is being conveyed" (Orton, 2004, p.157). Orton further revealed that although the teachers were aware of the problems that learners have, they were less concerned as to what the cause was. Hence, Skemp (1982) spoke of the „deep structures‟ as well as the „surface structures‟ to elaborate more on the two levels. The emphasis is that there should be a relationship between the ideas of Mathematics that need to be communicated and symbols which represent the ideas through which meaning should be transmitted. Therefore, it is important that the teachers become aware of the potential problems that might be attributed to the lack of mathematical vocabulary.

When addressing the vocabulary issue, Orton (1994) argued the importance of a Mathematics vocabulary or Mathematics register, where all new words in Mathematics lessons were written down. He stated that each time a new word was learnt, it should be added onto the list. Moreover, Orton claimed that some teachers insist on giving learners a chalkboard summary. However, he argued that for the learner who did not grasp the terminology well during the introduction or revision of the words, the chalkboard summary could be of no help. Hence, it should come to the teachers‟ attention that the Mathematics register is of much importance and

start developing it in their Mathematics classrooms. It is further argued that the Mathematics vocabulary may range from simple words such as "find" and "sort" to more complex words such as "bilateral" and "quadratic" (Orton, 2004, p. 158).

Furthermore, Orton (2001) argued that in as much as there were problems with the non-development of Mathematics vocabulary, there were more problems when words used in Mathematics carried completely different meanings to everyday spoken language. When giving an example of such words, Orton mentioned the word „relation". In mathematical terms this is a set of ordered pairs whereas in everyday spoken English, this word refers to a member of the extended family, and between these there is no resemblance at all. However, there are many other words which are specifically used in Mathematics and for which there should be no confusion with the everyday language usage. The examples of such words are "numerator", "isosceles", "hypotenuse", and so on (Orton, 2004, p.158). But there are many words which are used only in everyday spoken language "before the mathematicians adopted them and assigned special meanings" to them (*ibid*, p.158). The examples of such adopted words are „field"; „group"; „root"; and so on. There ought to be a lot of confusion arising from the mathematical usage of words and their everyday usage. Hence, stories such as those discussed previously where the learner thought that: the volume was a control knob on the television or radio; a set was what one would used to prepare tea; "…axes are only for chopping with; …or who believe that a revolution is what happens when a government is violently overthrown…" (Orton, 2004, p. 158) are frequently in our mist, hence language problem will always prevail when learning Mathematics.

There are words whose mathematical meanings are different from everyday meanings but, the meanings are very close. Examples of such words are „similar", „segment", and so on. Generally speaking, the word „similar" refers to two or more objects that look alike due to some of their features being the same, regardless of the objects" sizes. On the other hand, in mathematical terms, „similar" refers to two figures (such as triangles; rectangles and other polygons) having angles equal, regardless of the sizes of the figures. Another word is segment. In mathematical terms, segment refers to the portion "…of the circle cut off by a chord or part of the sphere cut off by a plane" and in everyday usage it referred to "each of the parts into which something is divided" (South African Pocket Oxford Dictionary, 2002, p.813). Orton (1999) stated that

sometimes the word segment was inappropriately used in general terms when the relevant word that should have been used is „sector". Generally speaking, a sector is "an area or part that is distinct from others" (South African Pocket Oxford Dictionary, 2002, p.812). Also, a sector might refer to "a distinct part of an economy, society or field of activity" (*ibid*, p.812). However, in mathematical terms, a „sector" is defined as "a part of a circle between two lines drawn from its centre to its circumference" (South African Pocket Oxford Dictionary, 2002, p.812). In geometry, many learners also experience difficulty in appropriately using the word „arc". Mathematically speaking, an „arc" is a curve, forming part of the circumference of the circle, whereas in everyday language, an arc is a "curving passage through the air" (South African Pocket Oxford Dictionary, 2002, p.39).

Some words are said to have specialized meaning in other subjects. These include, among other words, „chord". In mathematical language, the word „chord" refers to the line that is drawn from a point on the circumference of the circle to the other point on the circumference. On the other hand, in everyday spoken language the word „chord" refers to the group of three or more notes sounded simultaneously in harmony (South African Pocket Oxford Dictionary). Furthermore, the word „chord" is often confused with the word „secant". In mathematical terms, the word „secant" refers to the line which is "…obtained when a chord is produced in both directions…" (Orton, 2004, p.159). However, most often, the word „chord" was found to be used for this extended line as well. It was further argued that even the word „produced" brought problems since many learners could not understand why the word „extended" could not be used instead. The literature revealed that even the word „circle" has two meanings and only in mechanics that a distinction between the two meanings as a „disc" and as a „ring" was made (Orton, 1999; Orton, Orton & Roper, 1999). Furthermore, Orton (2004) argued that, for some words, it was very difficult for learners to understand the difference in meanings. Such words may include „odd", „real", and so on. Orton emphasized that it was very important to give learners an opportunity to come to terms with the new mathematical meaning since many words that were used in everyday language had different meaning to that of mathematical language. He made an example that when words such as root, product, and so on, were introduced in a mathematical lesson, learners had to be accustomed to the new meaning. Orton suggested a method for teachers to employ when developing the mathematical register. That is, teachers had to write down all the technical terms used throughout the year with a Mathematics class. These terms can be classified into four

categories, namely: those that are strictly mathematical, those that are not unique and whose difference in meaning was subtle, those which have a completely different meaning and those that are odd.

From the discussions above, it is clear that the teachers should take the vocabulary issue very seriously, if not, this could hinder learners from expressing their mathematical ideas. Orton (1994) argued that for some teachers, the problems posed by the vocabulary might be seen as superficial within both the language issues and Mathematics learning, but, it was very critical that these problems be attended to as they would not just go away. The language helped learners to facilitate their learning of Mathematics and therefore they needed to be assisted with mastering the vocabulary so that they could use it to discuss and process ideas.

2.3.2 Polysemy

Polysemy refers to the property of some words having two or more different but related meanings (Durkin & Shire, 1991). An example of such words referred to in Durkin and Shire are „mouth" and „product". Mouth, in everyday usage refers to the part of the face and also, on the other hand, where the river meets the ocean. However, in these two meanings, what is common is that they both refer to the „opening". A mathematical example could be „product". It is what one gets after multiplication and in everyday use, it is what has been completely made. Therefore, the common understanding of the word is "that which is produced" (Durkin & Shire, 1991, p. 72), although in Mathematics it refers only to the answer after terms are multiplied. In this study, a question was asked where learners were expected to find the product of 9 and 8. Most learners got it correct and they seemed to understand the mathematical meaning behind it, hence they used the correct procedure to arrive to the correct solution. However, with the word problem on perimeter, some got it incorrectly. Learners were expected to choose the appropriate definition of the word „perimeter". The given definitions were „piece of land" and „sum of the outside edges". Many of learners chose „piece of land". Probably they were easily confused by the fact that in most cases a rectangle is used as an example when deriving the formula or calculating the perimeter.

2.3.3 Homophony

Homophony refers to the phenomenon where two different words have the same pronunciation. According to Durkin and Shire (1991), the mathematical examples would include "two/too/to; four/for; sum/some; pi/pie"; and so on (p. 72). These authors argue that the use of these words may lead to a misunderstanding, especially to some learners. In this study, a question with homophonous word was asked and it stated „The sum of two numbers is 24". Although many learners were unable to get the correct expression, most indicated that they understood the mathematical meaning of „sum" as „adding". Therefore, one could conclude that it was only mathematization that failed them other than the homophonous nature of the word „sum / some"

2.3.4 Imprecision or sloppiness on the part of the language

Over and above the categories of lexical ambiguities that have been identified by linguists, Durkin and Shire (1991) further introduced the fourth category, namely **imprecision or sloppiness on the part of the language** (p. 72). Although this might occur in any language use, these authors indicated that it was more common in mathematical contexts. These would include „average" instead of „mean"; „share"- implied in division. Furthermore, these authors claimed that like any other language users, the Mathematics teachers fall to the same pit of using imprecise and misleading words. Moreover, Kerslake (1991) shared a similar idea as he argued that "…many of the difficulties that learners experience are due to the restricted and imprecise use of language in describing fractions" (p. 86). In this case an example of the semi circle is made whereby in primary schools it would be labeled as "one half" or ½ whereas the semi circle is the whole piece in its own right. It is therefore recommended that in such cases, the learner should not see just these pieces as individuals, but to regard them as part of the whole piece. One example of the sloppiness that was observed in this study was that of the explanation of the word „consecutive" as given by learners. The following is the dialogue between me and the learner:

Interviewer: What do you think consecutive means?

M39: I think it means numbers that are following each other.

From the above conversation, it could be concluded that learner M39 did not think of the fractions and decimals that are in between the two consecutive numbers. It should be made clear to the learners that he or she must talk of the whole numbers as the numbers that follow one after the other.

Furthermore, Kerslake (1991) argued that there was a lot of classroom jargon with regards to language used in fractions. Among other phrases that he regarded as meaningless were, "sharing by" and "dividing into". Anghileri (1991) added other phrases such as „divided into"; "divided by" and shared between". According to Anghileri, the correct interpretation of the division symbol (÷) is „divided by" whilst „sharing between" is only applicable to the division of whole numbers. Therefore, sharing in decimal numbers is meaningless. Kerslake (1991) stated that meaningless phrases such as "sharing by" and "dividing into" affect learning to a larger extent since many learners just use these phrases anyhow. The learners just pick up these phrases and eventually use them. In contrast, teachers just assume that the learners have absorbed these, without knowing what meaning these have for the learners and what image they present. All that is known is that they carry with them a general idea of a sharing or dividing activity. Eventually, learners learn that there is not necessarily any connection between word and ideas. Most, if not all teachers, initially use the notion of sharing items between children when introducing the idea of division. In this case one has sweets and children who want a fair share; hence this is regarded as a natural form of speech. This was emphasized by Anghileri (1991) when he stated that „sharing" activities provide one with the experience of the language and concepts of multiplication and division, and that is where terms such as "lots of"; "each; "equally" and "fair" are exploited and are necessary for later developments. However, Kerslake (1991) stated that the confusion came in when statements such as "sharing sweets by children" are introduced (p. 88). Kerslake argued that this confusion lay in the comparison with "dividing by" and this was said to apply strictly to numbers only. While still on the concepts that apply to numbers only, there are these "global truths" which young children are given during their early years of schooling, that "multiply means make bigger"; "divide means make smaller" and (you always divide a smaller number into a larger number" (Kerslake, 1991, p. 93). These are only applicable when working with the whole numbers or counting numbers and not when the numbers include fractions.

Another word that Kerslake (1991) foregrounded is „cancel". He stated that this is another instance where a word tends to be confused with a concept. Generally speaking, the use of the word "cancel" carries an idea of "to annul, to remove, to undo, to countermand or to neutralize" (p. 90). Hence this might be an explanation of why many learners appeal to the notion of canceling to escape from difficulty. But in actual fact, this is not a reflection of what happens when a fraction is cancelled. This is an example of what happens when a word is used in general terms and has a specific mathematical meaning attributed to it, but never refers to what has been done. Finally, Kerslake argues that, "Mathematics is hard for many people to learn; [and] we do not make it any easier by using ill-defined words and by changing the interpretation of others without even a minimum acknowledgement" (p. 90). This is to emphasize that we as teachers should avoid making things any worse by using the classroom jargon in Mathematics and it should be our task to make every effort to make sure learners understand the meanings of the terms that are used in Mathematics.

2.4 Some ambiguous words in Mathematics

There are words that are ambiguous when used in mathematical terms and when used in everyday spoken English language. The following are some of the ambiguous words that are commonly used in school Mathematics as listed by Durkin and Shire (1991, p. 74), namely:

> above, altogether, angle, as great as, average, base, below, between, big, bottom, change, circular, collection, common, complete, coordinates, degree, difference, different, differentiation, divide, down, element, even, expand, face, figure, form, grid, high, improper, integration, leaves, left, little, low, make, match, mean, model, moment, natural, odd, one, operation, overall, parallel, path, place, point, power, product, proper, property, radical, rational, real, record, reflection, relation, remainder, right, root, row, same, sign, significance, similar, small, square, table, tangent, times, top, union, unit, up, value, volume, vulgar.

In addition, Orton (2004) also stated some words which he considered ambiguous. Those are: axes; chord; circle; revolution; segment; set. Over and above common ambiguous words mentioned earlier, Kerslake (1991) gave certain word combinations that are created within

Mathematics that are intended to represent meanings which are different from their everyday usage. Examples of these would include: simple interest; pie chart; square root; closed figure; compound interest; and so on (Shuard & Rothery, 1984). Moreover, Durkin and Shire (1991) further stated that some colloquial descriptions of mathematical operations have meanings which are alternate to the everyday ones, for example, „take away" and „takeaway". In mathematical terms „take away" will mean „subtract" and generally speaking, a „takeaway" is the food bought in a kind of a restaurant and taken away and not eaten inside the restaurant. In this study, some ambiguous words were confused with everyday meaning. Some of these words are even, area, irrational. Some learners wrote the following (in brackets) as the definitions of these words: even (although), area (place), irrational (stone-headed). This should be an indication to the teachers that they should be aware that there are such words and therefore, in their lessons they should try and minimize the confusion and misconceptions that learners might have.

2.5 Metaphors in Mathematics

According to Nolder (1991), the ambiguity arising between the mathematical meaning and the ordinary English meaning may be clarified by making use of the metaphors. However, he argued that "…while metaphors may be of pedagogical value, they can also engender misunderstanding and confusion in the Mathematics classroom" (Nolder, 1991, p. 110). For example, a metaphor that "Algebra is shorthand" and therefore letters can be used as short forms of words. For example an identification: a = apples and b = bananas will lead to learners think that 2a + 4b means two apples and 4 bananas. Although such identification may be of great help at the beginning, it may obscure the mathematical meaning of 2a + 4b which is: two times the number of apples plus four times the number of bananas, where „a" and „b" represent apples and bananas respectively (Orton & Orton, 1999). Furthermore, Nolder (1991) argued that, in metaphoric identification of letters and objects, not only the concept of variables is missed out but also its development might be hindered. Hence, learners should be encouraged to talk through what they are thinking so as to identify the source of their mathematical errors whilst eliminating them.

2.6 Reading Mathematics

As it has been indicated previously in this chapter, reading a mathematical writing is different from reading an everyday language text. However, language problems may impede the progress of the learners. Hence, as much as possible, teachers should equip our learners with the language skills and the relevant vocabulary so as to help them improve their performance in Mathematics. On the other hand, Orton (2004) emphasizes that the mathematical text should be readable. This means that learners should be "…able to learn without the language itself getting in the way" (p. 160). This was also argued by Setati and Duma (2009) when they stated that the learners should be able to freely argue their point at any time without the language being a hindrance. In addition, Orton (2004) argued that the length of the words, the length of sentences, the specific words used and whether these words are part of the learners" vocabulary may all be equally important. Since some text may not be readable to some learners, Orton argued that there were many techniques or formulae that have been developed so as to check whether the text to be read is appropriate. Among the techniques used to check readability of text as mentioned by Orton (2004) are: the Dale-Chall formula, the FOG formula, the Flesch formula, the Fry procedure and the „cloze" procedure; etc. According to Orton (2004) the Dale-Chall formula is based on the sentence length and percentage of unfamiliar words in that sentence, whereas the FOG formula is based only on the average number of words in a sentence and the percentage of words with three or more syllables. Whilst the Flesch formula is used to compare the average number of syllables per 100 words and the average number of words in a sentence, the Fry procedure is based on the number of syllables and the number of sentences in a 100 word passage. Lastly, the „cloze" procedure is based on the ability of the reader to fill in the missing words in a text. It is stated in Orton (2004) that due to the peculiarity of mathematical text, Kane (cited in Orton, 2004) developed a formula specifically for mathematical texts only. However, owing to the complexity of the formula to use and the fact that it cannot give appropriate results in any place other than USA, it cannot be used here in South Africa.

2.7 Semiotics

Mathematical text can either be in a form of plain text or symbols. For example, 3 and three convey the same idea but have different forms. When reading the mathematical text it is important that the reader be able to read all forms, including the scenarios where the mathematical symbols are incorporated within the text (Orton, 2004). However, reading mathematical symbols has peculiar difficulties. For example, to an experienced learner, the expression (4+3) x 2 gives a clear message that one has to first add 4 and 3, thereafter multiply the sum by 2, but to someone else the inclusion of the parentheses does not give a clear indication as to what to do. Orton (2004) argued that "sometimes it is necessary to read a collection of mathematical symbols before a clear message can be obtained, for example

$\int_1^2 x^2 \, dx$. Sometimes same surface structure implies different meanings, for example 34 and 3x" (p. 163). Frequently learners experience difficulties when coming to terms with many different Mathematics symbols and their corresponding words. For example, in 7 + 6 = 13, commonly the young children will read the „+" as „add" whereas the statement „add 7 and 6", would not, in many cases, be written as +7 and 6. This then confuses some learners as they cannot follow the order as to why the latter cannot be done. Orton (2004) argued that on the same note, the „=" sign at first would be read as "makes" and later on as "equals" (p.163). Moreover, the very same symbol „=" at times may be read as „leaves" for example in 7 – 4 = 3. Durkin and Shire (1991) stated that, the symbol „=" may mean „equals, means, makes, leaves, the same as, gives, results in, and so on". Hence, it is assumed that this language diversity might be one reason why many school children experience difficulty in interpreting the equal sign in their school years (Baroody, Lai & Mix, 2006). Although these meanings might be applicable to some situations, there are cases where they cannot be appropriate. For example, „makes" cannot be applicable to

$\frac{d^2y}{dx^2} + 3\frac{dy}{dx} = 7$. Still on the mathematical symbols, Orton (2004) argued that many learners read the symbol „x" in 4x5 as „times" and that implies 4 lots of 5 but at secondary school level, the teacher would emphasize that it is „multiplied by" which has an implication that it should be „5 x 4" and this is 5 lots of 4. On the other hand, many learners read the division symbol „†" as „shared by", despite the fact that 15†5 might represent the sharing of 15 items between 5 individuals and might also represent the number of groups of 5 items that can be obtained from

15. Furthermore, it is crucial to differentiate between the very similar symbols in Mathematics. Orton gave examples of these similar symbols as „+“ and „x“, „—“and „†“, „2x“ and „x^2“. The different meanings of the latter tend to give many learners some difficulties. According to Skemp (1982), the mathematical symbols are the surface structures, but what is important is what is represented by the surface structures. Eventually learners have to be able to differentiate between the variety of symbols with same surface structures, for example: 23, 2⅔, 2a. Also, $5P^2$, $5P_2$, $^5P_2$, $\sum P^2$ and $\sum P_2$ have the same surface structures but have different meanings. There are many other mathematical symbols that tend to confuse learners because of their different meanings. For example, the fact that dy is a single unit and not a product like 5y, can cause problems. Another example is $\frac{dy}{dx}$: it becomes difficult for some learners to understand that this is not the quotient like $\frac{5y}{5x}$. Because of the difficulties experienced by most learners when dealing with the mathematical symbols, Skemp (1982) claimed that this could be attributed to the lack of understanding the deep structures, and then suggested some solutions to minimize this, as follows:

1. The symbols should only be introduced at the final stage of learning, developed from physical or concrete embodiments of the concepts.
2. The mathematical ideas should be sequenced such that there is a connection between the new concepts and the already learnt ones, and not just discrete.
3. The pressure to quickly convert to an abbreviated symbolism should be resisted and the spoken language needs to be used for an extended period of time.
4. The transitional notations should be first dealt with for a longer period before the condensed symbolism can be introduced, for example, Area=length x breadth needs to be used thoroughly before A=l x b can be introduced.

I strongly agree with Skemp, especially in his points number 3 and 4. I could observe that many learners were unable to correctly use the formulae A=lxb and P=2(l+b) to respond to word problems on the worksheet. Instead of working with the variables, they substituted with any numbers and tried to work out the solution. When asked why they did so, learner D2 stated that

he knew “Mathematics as numbers”. The reason for this might be that there was a quick conversion to abbreviated symbols.

2.8 Communicating meaning

Orton (2004) claimed that, the difficulty that the learners experience in Mathematics is at least partly because of the problem of interpretation of the language. Furthermore, he stated that when communicating meaning this frequently involves the interpretation by the learner. Hence, this should be a warning to teachers, that messages might frequently be incorrectly interpreted by learners. As previously stated, learners tend to interpret the statements into what they think was intended, the Cockcroft Report (1982) recommended that Mathematics teaching should allow learners the opportunities for discussion between learner and teacher, and between learners themselves. According to the Mathematics learning theories there is a very huge relationship between the language and learning. When emphasizing the relationship between the language and learning, Vygotsky (1978) argued that behind words there is the independent grammar of thoughts. In addition, he stated that language does not only serve as a medium of instruction and exchange but the instrument that can be used by the learner in bringing order to the environment. There is also a big relationship between the language, knowledge and thought processes (Barnes, 1976). Hence, according to Vygotsky (1962), talking for the benefit of oneself (egocentric speech) is important in that it serves mental orientation and conscious understanding, it helps in overcoming difficulties, and it is intimately connected with thinking. It cannot be over-emphasized that talking offers the teacher an opportunity to gain access to the learners‟ thoughts, which has been previously gained through question and answer method. Although this was valuable but, it did not allow for adequate learner involvement like class discussions do.

2.9 Language, Culture and Mathematics

According to Orton (2004), to communicate mathematical ideas for the message to be adequately understood is very difficult when both the teacher and the learner have a common first language, let alone when their preferred languages differ. Generally at the school level, learners are

expected to communicate and learn Mathematics in a language which is different from the one they normally use at home. Although learners might have some knowledge of a language used for learning, English in this case, this knowledge might be very restricted. As discussed earlier, the language is the vehicle for one‟s thoughts and not only used for communication (Vygotsky, 1978). Hence, when a learner has a very restricted knowledge of the language, it becomes very difficult for him to express his thoughts. Furthermore, Vygotsky (1989) stated that language influences the child‟s intelligence. If the learner has inadequately acquired the language, he or she cannot adequately express his or her intelligence. Moreover, Orton (2004) argued that almost certainly the language that is used for thoughts is the first language, thus when Mathematics is communicated in one language (in this case English) it might need one to first translate to another language (mother –tongue) to allow thinking, and thereafter translate back in order to communicate with the teacher. During this "…two-way inner translation process" (Orton, 2004, p. 169), the errors and misunderstanding might occur. Also, Orton further argued that in most cases, the lack of mathematical vocabulary and symbolism in most languages makes it difficult to translate Mathematics into a second language. In addition, Berry (1985) argued that it is likely that there are more severe problems which learners will experience when trying to learn Mathematics through an unfamiliar language which is different from their own. According to Berry (1985) learners become more at ease and function more effectively in a second language which is semantically and culturally close to their own language. Moreover, the structure of the learners‟ vernacular has a strong influence on their cognitive processes such as classifying and recognizing equivalences, which are processes central to the understanding of mathematical concepts. Hence, it is suggested that there is a greater need for development of the Mathematics curriculum which will enable and encourage learners to think in their mother tongue. Orton (2004) argued that both the anthropological and linguistic studies have proven that language and culture cannot be separated, hence "…no amount of translation will help many learners around the world, if the Mathematics does not fit the culture" (Orton, 2004, p. 170).

The literature revealed that the gap between the mother tongue and the language of instruction causes more problems, especially since the language of instruction is the one which dictates the design of the curriculum. One other suggestion is that since culture and cognition are strongly related (d‟Ambrosio, 1985), then a closer look at the relationship between ethno-Mathematics and cognition should be taken in order to improve the learners‟ mathematical competence around

the world (Orton, 2004). Furthermore, Orton argued that there is evidence that the bilingual learners academically suffer when learning arithmetic word problems in their weaker language (in this case it is English).

2.10 Word problems

According to Orton (2004), simply speaking, a word or verbal problem is a question requiring the application of Mathematics in order to arrive at a solution; however, the required procedure has to be first extracted from the sentences. Such sentences are intended to bring forward a real-life setting. Word problems differ in their semantic structures position and hence the position of the unknown will differ. For example, the structures of the following two sentences are different:

1. Maria had 6 marbles. Her father gave her another 4 marbles. How many marbles did Maria have altogether?

2. Maria had some marbles. Her father gave her 4 more marbles. Now she has 10 marbles. How many marbles did Maria have at the beginning?

The first example only requires the use of the elementary procedure $6 + 4 = x$ whereas to solve the second example, one would go as $x + 4 = 10$. Clearly the position of the unknown, x, is different for each case. According to De Corte and Verschaffel (1991) the sequence of the given numbers in the problem text matters when learners are required to solve the word problems. Although word problems require the use of the four basic operations: addition, subtraction, multiplication and division, De Corte and Verschaffel argued that for the young children, the writers of the textbooks should pay more attention to the formulation of word problems. In addition, Orton (2004) claimed that to solve WPs, one requires to use a combination of knowledge, rules, techniques, skills, concepts and simple algorithms in a new way.

2.11 Conclusion

The literature reviewed served as a solid basis to embark on the fieldwork for this study. In mathematical education research there are ambiguities in how language is used in Mathematics compared to its everyday use. For example, words such as „difference" „volume" „areas" and so on, have different meanings in Mathematics compared to everyday life. Moreover, research has shown that many learners encounter problems when translating English statements into Mathematics. Furthermore, some teachers find word problems difficult to teach. From my teaching experience I strongly agree that English statements, WPs in particular, are a challenge to many learners as many cannot correctly translate them into mathematical expressions.

CHAPTER THREE

THEORETICAL FRAMEWORK

3.1 Introduction

This chapter focuses on the theoretical framework on which the study is based. In this chapter the Social Constructivism Theory and Social Cognition will be discussed. Social constructivism is the theoretical framework within which this study is based.

3.2 Social constructivism

In this study the researcher used the constructivist theory to understand the effects of English language in learning of word problems in Mathematics classes for English second language learners and to analyze data collected. This study was framed within the theory of constructivism and, in particular, social constructivism as espoused by Ernest (1991). Ernest (1991) argued that "social constructivism views Mathematics as a social construction" (p. 42). Ernest (1996) further argued that in social constructivism, people engage in "meaningful linguistic and extralinguistic interaction and dialogue" (p. 342). This means that for the learners to construct meaning in Mathematics, they have to engage in a social discussion. When engaged in such discussions, the learners use a language to talk, share ideas, engage in debates and mathematical talks, and so on. Similarly, von Glasersfeld (1991) argued that "knowledge is not passively received but actively built up by the cognizing subject" (p. 162). The strength in this statement lies in the fact that constructivists believe in learner-centred learning and that knowledge can only be obtained through active participation of the learner. By implication, this means that the learner has to take ownership of his / her own learning (Ernest, 1996; Skovsmose, 1994, von Glasersfeld, 1991). A further implication is that true learning takes place only when meaning arises out of what the learner construes to be of importance (Ernest, 1991; 1996). However, it becomes difficult for the learner to be the active participant in his or her learning if they do not understand the language in which Mathematics is discussed, for example translating the word problem into mathematical equation. What makes it even more difficult is that research shows that learners think in their vernacular language then translate the thought to language of instruction (Barnett-Clarke &

Ramirez, 2004). In the case of second language English learners, they would need to read in English, translate to their vernacular language, translate to mathematical language and then again to English. Some information may be lost in this transition process. In this study, this would be more relevant since all the learners involved in the study are the English second language speakers.

According to Ernest (1996), social constructivism has a number of important suggestions. These include, among others: Firstly, how social interaction develops the mind of the learner and its impact on the learners‟ conceptions and classroom activities. This suggests that social interaction plays an important role in the development of the child‟s mind. Moreover, the way the concepts are formed in the learner‟s mind is informed by this social interaction with both his/her peers and the teacher.

Secondly, the focus of concern goes to an extent of the learner‟s nature of his thought which is bound by context. In addition, the way one thinks is expressed through language as Vygotsky (1978) stated that the language is the vehicle for one‟s thoughts. Vygotsky further stated that language is the shaper and also the summative product of the minds of the individuals. This suggests that one‟s language has to be sharpened in order for his thoughts to be articulated well since much instruction and learning occurs directly through the medium of language. Furthermore, learners experiencing difficulties with the language used as a medium of instruction might be deprived of the opportunity to express their thoughts. Therefore, learners should be assisted in mastering Mathematics by making language more accessible**.** Piaget and Bruner, as cited in Ernest (1996) also emphasized that learning occurs "…in a social context of meaning and is anyway mediated by language and the associated socially negotiated understandings" (p. 343). From these claims it is clear that language is a social issue. This study attempted to understand whether language has an effect on the learners performing poorly in word problems. In addition, the context under which the learner learns plays a major role. Hence, different contexts under which the learners in this study learn were explored to a greater extent.

Generally, in a South African school context, the English language is the medium of instruction and learning. This suggests that for learners with language problems, it becomes more difficult for them to translate the English statement in the word problem into a mathematical equation. Therefore, to such a learner who has very limited language skills, incorrect meaning might occur.

The context determines the way of the learner‟s thinking. Therefore, this suggests that teachers should create the conditions which enhance effective learning, conducive for the learners to think in a mathematical way, and which propels learners to think positively about the subject content.

Third, social construction of knowledge calls for a greater pedagogical emphasis on discussion, collaboration, negotiation and sharing of meanings and ideas. This pre-supposes, amongst others, the importance of active verbal interaction where learners share ideas through engagement in group discussions. Through this, learners learn to work collaboratively with other members of the group, learn to accommodate others‟ ideas without feeling threatened, and therefore acquire more knowledge and understanding of the concepts. However, one cannot actively participate in verbal interactions when the language through which he or she communicates is not well developed.

Furthermore, this might suggest that teachers have to re-visit their teaching methods. They should ascertain if their methods are changing from being too teacher-centred to being more learner-centred. Teaching methods should allow for discussions, sharing of both ideas and experiences.

Lastly, for a social constructivist, mathematical knowledge is full of texts and semiosis. Mathematics involves the usage of English text as well as mathematical symbols. This includes translation of English statements into mathematical equations. Hence, it can be argued that some learners who are English second language speakers, can have problems in translating the English statements into mathematical equations, especially in word problems. This is due to the fact that they have to first translate from English to their home language and then into Mathematics (Barnett-Clarke and Ramirez, 2004). In this manner, the information may be lost on the way during translation.

According to Ernest (1996) “social constructivism regards individual subjects and the realm of the social as indissolubly interconnected” (p. 342). This means that the people and the social issues in their societies are closely related. Since the language is a social construct, it implies that to understand and grasp the mathematical content in class, the learner has to understand the language of instruction. This means that learners have to understand English fairly well in order to understand the word problems and be able to translate them into mathematical equations.

Ernest (1996) also claimed that human beings form relationships through their interactions with each other as well as their individual processes. Hence for the learners to have effective learning, they have to socialize and share ideas of how they have made progress in as far as their solution of the mathematical problems are concerned. This can be based on arguments by Ernest (1994) and Harre‟ (1989) when they stated that there is no metaphor for the isolated individual mind but instead the underlying metaphor of social constructivism is that of persons in conversation, comprising persons in meaningful linguistic and extralinguistic interaction and dialogue. Therefore, one might conclude that if there is a problem with the language, specifically in word problems, then there can be no meaningful linguistic interaction and dialogue between learners and somehow they will be socially withdrawn. Ernest (1996) stated that when people are involved in a dialogue, that renders them pride and they feel very important. By implication, when learners are unable to communicate due to their lack of translating English statements in word problems and write them mathematically, they can become less confident and less social. Therefore, learners have to be active participants when constructing meaning. Cobb (1994) also stated that learners‟ experience plays an important role in their learning and during construction of meaning. On the other hand, I agree with Orton and Frobisher (1996) in that it is not implied in constructivism that learners can make progress only on their own, nor is it suggested that the teacher has no contribution to make. Moll, Ggultig, Bradburg and Winkler (2001) similarly argued that learning was not spontaneous but provoked by situations and by the teacher. The situations that contribute to a conducive learning have to be created by the teacher, however, as much as possible he or she should guard against spoon-feeding learners. Instead, learners should more often be encouraged to work together in solving problems.

Studies have shown that children working together in dyads or triads tend to perform better or at a higher level that children working as individuals (Doise, 1990). Therefore, this explains the important role of social interaction during the development and learning process of a child. From the above discussion it can be concluded that the kind of learning to be achieved by the end of a learning process has to be pre-defined by the teachers in terms of outcomes (Skinner, 1968). According to Ernest (1996) the social constructivists‟ model is regarded as a socially constructed world that creates and is constrained by the shared experience of the underlying physical reality. It is important therefore that the Mathematics teacher structures his / her work in such a manner that allows for learners to interact in order to improve learning, especially in word problems.

3.3 Zone of Proximal Development (ZPD)

For the teacher to achieve the learning outcomes (LOs) in Mathematics it is important for him/her to understand the process of knowledge acquisition and knowledge transfer and not only be concerned about the construction of meaning and understanding. During the process of both knowledge acquisition and knowledge transfer, the social interaction can play a major role. According to Vygotsky (1989) the true direction of learning and development of thinking in one‟s conception are not from the individual to the socialized but from the social to the individual. Again, it is argued that learning is the outcome of internal developmental processes that are able to operate only when the child interacts with people in his/her environment and in co-operation with his/her peers (Vygotsky, 1978). Vygotsky calls this the Zone of Proximal Development (ZPD). Vygotsky (1978) defined ZPD as:

> The distance between the actual development level as determined by the independent problem solving and the level of potential development as determined through problem solving under the actual guidance of or in collaboration with more capable peers (p.35).

Newman and Holtzman (1993) argued that the notion of the ZPD gives the explanatory framework for learning as a whole, in both the formal settings (such as learning in schools) and informal settings (such as learning outside the schools). As for Vygotsky (1978), within the ZPD there is the development of higher cognitive functions, and most learning within ZPD takes place when learners are involved with tasks or problems which go beyond their immediate individual capabilities in which teachers or adults assist their performance or in collaboration with more knowledgeable peers. According to Vygotsky, interaction with peers is an effective way of developing skills and strategies. He suggested that teachers use cooperative learning exercises where less competent children develop with help from more skilful peers. Vygotsky argued that when providing the appropriate assistance (scaffolding) to a student who is at the ZPD for a particular task, it will give the student enough of a "boost" to achieve the task. Once the student, with the benefit of scaffolding, masters the task, the scaffolding can then be removed and the student will then be able to complete the task again on his own. Having given word problems on the worksheet, learners answered them individually. After the answers were marked, learners were interviewed on their incorrect responses either individually or as a group. Thereafter,

brighter learners led discussions and helped one another on how they were supposed to have written answers. To a greater extent that helped many learners as they gained confidence to work individually to solve other problems which they had not finished.

3.4 Situated cognition

Within the broad context of social constructivism, the theory of situated cognition was the lens that I used to collect and analyze my empirical data. The emphasis on this theory is that what is being learned cannot be isolated from the context in which it is learned, instead, the context forms an integral part of what is learned (Brown, Collins & Duguid, 1989; Lave & Wenger, 1991). As a result, Brown *et al* argued that learning and cognition are "fundamentally situated" (p. 32). Furthermore, Lave and Wenger (1991) claimed that in a situated learning environment, learning of skills and knowledge occurs in the contexts that reflect how the knowledge is gained and applied in everyday situations. Hence, by this theory, it is important that what the learners learn in the classroom situation be applicable to the everyday life (Schell & Black, 1997). When emphasizing the importance of learning in real-life contexts Hannafin and Hill (2007) argued that for knowledge to be acquired, the subject matter has to be embedded in the experiences of the learner and, moreover, the opportunities be created for the learner to interact with the real-life situations. Once such a natural environment has been created, transfer of learning occurs as the learners engage in solving complex, non-routine problems that they would likely come across in job situations (Winn, 2002). In addition, Hardy and Moore (2004) stated that in such environments, the learners should refer to and apply their experiences so as to participate and intervene in the social environment in which they are situated. Hence, it can be argued that effective learning occurs when the learners are allowed an opportunity to use their experiences and more familiar contexts. This can be based on Driscoll (2004) when he acknowledged the importance of learning in contexts. Driscoll argued that when learners learn in familiar contexts they are more capable of relating new information than they would be in an unfamiliar context.

This emphasis on the importance of contexts indicates that human actions are dependent on the context in which they occur (Halliday & Hasan, 1991). Gee (2004) also argued that the environment in which one interacts provides one with various affordances that eventually result

in perception which becomes a consequence of the properties of the environment. This has an implication that when a learner does not interact well with the environment of learning (due to various reasons such as language barrier), he or she might end up having a negative perception about the subject or topic. This can be the case with learning word problems. Therefore, the learner has to be involved in an environment that promotes social interactions so that he or she may be assisted all the way through his / her cognitive development. Vygotsky (1978) claimed that, the social interaction plays a major role in cognitive development. When arguing his point, Vygotsky stated that, "every function in the child‟s cultural development appears twice: first, on the social level, and later, on the individual level; first between people…and then inside the child" (p. 57). From this statement, the role of social interaction during learning cannot be underplayed. More importantly, Vygotsky‟s theory further claimed that an individual‟s development cannot be understood without reference to the social environment in which the individual is situated (Driscoll, 2004). Lave and Wenger (1991) also argued that social interaction is a critical component of situated learning. One principle of situated learning is that learning requires social interaction and collaboration and hence learning is social (Greeno, 1998, 2006; Lave & Wenger, 1991; Salomon, 1996). Therefore, the social environment is of paramount importance. Moreover, the different abilities of the individuals in a social interaction are considered. As all individuals actively participate in a discussion or activity, others during these social interactions do consider that members have varying and different abilities and hence make various contributions to activity, and possess varied opinions (Halliday & Hasan, 1991). In this study, the more gifted learners engaged other learners by leading discussions on solving word problems on the worksheet after they had been marked for. Thereafter, other learners gained confidence to try problems on their own. The schools‟ contexts were of importance for this study since that might have an impact on the learners‟ performance as well. Contexts against which schools were checked were: whether the school was rural or a township school, whether it was an English medium school or IsiZulu medium school, whether it was an ex-model C or African public school, and so on. The participating teachers from the same schools were also checked their genders, their first languages, and so on. The study was conducted in three township schools and two rural schools.

3.5 Conclusion

According to the constructivists, the learner‟s understanding is constructed by the individual‟s effort by being actively involved in his learning (von Glasersfeld, 1991). This means that the learner should not be passive but take ownership of his learning so that he or she will have new discoveries (Ernest, 1996; Skovsmose, 1994). However, for social constructivists, there should be social interaction for one to make sense of the world. The emphasis on the social interaction and communication is to facilitate learning. The teachers therefore should create the environment which enables learners to take advantage of social interaction (Halliday & Hasan, 1991).

CHAPTER FOUR

RESEARCH DESIGN AND METHODOLOGY

4.1 Introduction

In this chapter, the data collection methods that were adopted in this research study are introduced and discussed. When discussing each of the research methods, a reason for its selection and use in the study is provided. Also, the literature that is relevant to each method is discussed. Moreover, some reflections on how effective different methods are, in terms of answering the three research questions, are shared. The research tools used in this study are provided at the end of this dissertation as appendices. The focus of the study and sampling strategy is briefly discussed in this chapter.

4.2 Classification of this study

Research is often classified as either qualitative or quantitative research. This research is mainly qualitative and to a small extent quantitative in nature. Strauss and Corbin (1990) defined qualitative research as "…a kind of research that produces findings not arrived at by means of statistical procedures or other means of quantification" (p.17). Hence, in this view, it is the non-mathematical nature of the analysis that makes the study qualitative. Moreover, this research was interpretive in nature since, the researcher tried to interpret the nature of the cause for the learners experiencing of difficulties with English language when doing word problems. All the data collected was interpreted against the title and the research questions. Furthermore, a small sample was used for this study and that qualified it to be qualitative. The research methods used to conduct the study were interviews, questionnaires and lesson observations. The use of interviews qualified this study to be qualitative while the use of questionnaires qualified it to be quantitative. Leedy (1989) argued that should the data be verbal, the methodology used is usually qualitative, and should it be numerical, the methodology is usually quantitative. Moreover, the nature of most data collected in this research study was verbal and was collected through interviews as well as lesson observations.

According to Bogdan and Biklen (2007), the qualitative study has the following five characteristics:

First and foremost, qualitative studies are naturalistic. This means that these studies have the actual or real settings from which to extract data. That is, the settings might be the schools, home, neighborhoods and so on. Likewise, this study has been conducted under actual settings: I have entered and spent time in schools; talked to and interviewed real people; that included teachers and learners. Moreover, the research involved learners‟ parents. According to Aitchison (1998), when a small sample is used and when the research is interpretive and naturalistic in nature, the approach is said to be qualitative.

Secondly, the qualitative research is descriptive in nature. That is, the collected data takes up the form of words or pictures other than numbers. The research results contain the written quotations from the collected data so as to "illustrate and substantiate the presentation" (Bogdan and Biklen, 2007, p. 5). It is further stated that when the study is descriptive, it contains, among other, interview transcripts. In this study I have mostly used words when analyzing data. Since the qualitative study is descriptive in nature, it could reveal the nature of the difficulties the learners encounter in learning word problems, as stated by Ormrod (2004) that qualitative research is a great tool for discovering and interpreting the existing problems.

Thirdly, the qualitative research has a concern with process. That is, the qualitative researchers look closely at the process rather than simply with the outcomes or products. For example, Bogdan and Biklen (2007) raised questions such as, "How do people negotiate meaning?"; "How do certain terms and labels come to be applied?"; "What is the natural history of the activity or events under study?" and so on (*ibid*, p. 6). Similarly, in this study I was concerned with how the students perceive the Word problems and what was it with the English language that makes them to poorly perform in this aspect. Also, this study sought to find out from the learners as well as the teachers how the learners could be assisted with Word problems.

Fourth, the qualitative research is inductive in nature. It is said that the qualitative researchers tend to analyze their data inductively. That is, they do not collect data to prove or disprove the hypotheses they hold before conducting the study. Rather, the abstractions get built as the information that has been gathered is grouped together. Also, in developing their theory, the

qualitative researchers work from the bottom up rather than top to bottom, since many "disparate pieces of collected evidence" are the ones that are interconnected (Bogdan & Biklen, 2007, p.6). Similarly, in this study I had used the small pieces of information collected to work from the bottom up in trying to establish if English had an impact on the learning of word problems.

Lastly, meaning is also what describes qualitative research. It is said that the qualitative researchers are greatly concerned with how different people make sense of their own lives, called "participant perspectives" (Bogdan & Biklen, 2007, p.7). Qualitative research focuses on questions such as "What questions do people make about their own lives?"; "What do they take for granted?"; "What are they experiencing [and] how they interpret their experiences?" (Bogdan & Biklen, 2007, pp.7-8). This study tried to establish what the teachers thought about their strategies of teaching word problems and what the learners thought about how they learnt and worked with word problems.

4.3 Sample of the study

The research study was aimed at establishing the impact of English language in learning of word problems by the English second language learners at FET phase. The study was conducted in five FET schools in the Mtubatuba district in Northern KwaZulu-Natal. Three of these were the township schools and two were rural. The sample consisted of five teachers teaching Mathematics in FET phase as well as fifteen learners being taught by these teachers. On a daily basis, these teachers consciously or unconsciously engaged in research trying to find answers as to why learners did not to perform well in word problems or other topics in Mathematics and what strategies could be employed to assist learners. Since learners were the ones engaged in learning process, they were assumed to know better about the challenges and difficulties they encountered when learning Mathematics, word problems in particular. Probably their learning experience might assist in establishing how English affected their performance in word problems.

In selecting the participants in the study, I followed the purposive sampling. According to Strydom , Fouche‟ and Delport (2004) and Singleton and Straits (1999), this kind of sampling is entirely based on the judgment of the researcher and the constituents of the sample are the

elements which contain the most characteristics, representative or typical attributes of the population. Since the schools that participated in the study were from the same ward, the findings would be most representative of the ward. The participants in the study were drawn from the five FET schools in the same ward. The following procedure was followed in selecting the learners as participants:

A class of Grade 11 learners doing Mathematics from each school was asked to complete the worksheet activities that I were issued. Thereafter I designed codes according to the number of learners in each class. Each learner was assigned the code which he or she wrote on his or her script. Thereafter, I collected and marked the worksheets. Having marked all the worksheets, I selected the best three learners from each school. This translated to a total of 15 learners in total. Since the research on gender differences has not yet established whether there are sex differences in the way children solve word problems (Mulligan, 1991), the specific number of girls and that of boys participating in the study was of no consequence. Hence, six girls and nine boys eventually became participants in this study. Thereafter one Grade 11 Mathematics teacher teaching the learners from each of the five high schools was given the questionnaire to answer. Three of them were females and two were males. Three of these teachers were from the township schools and two were from the rural schools.

4.4 Research methods employed in this study

Various methods were used for collecting data since more than one method would be suitable for this particular research study. Moreover, research enterprise requires that the researcher considers what resources are available when choosing the method for collecting data (Bogdan & Biklen, 2007). For instance, the time and money available for a research project will often dictate the kind of the research methodology to be used (Leedy, 1989).

In this research, the data collection methods used were:

- Worksheets for the learners.
- Interviews with the learners.

- Questionnaires for the teachers
- Lesson observations

According to Aitchison (1998), the two methods namely, interviews and lesson observations, qualify this research study as a qualitative research. The qualitative methods were appropriate for this study since they were going to facilitate in-depth study of the problem at hand and allow for more details (Patton, 2002). I used worksheets to identify the challenges that the learners had with translating word problems to mathematical statements. To supplement the information gathered from the worksheets‟ responses, individual and group interviews were conducted with the learners. On the other hand, the teacher questionnaires were used to have teachers‟ responses on challenges with teaching of WPs. In addition, lesson observations were conducted in order to observe a variety of aspects such as language used during teaching and learning, co-operation and participation level, frequency of interaction among learners, teaching methods used by each teacher, and so on. The combination of these two instruments was to verify the quality of the teachers‟ responses to questionnaires and also to ensure triangulation.

4.5 Reasons for choosing the research methods

The poor performance in word problems is a cause for concern as it was explained in the literature review. I was particularly interested in the impact of English language on the teaching and learning of word problems to the second language learners. In order to find more about the above, I embarked on this study. Since the study is mostly qualitative, these methods were chosen as they would help me to gain more insight into the language aspect.

Qualitative methods were appropriate for this study as they facilitated the process of trying to establish the impact of English language in depth and detail (Patton, 2002). Since qualitative research is descriptive, it could reveal the nature of the classroom situation where word problems are dealt with, including the relationship between the learners and the teachers.

Teachers are directly involved with the learning that takes place in class, creating learning situations for the learners. Probably, teachers would have more information which could be useful in this research project. The teachers‟ questionnaires assisted me to learn more about the

teachers‟ experiences in as far as the teaching of the WPs. As the teachers prepare themselves for their lessons on daily basis, they are somehow always engaged in some kind of research which is systematic in nature. „Systematic‟ is derived from the term „system‟ which Smith and Lytle (2009) defined as ordered ways of gathering and recording of information, documenting experiences inside and outside of classrooms, and making some kind of a written record. However, teachers neither submit their findings nor their experiences to any formal body except having informal discussions with department of education (DoE) officials such as subject advisors, Superintendent Education Management (SEM) officials and others. The teachers always have first-hand information about the children‟s education. They are also aware of how children receive and respond to the content the teacher presents to them. Therefore, questionnaires with the teachers were of paramount importance in this research project- over and above worksheets completed by the learners.

Worksheets helped me to determine language problems faced by some learners when translating the English statements into the word problems. Also, the learner interviews in this study comprised questions which were open-ended. This permitted me to make probes so that more information could be obtained. Such flexibility was likely to yield information that I had not planned to ask for, and thus enriching the findings in the study (Singleton & Straits, 1999). To supplement the data collected from the learners‟ worksheets, interviews were conducted with the learners. In order for the learners to be more truthful, especially when they discussed their teachers, I had to assure learners of anonymity and confidentiality.

4.6 Discussion of each method

4.6.1 Questionnaires

The use of the questionnaire method assisted me to identify English words with which the learners had difficulty in correctly translating the English statements into mathematical equations. Hence, this method assisted in answering the second critical question of the study. According to Bless and Achola (1990), a questionnaire is a tool for gathering information from a population without actually making personal contact with the respondents. The use of the questionnaire method as the data collection tool in this study provided some advantages which

included among others: The questionnaire method was found to be relatively inexpensive in gathering information. In addition administering and collecting a questionnaire was easy to do. Moreover, all respondents in this study were asked the same questions in the same way which assisted with reliability and validity. Although it was more beneficial to use a questionnaire method in this research project, there were some shortcomings that were encountered. Firstly, some questions were misunderstood by the participants. Secondly, it took more time to design a good questionnaire. Lastly, the use of the questionnaire gave no opportunity for probing or for the respondent to clarify his/her responses.

4.6.1.1 Questionnaire design and piloting

The design of the questionnaire was guided by the purpose of the study and the three critical questions. I was also aware that the targeted group was the FET learners doing Mathematics and their teachers. The drafts of the teachers‟ questionnaire and worksheet were given to my ex-colleague who also taught Mathematics to Grade 11 at my previous school to check for the correct use of the language and to eliminate ambiguity. To ensure careful design of the questions and to check for the adequacy of the questions, the worksheet was given to a group of Grade 11 learners in a class that he taught. The feedback that I received from these respondents after piloting helped me to refine the worksheet accordingly. Some questions had to be refined because of the following reasons: From the pilot exercise there were questions that were identified as having the potential to pose difficulty for the learners to respond to. Also, it transpired that there was ambiguity in some questions. Moreover, some instructions were not clear to some learners. Therefore, where necessary, the instructions were made clear and the questions were edited and simplified, with the final product included as Appendix A. Having refined the questions, the worksheet was then given to the non-participating neighbouring high school for the grade eleven Mathematics learners to complete. In designing worksheet, the order of difficulty was considered and therefore questions ranged from easy to more complex. That helped to enable the respondents to answer with sustained interest.

With regards to the teachers‟ questionnaire, I was aware that answering and completion of a questionnaire was “…a courtesy asked of persons…” (Behr, 1973, p. 74). The longer the

questionnaire, the more tired and bored the respondents would be. Therefore, that could mean questions that appear at the end of the questionnaire might be left unanswered or answered without much honesty. Hence, the questionnaire was structured such that the data required is obtained with minimum amount of the teachers‟ time by making it as brief as possible, while on the other hand digging for adequate information as possible.

4.6.1.2 Types of questions

Behr (1973) argued that questions may be asked in a closed form or in an open form or in a combination of both. When explaining the difference between the two, Behr stated that the closed form requires that the respondent places a tick, makes a mark or draws a line along the correct answer among the several given answers whilst the open form of questions enables the respondent to answer as he or she likes and hence is not confined to a single alternative. In this study, the open form was used. This enabled me to dig as much detailed information as possible from the respondents. Moreover, the open form of questioning allowed each respondent to respond in as much detailed manner as possible, giving the reasons where necessary. In this way, this form allowed for fuller and richer responses. Behr further argued that the free response questionnaire often goes into the area of hidden information which may include attitudes; interests; preferences and decisions other than statistical data or factual information. However, in this study I found the open-ended questionnaire to be disadvantageous in that summarizing the responses took longer time.

4.6.1.3 Administering the questionnaire

The researcher personally issued the questionnaires to the teachers and they (questionnaires) were completed immediately. No copy of the questionnaires was mailed. This was mainly because all the respondents were from the local schools. I also wanted to ensure that I got the responses as early as possible, unlike with the mailed questionnaires. Moreover, self-administering the questionnaires was advantageous in that I was able to establish personal

contact and hence get better co-operation from the respondents (Bell, 1991). Also, I was able to clearly explain the main purpose of the questionnaire and give any clarity where necessary.

4.6.2 Interviews

In this research the semi-structured individual and group interviews were used. These allowed for probing and digging more information from the interviewees. According to Bell (1991), "…the interview is defined as a conversation between the interviewer and the interviewee with the purpose of eliciting certain information from the respondent" (p. 70). During the interview in this research, the interviewees gave the information as needed by the interviewer through the questions that were asked. On the other hand, Wiseman and Aron, cited in Bell (1991) argued that the "…interview is similar to a fishing expedition" (p. 70). Depending on how he or she had prepared for the process, he can or cannot be able to catch fish. Therefore, as the interviewer I had taken time to prepare my questions so that I could get what I wanted from the interviewees. Similarly, Cohen, Manion and Morrison (2007) claimed that interviewing is an activity that requires careful preparation; much patience and so on. I was also aware that for the interview to be more successful, I had to prepare thoroughly and be patient with the interviewee during the interviews in order to obtain as much information as possible.

The interview method was of benefit in various ways. Unlike the questionnaires, the interviews involved direct personal contact with the participants (Bless & Achola, 1990). As stated by Bless and Achola (1990) the interviewer's presence enhanced the comprehension and objectivity in the recording of the information. As suggested by Gilbert (1993), in this study the interviewees were provided with the interview schedule. Furthermore, the interviewer used the recorder to capture responses which were transcribed later.

By using the learner interviews, I tried to establish the difficulties the learners experienced when learning to translate word problems into mathematical statements. Through the responses from the interview questions, strategies which would address challenges experienced by learners when learning WPs would be established. Hence, this method assisted me to answer the first and the third critical questions of the research.

4.6.2.1 Advantages of the interviews

In this study, I found it advantageous to use the interview method as one of my data collection tool. With the individual interviews and through the guaranteed confidentiality, the interviewees felt safer to convey a lot of information within a very short time. Also, as the interviewer, I was able to modify or change the style of the interview to suit the interviewee. Moreover, as the interviewer, I always had room for in-depth probing of the responses and could make a follow-up on ideas where necessary (Bell, 1991). With the group interviews, everyone in the group became aware of what the other members of the group said, hence a wider range of responses were generated (Watt & Ebbutt, 1987). In addition, the group members could always complement one another with additional points thereby yielding more complete reliable responses (Arksey & Knight, 1999). Furthermore, as stated in (Cohen, Manion & Morrison, 2007), the group interviews were quicker than individual interviews, hence time saving.

4.6.2.2 Disadvantages of the interviews

Although the use of the interviews in this study had advantages, there were also disadvantages. In this research it was observed that conducting the individual interviews was time-consuming mainly because an interviewer spoke to one person at a time. Since there were many interviewees in this study, this really took a lot of time to complete. Furthermore, the interview method tended to investigate motives and feelings, which was rare with the questionnaire method. This included the way questions were asked and the type of the questions asked. When the questions were somehow personal and sensitive, the interviewee became emotional when answering such. In this study it was established that the tone of the voice, facial expression and hesitation could give the information which a written response could not do. However, Bell (1991) argued that this might lead to an interviewee giving a misleading response.

In addition, with the group interviews the dominance of some individuals could not be completely avoided. Therefore, more honest and personal responses were withheld and access to more personal feelings with some individuals was denied (Arksey &Knight, 1999, Watt & Ebbutt 1987). Furthermore, evident was the comment by Cohen, Manion & Morrison (2007) that

group interviews discourage individuals to speak out freely when they hold views different from those of the group.

4.6.2.3 Sample for the interviews

This study involved five Grade 11 Mathematics teachers from five FET schools. Three learners from the same schools and taught by the same teachers were also participants in the study. From the fifteen learners, nine were boys and six were girls. Three teachers were females and two were males.

4.6.2.4 Interview process

All the interviews conducted had undergone the following steps. I hoped that these steps would help to improve the quality of the collected data.

4.6.2.4.1 Prior to the interview

- The research questions were revisited
- The interview schedules were prepared
- Appointments with the interviewees were made
- The interviewees were visited two weeks before interviews
- Via telephonic conversations, the dates and time were confirmed with the interviewees

4.6.2.4.2 For the interview itself

- I went to the centres half an hour before time
- The interviewees were greeted in a friendly manner
- The purpose of the interviews was explained while assuring the confidentiality
- The interviews proceeded

- The responses were recorded using the recorder
- The researcher thanked the interviewees and ended the interviews in a friendly manner

4.6.2.4.3 After the interview

- Thank you cards were sent to the interviewees

4.6.3 Lesson observations

I also used lesson observations as one of the research methods to collect data. This method assisted to establish a variety of aspects such as the different teaching methods used by each teacher, level of co-operation and participation from the learners, frequent use of English language by both the teachers and the learners, interaction among the learners and between the teachers and the learners, and so on. Like any other research instruments, lesson observations conducted with the participants had both advantages and disadvantages.

With the lesson observations I was offered an opportunity to gather „live" data from the natural settings, thereby gathering more authentic valid data (Cohen *et al*, 2007). Also, I was aware about what is stated by Robson (2002) and Cooper and Schindler (2001) that what people say may not be what they do. Observing teachers assisted to corroborate their responses to the questionnaire with what they did in class. Compared to many interviews I would have conducted with the teachers, observing the lessons saved me time and energy while allowing me to take useful field notes. On the other hand, gaining access to some teachers" classrooms was not easy since they were reluctant to let me in. Although I tried to explain the purpose of the visit, some thought that I was on fault-finding mission. Hence, I had to re-assure them of the ethical issues which included conformity to confidentiality and anonymity.

4.7 Ethical considerations

When I planned and implemented the research, consideration of the ethical issues that could arise when using learners as participants during data collection was given. Although one tries by all means possible to consider as many of the issues as possible, the challenges that they present are very diverse. Hence, it is not always possible to eradicate these issues without compromising the study. As the researcher, I had to acknowledge that some learners might be sensitive to the information which I wanted to collect and they might not be willing to share it with me. Moreover, I had to make sure that the methods which were used to conduct this research were not questionable since they were aimed at producing results that were valid and reliable. The instruments used in this research to collect information from the participants were learners‟ worksheets, individual and group interviews, teachers‟ questionnaires and lesson observations. I was also aware that due to power differential between me (the researcher) and the learners might cause learners to be forced to participate in the study even though they were not willing (Cohen, Manion & Morrison, 2007). Hence I had to explain to them that as much as I needed their contributions, participation in the study was voluntary and they might withdraw anytime they wished so.

After having applied for the ethical clearance from the University of KwaZulu-Natal, it was granted to me and immediately afterwards I started conducting this study. In the application I elaborated on the type of research I would conduct. I also outlined the research methods and data collection instruments that would be used. Moreover, I stated in the application how the ethical issues pertaining to the participants were to be addressed. I also applied to the Department of Education, asking for the permission to conduct research in five FET schools around Mtubatuba. The permission was granted. In addition, for all the research sites, I wrote letters asking for the school principals to grant me the permission to use their schools as the research sites. The permission was granted based on the ethical guidelines I presented to them. I also wrote letters to the FET Mathematics teachers from these schools asking for them to participate in the study. The letters outlined that participation was voluntary and also indicated how anonymity and confidentiality of the findings of the study would be ensured. The ensured anonymity among participants enhanced the mutual trust and at the same time built confidence to freely answer the questions. Also, the assurance of anonymity and confidentiality presupposes that at no point will

the write-up expose the information which would reveal the participant (Cohen, Manion & Morrison, 2004).

As this study was to involve learners, I had to get permission from the parents of those that were to participate. Therefore letters of consent were issued to the learners that participated in the research. Among other things, the letter explained the area of research with its aims. It also clearly indicated that the study was voluntary and confidentiality and anonymity would be assured. As far as I was concerned, the latter was one reason that caused learners to participate truthfully. Getting the consent was important as it protects me, as the researcher, together with the learner from any future problems. Again, it allows the respondent and the researcher to have a relationship based on trust. Moreover, according to Cohen *et al* (2004) the consent provides proof of authenticity of collected data and the processes used.

4.8 Conclusion

For this research, four research methods were used namely: learner worksheets, learner interviews (individual and group interviews), teacher questionnaires and lesson observation. Using a variety of methods enabled me to dig as much information as possible from the participants (Patton, 2002). A small sample was used for this study: five FET schools were selected wherein one Mathematics teacher and three learners doing Grade 11 Mathematics from each school were participants.

CHAPTER FIVE

DATA ANALYSIS AND FINDINGS

5.1 Introduction

In this chapter, teachers and learners are introduced according to the codes allocated to them. Then analysis of data and findings of the study are discussed. Data was obtained using learner worksheets, learner interviews, teacher questionnaires and lesson observation. Therefore, discussion is round the results obtained across all data collection tools. Hence, the analysis is in the following order: Results obtained from learner worksheets, Combined results from teacher questionnaires and some learner interviews, Results obtained from learner interviews and Results obtained from lesson observation. Where there are similarities between responses from teacher questionnaires and learner interviews, those are discussed under one theme. Data sets used to analyse teacher responses are teacher questionnaires and lesson observation. For the learner responses, data sets used are learner worksheets and learner interviews. Learner worksheets are discussed first since I started interviewing learners on what they got wrong from the worksheets then followed by the questions on the interview schedule.

5.2 Introduction of teachers and learners

Schools where participants in the study come from are indicated as schools C, D, K, M and S. Participating teachers from these schools are coded as Teacher C, Teacher D, Teacher K, Teacher M and Teacher S. All teachers were professionally qualified to teach. Learners are labeled according to the schools where they come from, for example: M39 is from school M, K1 is from school K, S4 is from school S, and so on. Learner M was taught by Teacher M, and so on. However, numbering on codes (for example M39) was given when worksheets were issued to all learners in class. After marking, the top three learners from each school were selected to participate in the interview, regardless of the numbers.

Table 1: Description of teachers and the schools' contexts

Teacher	Description of the teacher	School context
Teacher C	• White, Female • English first language speaker, did not know IsiZulu • Has always taught in the ex-model C schools	• Township school • Ex-model C • Mainly English medium
Teacher D	• Black, Female • IsiZulu first language • Taught in both ex-model C and rural public school	• Township school • Public • Mainly IsiZulu medium
Teacher K	• Black, Male • Nigerian first language speaker, did not know IsiZulu • Has a taught in the Nigerian and ex-model C schools	• Private, Township school • Ex-model C • Mainly English medium
Teacher M	• Black, Male • IsiZulu first language speaker • Has always taught in the rural, public school	• Rural school • Public school • Mainly IsiZulu medium
Teacher S	• Black, Male • IsiZulu first language speaker • Has always taught in the rural, public school	• Rural school • Public school • Mainly IsiZulu medium

5.3 Results obtained from learner worksheets

Section A

There were items from the worksheet that were well-answered. Areas of good performance were observed in numbers 1 and 2 under section A. The majority of learners were able to calculate the difference of 10 and 7 as

10-7=3

Only C2 and C3 did not show their working but only wrote the values „3" as an answer. Many learners could calculate the product of 9 and 8 as 72. However, many of them could not get the correct answers to number 3 and 4. For number 3, many were unable to use variables to represent numbers. Hence, many learners actually added any two numbers to get 24. Examples of such are: 10+14 or 12+12 or 18+6, and so on. The performance was even worse with the question on „average" (number 4 of section A). The majority of learners did not get this one correctly. Some learners left it blank while others gave different incorrect responses such as: 18/x=6 or 18/2=9 or 6/2=3 and so on. For number 3, one could conclude that many learners are used to numbers other than the variables. Also, for number 4, many learners were doing trial-and –error calculation and not sure what the correct procedure was. Except for few learners (for example C1 who did not attempt the solution), many knew that they had to divide in order to get an average. Some learners such as C2 and C3 just wrote 3 as an answer, without showing their working. From C2 and C3 responses, one could conclude that they divided 18 by 6 to get 3. This is an indication that these learners did not know how to get an average. For all the learners" responses in this section, none of the lexical ambiguities could be observed. One reason was that the nature of the activities in section A did not accommodate ambiguities.

Section B

The majority of learners did very well in this section, except for very few who did not get number 1 or 9 or 10 correctly. Some learners wrote „piece of land" instead of „sum of outside edges" for number 1. C1 left number 10 blank whereas she wrote „place" instead of „space occupied" for number 9. This might be an indication that many learners did not have difficulty

using homonymous words such as volume, difference, odd (Durkin and Shire, 1991) and so on. However, polysemous words such as area and consecutive distracted few learners to give the general use of the terms.

Section C

Word problem number one

Many learners had a problem with this section. The majority was unable to translate from the English statement into the mathematical equation. Therefore, many just wrote only the values as the responses. For example, in number one, some learners such as M39, K1, S1, D2, D4, D5, C2 and C3 wrote 30 and 24 as numbers that when added will give 54 and when subtracted will give 6. These two are the correct values. This shows that learners could calculate intuitively and arrive at the answers. Whilst some learners wrote at least only the values, some learners left the problem unanswered (for example K4). M39 tried once again to do the same problem using equations. She correctly wrote „x + y = 17" for the sum. But for the product, she wrote

„$x^2 + y^2 = 72$". Despite the majority not getting this problem correctly, C1 did it correctly. Learner C1 correctly represented the unknown numbers by x and y, introduced two equations and solved simultaneously to get 30 and 24. It"s interesting to note that learners from the same class, for example C1, C2 and C3 could have different methods of doing the same problem.

Word problem number two

Many learners only wrote the values 8 and 9 as the responses. Although these were the correct values, learners were expected to show how they worked out their solutions. Only M8 and K9 showed their working. They correctly established the two equations, solved them simultaneously and worked out the answers as 8 and 9. It is also amazing how the whole class could not similarly to what K9 did but only wrote values and others leaving it blank (for example K4).

Word problem number three

Many learners were unable to correctly do this problem. Most tried to substitute actual values for „*l*" and „*b*" that would work out to a perimeter of 6m. The value for the perimeter was very small and most learners could easily work out the values for l and b as 2 and 1. But some learners could not even get these values, they only made a wild incorrect guess. Out of all the learners, only K9 correctly worked out the solution to the problem.

Word problem number four

Many learners were unable to get the correct answer to this problem. Some learners (for example M8 and M39) worked out the correct values intuitively. Having got them in their mind, they substituted them into the formulae for area and perimeter to prove that they (values) are the only ones holding true for the two formulae. Other learners made their attempts whilst others (for example C2 and C3) made no attempt.

Word problem number five

Only Learner C1 attempted this problem, the rest did not make any attempt. Although C1 di not get the equations right, but she managed to translate the statement „units digit is four times the tens digit. She wrote: „units digit = t (4)". Thereafter, she wrote a complicated equation, including 10 (for the sum). This might be an indication that no matter how much complicated the Word Problem might be, some learners understand the language and the procedure, but lack the mathematization skills.

Word problem number six

Only M8 did this problem correctly, however she did not write the number with the digits she calculated. The digits for the two digit-number worked out to be 8 and 4. Eventually the number was 84, so that the tens digit may be larger than the units digits. Learners S1, C2 and C3

determined the two digits intuitively and proved by calculation that the sum is 12 and the difference is 4. They wrote: 8+4=12 and 8-4=4. Other learners did not make any attempt.

5.4 Combined results from teacher questionnaires and some learner interviews

5.4.1. Views on the difficulties experienced when teaching and learning WPs

Many teachers stated that they generally had problems teaching word problems. Some claimed that language was the main obstacle when dealing with word problems. Related to spoken language was the idea that Mathematics was in itself a language (Setati, 1998a, 1998b) and it was often difficult. This was corroborated by Teacher C when she said that

> *"Sometimes the learners don"t understand the vocabulary used. There is specialised maths vocabulary that the learners should learn. Just like in language, they have to learn what that word means and how to use it in a particular context".*

She provided an example of words or phrases such as „consecutive" and „twice as much as", as specialised vocabulary in the Mathematics language (Austin & Howson, 1979 and Orton, 2004). Teacher C insisted that even the English first language learners did experience problems with some words as used in word problems. According to her, most of these learners might know „twice as much as" but not „consecutive". Elaborating, she stated that knowing „consecutive" would depend on how frequent the word is used at home. She continued to say "a lot of children are very good at speaking English but they might not have knowledge of specialized vocabulary". Somehow, the words „twice as much as" also seem to be difficult to understand, but Teacher C felt that this was easier for learners to grasp. Mathematics is a language on its own that needs to be learnt and understood with its vocabulary, just like any other written language. When learners do not understand Mathematics vocabulary, they experience problems and "cannot translate textual problems into mathematical statements" (Teacher S). From Teacher S"s responses it is unclear whether the real problem lies in mathematization or with the translation of words from English into a language they are more *au fait* with (Berry, 1985, Setati 1998b).

Teacher M also initially indicated that language was a problem when he stated that "let us look at the language". He went on to say that there were problems with the way the learners read and

wrote using the English language. But the example he quoted showed a deeper problem when he claimed that the real problem begins "as early as the primary level where the learner could go on to the next grade although failing to read and write". This may imply that the problems in Mathematics may have roots as far back as the primary school level. According to Teacher M, learners lacked fundamental principles of which reading and writing are two of them. He even stated that "if *ungenawo amafundamentals ayikho into ongayenza* [if you do not have fundamentals there is nothing you can do], which in essence was intimating that it was the Mathematics that really was the problem. He quoted the idea of asking a grade 12 learner what x plus x is. He then claimed that there were students who answered by saying x^2. This problem might lie with mathematization. It would have been worth asking the learners the question in writing by using the symbols of Mathematics, for example x + x. It could be possible that by seeing „+" they might understand what was expected. Perhaps the Mathematics when read or heard in terms of words becomes difficult to interpret and understand. Learners may prefer to see the actual symbols. As much as learners may see the symbols, teachers will still be expected to help learners with the strategies to solve problems.

Teachers D and K claimed that at times the teachers lacked strategies to assist learners with the understanding and completion of word problems. This might obviously be the problem beyond the language. From Teacher D"s statement, "...some problems are really difficult to teach", it was clear that it was not only the language that hindered the understanding of the WPs but that teachers needed the most appropriate methods to help learners master the word problems. This could be re-affirmed from Learner M8 when she stated that she understood English in the statements from the worksheet but lacked the method on how to do the sums. She made an example of question 13 *„The sum of two numbers is 54 and their difference is 6. Find the numbers"*. For the answer, she wrote 48-6 and 48+6. She stated that she did not understand that she was supposed to introduce the simultaneous equations and admitted that her problem was writing the statement mathematically. Indeed, from her working, it could be observed that M8 knew the operations associated with „difference" and „sum". It was only mathematization that posed challenges.

5.4.2 Language and Word Problems

According to Teacher S, English seemed to be a major problem for learners when dealing with word problems. He claimed that learners were unable to extract crucial information from the given verbal statements since they did not understand the words used. It seems that learners failed to make a mathematical sense out of these statements. He further stated that sometimes learners even failed to make sense or realise that a number like „204" when written in words actually read as „two hundred and four". It seems that some learners sometimes think that Mathematics is only about numbers, no words involved. This can be confirmed from the statement by Learner D2 when he stated that "...when there is no numbers (in a WP) I experience difficulty… It"s because I usually know Mathematics as numbers".

Teacher M also claimed that learners had difficulty differentiating between words used in spoken English and also in Mathematics. This is what Durkin and Shire (1991) called homonymy. Teacher M mentioned words like difference, sum, and so on. He insisted that although learners are used to such words but "...in Mathematics they need to understand exactly what the sum is, what the difference is, than just using the word". Knowing what each of these words mean, might help learners write the correct expressions when writing mathematically. Teacher M suggested that to help learners understand the meaning of these words in Mathematics, there should be a glossary at the end. However, he pointed out that learners might not read them since, according to M, they were lazy to read. Teacher D also agreed that language was a problem. Furthermore, she claimed that learners are unable to interpret WPs when they really do not understand English.

On the other hand Teacher C and Teacher K stated that sometimes language was not much of a problem. Teacher C even stated that "most of our learners are isiZulu first language speakers, but do speak, read and write English". She further indicated that, in the former model C schools, as long as the isiZulu speaking learners had done English from grade 1, there would be no difference in performance as the English first language speakers. She quoted the example of her two students in grade 12: one English first language speaker and the other English second language speaker, who had learnt in English from grade 1. She stated that

"There was no difference. My English first language student was just as good as my English second language speaking student. So, if the child is coming to an English school later on, say in grade 8, and has been to a normal public African school before that, then there might be problems".

Teacher C felt that one had to be exposed to Mathematics vocabulary because "if you are not exposed to such words in your everyday use, you are not going to make it" (implying that the learner would not understand). This indicates how much importance she accorded to student exposure to Mathematics vocabulary in order for them to perform well in word problems and in Mathematics in general. This can be supported by Austin & Howson (1979) emphasis on the Mathematics vocabulary. From the study, two out of five teachers (67%) stated that the English language was not much of a problem when teaching and learning word problems whilst on the other hand the other three (33%) strongly believed that learners experienced problems understanding English in the word problem.

Many learners did not have much problems with the English language in the WPs. The only challenge was translating the statement into mathematical equation. From learners" responses, two important points could be deduced. Firstly, knowledge of English does not guarantee a correct solution because the learner needs to know the Mathematics as well. Secondly, knowledge of Mathematics must be accompanied by knowledge of basic terms in English for successful solution of a problem. Sometimes, a learner might understand English and know relevant Mathematics for a word problem, but lack confidence and either not write a correct solution or leave the question unanswered. For example, K1 wrote an incorrect solution to question 4 (question on average of two numbers) whilst C1 left it unanswered. During an interview with each of them, it transpired that they knew what the word „average" meant and knew the Mathematics behind it. However, they did not write a solution to the problem. When asked why they did not write solutions, K1 gave the following responses:

I: K1, it"s likeyou never knew what „average" meant?

K1: I do know what average means-you add the sums, you divide by the number of items.

I: Why didn"tyou write then?

K1: Eyi…(Nodding in despair). I wasn"t sure if Iwas thinking correctly.

Similarly, Learner C1 did not write the solution to the question on average. During the interview with her, it transpired that she knew what she was supposed to write as a solution.

I:. What made you not to write anything on question 4?

C1: Mhh…I wasn"t quite sure which equation to use.

I: But are you familiar with the term „average"?

C1: Yes.

I: What does it refer to?

C1: Add the numbers together, divide by the number of digits.

I: Ok. And why didn"t you write it down therefore?

C1: I"mnot too sure.

From these responses it seems that learners might get confused very easily when faced with the word problems. They can even forget the simple mathematical procedures that they have learnt and known for a long time. For example, it appears from K1"s response that she knew what an average was, however she got it incorrectly when it was with the WPs.

5.4.3 Some problematic words

In indicating some words that are generally problematic in word problems, Teacher S listed words such as „greater than", „smaller than", „as twice as", „doubled", „increased by", „decreased by", „maximum", „minimum", and so on. Teacher K also suggested words such as „twice as much", „doubled and then added to", „at least", „at most", „square of", „squared" as providing challenges in word problems. It should be noted that „at least" and „at most" are mostly used in linear programming. If such words provide a challenge, it might be the reason that some learners perform badly in linear programming, as indicated by Teacher D that failing to use these words appropriately caused learners to misinterpret statements in linear programming and in financial

Mathematics. Also, Teacher M indicated words such as „difference" and „sum" as problematic in learning WPs. He stated that failing to understand the meaning of these words started as early as the primary school level. He further suggested that to avoid such problems, teachers should build a link between the primary and secondary school levels. Moreover, Teacher M stated that comparisons such as „twice as older than" are also problematic in word problems. Also, Teacher C claimed that (homonymous) words such as „difference", „volume", and so on, could be quite confusing to learners when answering WPs. Durkin and Shire (1991) have also made a great emphasis on such words leading to confusion. According to Teacher C, some learners would not understand that there can be two meanings to these words. Moreover, she stated that as far as the individual words which children did not come across more often in everyday language, those words could be a problem. In addition, that might mean that learners could not be able to translate English statements into Mathematics. However, Teacher C further argued that "it is more how the questions are worded or phrased that is the problem". This might suggest that learners could fail to write a correct mathematical statement even if more familiar words have been used in the statements.

5.4.4 Language in which Mathematics was learnt

It seems that all teachers who participated in this study learnt Mathematics in English when they were at school. However, Teachers D and S were also taught in isiZulu. Teacher S added that his teacher used a little bit of isiZulu when he wanted "...to clarify an important point for more understanding". Obviously, Mathematics is mainly taught in English. Some vernacular may be used to clarify some concepts. However, as indicated by Teacher C, one more challenge with regards to language in WPs was that there were some mathematical words that cannot be translated into isiZulu. She stated that

> *"For example when we talk about consecutive maybe in isiZulu there isn"t a word for consecutive and you"ll have to explain what that word means and not just give synonym for it, give examples of what I mean by that word. So if there is no synonym, it might bring problems when one cannot attach meaning to that particular word".*

This is illustrated in the lesson by Teacher M when explaining the word problem „The sum of two consecutive integers is 51, find these integers".

Teacher M: What does it mean to say consecutive? If I say there was drought for two consecutive years, what do I mean?

Learner M: Consecutive years mean respective years.

M: Heyi isiNgisi sakho sikhulu kakhulu (Your English is too big). Can you explain that?

Learner M: Ngokulandelana kwayo (Following after each other).

M: Good, if the drought was in 2006, also in 2007 there was drought. So if one number is p then the next one is p+1, isn"tit?

Class: Yes sir.

Hence, translating to isiZulu might imply either giving a synonym for the word or translating the general idea of the mathematical problem. So, there may be no direct translation from English to isiZulu, but learners can acquire the basic meaning of what is expected or implied. This can only apply if a teacher is available to make these inputs. But in the absence of a teacher (during tests and examinations), the learners will struggle.

5.4.5 Frequency of Code-switching

Although all teachers in this research preferred teaching in English, some of them did code-switch in order to explain and clarify some concepts. Teacher D explained that there were times when she realised that learners did not understand when she explained and eventually she code-switched to isiZulu for them to understand better. Out of the five teachers, three (Teachers S, M and D) code-switched from English to isiZulu, while two (Teachers C and K) never code-switched. Teachers C and K were only English speaking while Teachers S, M and D were isiZulu speaking. Although the three teachers did code-switch, Teacher S stated that he did it very seldom. According Teacher S "a lot of code-switching distracts or impedes learning of English (which in turn could impede the learning of maths)". This was evident in the response by

learner D5 when he stated that, “we usually use our language-IsiZulu- and not English which makes it hard for us answer some questions during exams „cause questions in exams are usually asked in English rather than IsiZulu”. Perhaps teachers should not over-do code-switching since that deprives the learners the chance of effectively learning Mathematics in English.

On the other hand, Teacher M stated that he code-switched to accommodate learners from different backgrounds. That is, from townships and from rural areas. He stated that at least learners from townships did try and speak English whereas learners from rural areas generally didn‟t. He continued to say “…when you speak one or two English words to these (referring to learners from rural areas), they will regard you as a totally different person to them”. Concurring was learner D5 as he stated that he tried by all means to speak English everyday as a way of improving it. However, in class he mostly used isiZulu to answer questions “…„cause some of the people in class, they say if I use English more than them they will say I think I‟m superior to them”. This explains the fact that no matter how much D5 wanted to speak English in class, he became discouraged by the fact that other learners did not approve of it. This might be an indication that some teachers do not do enough to encourage learners to use English so that no learner will be deprived of the freedom of speech and freedom of expression in class. Moreover, this also might be an indication that some learning environments are not conducive enough for the learners to be free to express themselves and feel comfortable (Moll, Ggultig, Bradburg & Winkler, 2001). Although Teacher M believed that code-switching helped learners to understand WPs, he stated that too much of it would disadvantage learners when they pursued their studies at tertiary institutions since “...there is no code-switching at tertiary (institutions)”. Hence, he insisted that although he used some isiZulu, he encouraged learners to use English most of the time. On the other hand, although Teacher K did not code-switch, he believed that illustrations and more examples could help to cater for the slow learners and those who were not competent in English. Here Teacher K was alluding to the use of visual strategies. He conceived that this might be useful for slow or second language English learners. But many strategies may be useful to all learners. However, he pointed out that it was a challenge to code-switch for a mostly mathematical problem. Probably, this might be so because there are no isiZulu words or phrases to explain some mathematical terms.

The extent to which one code-switches is under scrutiny. Does too much impede mathematical maturity or does too little inhibit mathematical development? This could not be established from this research but it would be a useful study for the future. Although some teachers implied that too much code-switching prevents learners from engaging with English and hence becoming *au fait* with the language, it can be contrarily conceived that greater experience will be obtained if the teacher actually code-switched more often. As has been stated previously, the data does not conclusively show any particular result because the sample size was too small.

Generally, many learners preferred to learn Mathematics in English since it is the language of learning and teaching in schools. Hence, using English often helped them get prepared for the tests and exams which are always in English. Moreover, they stated that English is the universal language used for communication, therefore they had to be more exposed to it. On the other hand, as much as many learners preferred use of English, some prefferred code-switching between English and isiZulu. Even some learners from the English medium schools stated that they would prefer code-switching as well, so that all learners may have clarity and be at the same level of understanding. The general claim was that code-switching helped them (learners) to understand better. This is questionable though, since English words and mathematical terms do not have synonyms in Zulu. C1 even stated, when disapproving code-switching, that there might be some important information that might be lost on the way (Barnett-Clarke & Ramirez, 2004) as the teacher explains in isiZulu. Code-switching was also said to reduce the level of difficulty of the question, hence easy to translate into the mathematical equation. This statement remains questionable as well since the learners from the schools where most code-switching took place, performed very poorly. It was much better with the English medium schools where there was no code-switching at all.

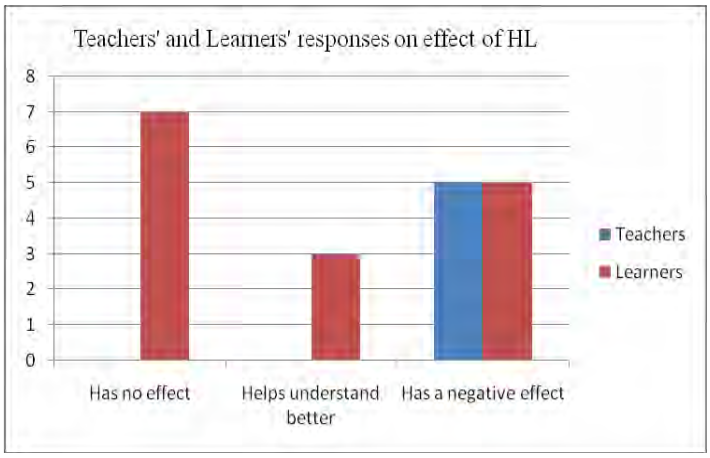
5.4.6 Influence of home language on the teaching and learning of WPs

According to the five teachers, the home language background had an influence on the learning of WPs. Teacher S stated that learners who spoke in English at home had an advantage over learners who did not use English at home. English first language learner could easily interpret what was expected in a word statement even if he or she could not solve the problem. On the

other hand, Teacher M stated that frequent use of isiZulu hinders learners‟ chances of becoming *au fait* with English words. Teacher D also claimed that more exposure to non-English home language promoted poor understanding of the instructions and questions in English. Similarly Teacher C stated that if one was not exposed to some words in his everyday use, he or she was likely not to make it. Teacher K claimed that language led to understanding the environment. He stated that when mathematical word problems were taught in English using certain contexts, this could mean that those who grew up in a different environment with unfamiliar contexts might face difficulties to form concrete ideas in their minds.

Seven out of fifteen learners stated that their home language has no effect in the learning of WPs. While five learners thought more use of their home language had a negative effect in their learning, only three learners thought isiZulu made them understand better. Although Learners K4, S1 and S4 spoke isiZulu at home, that didn‟t affect them in learning Mathematics. However, they acknowledged the fact that an English first language learner would be likely to understand better whilst the English second language learner would be disadvantaged. S1 and S4 argued that as much as the English speaking learner can understand English better, he or she could also have problems translating the WPs into mathematical equations. S4 further argued that "I think the way English is used here (in WPs) is not the same as the English that one uses when speaking. So, it has to do with understanding and translating into maths". At least S4 acknowledged that Mathematics is the language on its own and it has its own vocabulary and terminology (Setati, 1998a, 1998b) that one needs to understand in order to do his Mathematics correctly. Moreover, home language may not have any effect in one‟s learning of Mathematics.

Figure 1: Graphical representation of teachers‟ and learners‟ responses on the effect of home language (HL)



5.4.7 Development and implementation of language policy

In all the five schools there were language policies and, according to these teachers, the policies were being implemented. In School S the policy was developed in 2008, in School M it was developed in 1995, in School C- in 2008, in School K- in 2009 and in School D in 2007. Teacher D indicated that other learners did not want to use English as the language of communication despite the fact that they were not allowed to use their home language- not even during break and lunch times .Contrary to the responses by Teachers M, D, and S, the responses from the learners of school M, D and S indicated that they were at liberty to use isiZulu even when orally answering the questions in class. Hence, there seemed to be a contradiction in the way the policy was implemented in these three schools. Furthermore, learners expressed high levels of dissatisfaction about the free usage of isiZulu in their classrooms whilst in the examinations they would be expected to answer in English.

5.4.8 Difficulties experienced with interpretation of the language inherent in WPs

With regards to the interpretation of the language located in the problem statement Teacher S stated that sometimes learners misinterpreted the problem, maybe because their English

vocabulary was not well developed or poor mathematization. He further stated that sometimes learners also failed to interpret correctly when the problem was deeply embedded into a complex statement with long sentences and specialised language. Also, Teacher K stated that learners struggled to interpret and give correct mathematical translations of the statements.

Teacher C stated that sometimes learners have to first translate English statements into isiZulu. However, she mentioned that often there wasn‟t an exact synonym for the word in isiZulu. Therefore, this leads to a learner not understanding what the statement was all about and hence be unable to translate into a mathematical equation. Moreover, the emphasis that Barnett-Clarke & Ramirez (2004) made was that there was a loss of some information during the translations across languages.

Teacher M claimed that the learners‟ ability to interpret the statements depended on the manner in which the problems had been presented. This suggests that no matter how the WP might be, if it is not expressed in the way that will be simpler to learners, they may not understand the question.

5.4.9 The causes of learners' difficulties with translating a WP into equations

With regards to the difficulties associated with translating WPs, Teacher K stated that lack of exposure and awareness to everyday problems that involve Mathematics was one reason that led to learners having difficulties translating word problems into mathematical statements. Similarly, Teacher S stated that learners could not make a connection between what they learnt in class and the Mathematics they were exposed to in everyday life. He provided an example of a learner confronted with a problem about the rondavel house (referring to the learners from the rural areas) who could correctly answer general questions about the rondavel house easily. (The rondavel house has a circle base, hence walls are cylindrical and the roof is conical in shape). Immediately the learner‟s everyday Mathematics (such as calculation of the area and volume) was fitted into the rondavel problem, then the learner could easily get confused. Teacher M, on the other hand, indicated that one reason might be that teachers do not ensure that they help learners in the interpretation of the language used in the word problems.

Teacher C indicated a couple of difficulties experienced with translating WPs. Firstly she stated that non-exposure of learners to mathematical terminologies and appropriate phrases led to difficulties in answering word problems. Like Teacher M, she went on to say learners needed to be taught how to interpret and translate mathematical language. Secondly, she stated that the difficulties were inherent in the way the problem was worded. Elaborating on this she said that some WPs are too worded such that learners "...do not know how to break it down and get into that (what) they need". She added to say that learners needed to be taught how to break statements down into smaller sections, tackle one section at a time, and write down all the necessary information.

Teacher D, on the other hand, argued that the difficulties she experienced were as a result of the learners coming from the African public schools (where IsiZulu is dominant) who had difficulties translating word problems into Mathematics. Generally, learners coming from those public schools are isiZulu speaking. Teacher D"s statement then leaves the question of whether those learners who had been in the English medium schools from lower grades were able to translate statements into Mathematics better than those who were in African public schools. Despite the challenges espoused by the English language, it could be observed from the worksheets that incorrect translations were as a result of poor mathematization.

5.4.10 Overcoming language barriers

There were a few strategies that Teacher S employed as measures to help learners with language problems in word problems. Firstly he taught and exposed his learners to the variety of mathematical terminology or vocabulary that might be required in WPs. Secondly, he helped his learners construct a mathematical statement from a given textual statement, for example he let learners express their age relationship using a mathematical statement. He gave an example of what he asked his learners to write mathematically "*Nosipho is 3 years younger than her brother Themba*". He explained that at this stage learners would only be required to write the correct mathematical expression thereby developing skills to translate the word statement into a mathematical statement and vice versa. Lastly, he then gave learners a word problem to solve by applying the methods learnt. Over and above these strategies, Teacher S suggested that an

integration between Mathematics and other subjects(for example English) could assist, otherwise as a maths teacher one ended up teaching grammar, sentence construction and even how to pronounce some words. What was even more challenging, he said, was teaching learners how to extract most crucial information from the WP statement.

On the other hand Teacher C rephrased the problem, broke statements down into smaller sections, tackled one section at a time, and wrote down all the necessary information and converted that into mathematical statement. If not done this way, she said, they might have problems with words like difference of, twice as much, and so on. According to her, learners might understand the statement but to change it from words into Mathematics might be a problem. She quoted number 18 on the worksheet as an example „*A two digit number is such that the tens digit is larger than the units digit. If the sum of the digits is 12 and the difference is 4, find the number*". Teacher C explained that learners would break down the statement into smaller sections, tackle one section at a time, and write down all the necessary information. In addition, she said she used diagrams to explain and clarify further. She also did one-on-one tutoring with her learners in making sure that they worked through the worked examples from the books, for them to have an understanding of the method since, with a lot of word problems, there were similarities in between. Furthermore, she grouped the WPs according to their categories, for example she stated that "…group the ones about tens and units, the ones on area and perimeter and the ones on ages". Having grouped them like that, she tried and established the method of solving the problems of each category, referring to the worked example as well. She insisted that this method helped learners when they worked on their own. Also, Teacher C suggested that learners with a better understanding could be encouraged to assist the other learners with extraction of the important information.

Teacher K did a few things to help his learners with the word problems. He gave them more concrete and practical examples, then put much emphasis on the problematic words such as: „twice as much as", „doubled and then added to", „at least", „at most", „square of" and „squared". He also made sure that enough time was given for interactions when working out problems. Over and above that, he allowed his learners time to build up the mathematical statements on their own.

On the other hand Teacher M stated that he took a closer look on each and every learner‟s working so as to establish what each learner‟s problem was, thereafter tried and made them understand the language attached to the word problem. During the beginning of the lesson, Teacher M normally did half of the activities with learners in class and thereafter allowed learners to do the other half on their own. He argued that by so doing he wanted to get them working and be ready for their assessment tasks. He gave them the chance to read and understand, and then helped those who were struggling. He also suggested that teachers should, at all times in all grades, teach all chapters and complete the syllabus. This should be done since there were those chapters that link closely to each other, such as word problems and linear programming. Therefore, if one chapter from those had never been done, that might disadvantage the learners from knowing the other chapter better. Moreover, he suggested that by all means the schools had to make the books available for the learners to read. Earlier on Teacher M had said that learners lacked the fundamentals, which included reading and writing. Therefore, getting learners to read a lot could minimise problems associated with learning WPs.

5.5 Results obtained from learner interviews

5.5 1 Learners' views on the difficulties they experienced when solving WPs

Generally, for most learners it was difficult understanding the WPs. Learner C1 stated that she experienced difficulties in solving word problems most of the time. Despite the fact that she answered most problems on the worksheet correctly, she argued that it took her a long time to understand the question and then solve. Some learners, such as D5, could only try solve some problems while leaving others unattempted. Worse though, was the fact that some learners, for example D5, had to read the word problem and first translate it word for word into their home language (isiZulu) and then try and understand the context of the problem. In other words, this supports what Barnett-Clarke & Ramirez (2004) stated, that when learners read a text in English, they have to first translate it to their own language thereafter try write it mathematically. At the same time one should be aware that during the translation process, some meaning might be lost on the way. However, D5 admitted that this did not help him much, but only delayed his working pace. This might be significant as well. It meant that Learner D5 did not benefit too much from

the actual translation from English to isiZulu. He either understood English fairly well or he struggled with Mathematics. Similarly, M39 had problems doing word problems. She stated that despite the fact that she made every effort to make herself understand the WPs through doing many different word problems as a way of practicing, she still could not get them correctly. M39 further indicated that the word problems on digits had a lot of English and she eventually failed to understand what the problem was really all about.

On the other hand, some learners indicated that the phrasing of the word problems posed difficulties for them and hence were unable to write mathematically. For example, as much as K1 was schooling in an English medium school and understood English fairly well, however she struggled getting correct solutions to WPs. She could not correctly translate English statements into mathematical statements. When asked what her challenge was, she stated that "too much wording makes it confusing"! This is an indication that when one does not understand sets of words in a word problem, he or she might be unable to work with the given information to translate to a mathematical statement. Some learners indicated that having to think about the statement, many words in it and doing the sum, made them to be more confused as they did not know where and how to start. This might be an indication that some learners really become helpless when they have to solve word problems, not mainly because they do not understand English but lack mathematical procedures to correctly translate into a mathematical equation. C3 even stated that the vocabulary that was used was a challenge to him. Furthermore, he was confused as he read the WP since "the questions got twisted".

I: What do you mean "they twist their questions"?

C3: A variety of questions get asked and these need different interpretations and sometimes the same question can be asked in different ways. This makes it difficult to grasp the method on how to interpret and translate word problems.

What the above comment suggests is that, although there are a variety of methods different teachers use when teaching word problems, learners should be given the basics on how these could be tackled. Apparently teachers should help learners acquire basic methods on how to solve word problems.

Moreover, some learners lacked strategies on how to write mathematical expressions correctly. For example, M8 stated that she understood English very well and did not have a language problem in answering the word problems. When asked what exactly made her get some WPs incorrectly from the worksheet, she explained that she lacked the method on how to do them as they were "…a bit too tricky". She made an example of question 13 „*The sum of two numbers is 54 and their difference is 6. Find the numbers*" where she wrote 48-6 and 48+6. She stated that she did not understand that she was supposed to introduce the simultaneous equations and admitted that her problem was writing the statement mathematically. Hence, other than understanding English, M8 lacked strategies and mathematization to reach to the correct solution. In order to establish whether she understood what the requirement for the problem was, she was asked:

I: What does it mean to say „sum of two numbers is 54 and their difference is 6"?

M8: That means, there are two numbers that when you add then will give you 54 and when you minus them they should give 6.

I: So in terms of x and y, what would be the first part?

M8: It would be x plus y.

I: What would be the „the difference is 6"?

M8: I think this would have to be where a bigger number you"llget a smaller number when you minus a 6, and that can be…(wanting to put numbers in and not x and y).

I: Not putting in the actual numbers but x and y, what would be the difference?

M8: That means when you minus the smaller number from the bigger number you should get a 6.

I: In terms of x and y?

M8: Then it means x minus y is equal to 6.

From Learner M8"s responses above, it is implied that she understood the word problem and the operations to use when solving it. In addition, she did not have a problem understanding English and mathematical terms but her main challenge was translating the statements and writing them

mathematically. It was evident that with some probing, it was possible for this learner to get the solution. Hence, for her, mathematization was more a problem than the English language. Furthermore, the researcher tried to establish Learner M8"s understanding of some terms used in the worksheet on WPs. The following probing questions on „consecutive" were asked:

I: And with regards to question 14, do you understand what is meant by „consecutive numbers"?

*M8: I think it means two numbers which are following each other, with no other number between them. (*Not understanding that there are rational numbers between consecutive whole numbers*).*
*M8: So it (*their sum*) will be x plus y is equal to 17.*

I: And the product is 72?

M8: When you times x times y…When you multiply x times y is equal to 72.

I:Ok. Thereafter?

M8: I would solve simultaneously, isn"t it?

I: Yes, good.

M8: Like I said, my problem was not actually with the understanding of the English statement but was with translating the statement into mathematical form.

Surely, Learner M8"s challenge was writing a statement mathematically and not understanding English. From the above responses it may be concluded that some learners generally did not have much problems with English language as predicted earlier, but the main challenge was with mathematization and strategies to reach correctly solve the Word problem. Learners mostly lacked methods and strategies on how to tackle Word problems. Over and above poor mathematization, M8 also indicated that she was not used to solving word problems, simultaneous equations, and so on. She stated that she only last did WPs with place holders in the lower grades. What transpired here was that it was not clear to learners that the variables in the mathematical equations were just the place holders that were normally taught in the lower grades. Moreover, some learners did not think that mathematical concepts were developmental from one grade to another.

Over and above lacking strategies, some learners felt that less exposure to English language and familiar terms, posed challenges to them. D2 stated that he was more exposed to his home language than English, even at school. He insisted that he normally experienced difficulties when his home langauge was not used during teaching of maths. Therefore this implied that he was more comfortable when his teacher code-switched from English to isiZulu. Similarly, D4 stated that he was not too exposed to English. H e explained that lack of exposure to English made it difficult for him to answer a lot of questions in word problems, hence was unable to write mathematically. Also, M39 stated that very little exposure to the usage of some words such as „consecutive" might have been the cause for her to experience difficulties with solving WPs. As a result, the solution to the question on consecutive numbers was a wild guess. But when asked what she thought the meaning of „consecutive" was, she said that: "I think it means numbers that are following each other". So, she seemed to understand the meaning of the word butsomehow could not continue to find the solution.

I: And which words were familiar to you?

M39: Difference and the sum. We normally use those words and are familiar and I got those problems right- they were not difficult.

Indeed, the problems on difference and sum did not give M39 any difficulty. It might be correct that when the learners are not exposed to some terms, they are unable to answer questions based on such. And when problems are based on more familiar terms, learners may be successful in doing them correctly. M1 also had a problem with some terminology that was used in some word problems and therefore could not attempt the solution. When asked what terminology he had problems with, he responded: "I think it"s the units, digits thing. I didn"t understand it really". Seemingly, this might be the indication that at times the learner cannot proceed with the solution to a WP once there are some terms he or she does not understand.

Furthermore, it was observed that many learners thought of substituting actual numbers, and not variables, when solving some word problem. For example, D2 indicated that question 17 on the worksheet was one of the challenging ones. He further stated that it would have been better if this question had numbers, otherwise if the question had no numbers, he always experienced difficulty since he only perceived Mathematics as numbers. This was observed with many

learners‟ solutions to the worksheet sums. They mostly substituted with actual numbers when they were supposed to write mathematical expressions or solve a given problem. For example, one question on the worksheet was „*The length of a rectangle is twice its width, while the perimeter measures 6m. Find the length and the breadth of the rectangle. [Note: P=2(l+b)]*‟. Some learners substituted 6 for „*l*‟ and 2 for „*b*‟. When explaining why they opted for 6 and 2, they stated that they took numbers from the given statement. Furthermore, they understood that „length‟ is longer than the „breadth‟, hence 6 and 2 were substituted accordingly. Other learners just gave any numbers for „*l*‟ and „*b*‟ as solutions. This might indicate that learners are more exposed to Mathematics as numbers and are not given enough chance to think Mathematics in any other format. This could suggest that teachers have some work to change learners‟ perspective on Mathematics to think in terms of variables representing certain numbers. In addition, learners should be given more exercises where they would translate statements into mathematical equations.

5.5.2 Minimising problems encountered when solving WPs

When responding on what could be done to minimise the problems that learners experienced with the solution of WPs, C1, C2 and C3 stated that they had to be given more problems so that they could practice a lot so that they could familiariase themselves with the way questions were asked. In this way they would get used to the strategies of solving word problems. This really translates to learners being exposed to more word problems so that they can interact with more terms and hence engage with them as much as possible.In addition, C1 stated that teachers should spend some time explaining the statements and some words attached to the problem. They (teachers) should also spend some time dicussing strategies and methods to solve different WPs.

On the other hand D5 and D4 argued that teachers should always use English when teaching and should also encourage the learners to use English when answering questions on word problems. Teachers should discourage learners from responding in isiZulu when asked oral questions during teaching time. They further stated that talking more often in isiZulu deprived them of more exposure to English while their exams were in English. This can be supported by statement by Adler (1995) when she stated that in most cases teachers allow learners to speak in their own

language when speaking to their peers, however learners are required to use English when in class. Moreover, D5 stated that teachers had to discourage learners from being sarcastic when some learners speak in English. Otherwise, the classroom becomes less conducive for learners to learn effectively as they do not feel comfortable (Moll, Ggultig, Bradburg & Winkler, 2001).

From the learners‟ responses, it transpires that many learners need teachers to help them with strategies, methods and ways to master word problems. Moreover, some teachers seem to use a lot of isiZulu when teaching Mathematics and also allow learners to use isiZulu more often when responding. Also, it could be established that learners felt that they lacked a good background with word problems. Moreover, it was clear to them that they needed to grasp WPs in the early grades so that they would not experience much problems in the upper grades.

5.5.3 Translating into Mathematics symbols

For many learners, it was a challenge translating the English statements into maths equations. For example, Learners C1, C3, D4, D5, M1 and M8 did not have a problem understanding English, but were sometimes unable to correctly translate the statements into maths. When asked if he was able to translate into maths, a good English speaking Learner K2 even stated that “only the Mathematics blocked my way” and hence could not write mathematically. In other words mathematization could be the problem and not understanding the language in the WPs.

It seems that translating into mathematical language is more than just understanding the language. It is necessary for learners to understand the words within the Mathematics context. This alludes to a much deeper problem and despite the fact that it is linked to English, the understanding of the words cannot be differentiated from the context in which they are used.

Over and above being able to know words and the contexts in which words are used, learners should be able to write mathematically. For example, M39 thought she was able to translate a WP into Mathematics. When elaborating as to why she thought she was able to translate, she stated that she knew that „sum‟ meant she had to add and she could use variables such as x and y. Indeed during the interview, she indicated some understanding of „sum‟ but not of „product‟:

I: So how should this „Thesum of two numbers is 54 while their product is 72. Detemine the two numbers" betranslated?

M39: I think it will be x plus y is equal to 54.

I: And the product of the numbers is 72?

M39: It is x squared plus y squared because the numbers can be squared so that I can times [multiply] it to get product.

I: Why squared? Previously you said x plus y equals 54, and not squared?

M39: I think there it"sthe product- so it"sa number times another number. So I think I can use squared so that I know that now I times [muliply] multiplicand.

I: So what will be the mathematical equation?

M39: It will be x squared plus y squared equal 72.

I: But if you write „plus" areyou still multiplying?

M39: No, I'm not multiplying. I will use the old way. Say maybe 8 times 9 is equal to 72. because if I do 8 plus 9 it means I"madding. I have to times [multiply] than add. So I think it"swrong [to say x squared „plus"y squared].

When M1 was asked if she was able to translate, she said:

M1: At times I am able and sometimes I translate incorrectly. For an example in question 13, if you say the sum of two numbers it means those two numbers were added.

I: So, when writing this mathematically, what would you write?

M1: I"llsay x plus y is equal to 54.

I: And this one (pointing at question 14)- the product of the two numbers is 72?

M1: I''ll say x times y is equal to 72 because the product is the number [answer] that you get when you multiply.

I: And question 14, the sum of two consecutive numbers is 17?

M1: That one I don't understand. „Consecutive'' - I don''t understand.

I: But you were able to get the sum right?

M1: Ya…I tried.

I: So you were doing guess work?

M1: Ya… But I guessed right (laughing loud).

It could be deduced from these responses that generally, most learners had difficulties translating English statements into Mathematics. Generally, the problem was not the language *per se* but it was mathematization. For example, there was a misconception that when there was multiplication, variables had to be squared. Again some learners could easily confuse the operations „x" and „+" like it happened with Learner M39. It also transpired that some learners had a problem understanding that Mathematics was not only about numbers. To get their way out from getting even more confused with words, some learners ended up opting for numerical substitutions instead of using variables.

5.6 Results obtained from lesson observations

5.6.1 Teachers' code-switching between first and second language

Teachers C and K were from the English medium schools. They neither code-switched from first language to the second language nor from second language to first language. They always used English throughout their lessons. On the other hand, teachers M and D often code-switched between English and isiZulu whilst teacher S seldom switched from English to isiZulu. He mostly used English during his lesson. When there was code-switching, it was either within a sentence or trying to elaborate more on the given context using another language or merely having a general discussion outside the mathematical talk.

5.6.2 Learners' code-switching between first and second language

Learners from schools C and K only used English when responding or asking questions. This was mainly because they were the English medium schools. Moreover, their teachers were English speaking and did not know isiZulu. On the other hand, learners from school M, D and S code-switched between isiZulu and English more often. This could be emanating from the fact that their teachers allow more code-switching during teaching and learning. Furthermore, learners from schools C and K communicated amongst themselves only in English. On the other hand, learners from schools M, S and D mostly interacted with one another in their home language- isiZulu. During their discussions either in groups or in pairs, they spoke in isiZulu.

5.6.3 Learners' interaction with the teacher in English

When responding to the questions asked by the teacher, learners from school C and K always used English. Similarly when they asked questions from the teacher, they fluently used English. They were free to ask anything they wanted to know from their teacher, as long as they felt it was related to the lesson.

Learners from schools M and S, on the other hand, used some English when interacting with the teacher. Although their English usage was not that good, but the way they communicated with the teacher was satisfactory. Learners from school D used both English and isiZulu interchangeably when answering or asking questions from the teacher. They had all the freedom to use either language while the teacher never motivated them to use English.

5.6.4 Learners' participation and co-operation during the lesson

The level of learners‟ participation in schools C and K was excellent whilst the teachers always kept them involved. They also co-operated vey well and were always disciplined during the lessons. They were always willing to try and answer the questions asked by the teachers.

Very few learners were not participating from schools M, and S. The majority of them co-operated and participated throughout the lesson. As much as possible most learners tried to

answer questions. With school D on the other hand, there was very poor participation from the learners. The majority did not co-operate during the lesson and the teacher kept on reminding them to be quite. They were very noisy and some had no exercise books on which to write. Almost the whole class was chaotic.

5.6.5 Learners' fluency in English

Learners from schools C and K were very fluent in English. They had no problem expressing themselves and giving their opinions. They were also very free to ask or say anything to the teacher, without feeling intimidated. Most learners from schools M, S and D on the other hand, had many grammatical errors. They had problems expressing themselves and struggled to voice their opinions adequately. At some stage the teacher had to help some learners finish their sentences when they were responding to the questions.

5.6.6 Teaching method(s) and use of teaching resources

Different teachers used different teaching methods during their lessons. The methods which teachers C and K used were very effective in that most learners correctly did the WPs, thereby showing some understanding. Also, the use of these methods ensured learners‟ interaction and involvement for the whole lessons. Among some methods teacher K used were discussions in pairs, question and answer, lecturing. Apart from discussions, question and answer and lecturing, teacher C also used demonstrations through diagrams and illustrations when explaining some concepts. For example, she drew the rectangular fields to illustrate what the perimeter and area were.

Although teachers M, S and D did not have much effective lessons, but they also used similar methods to C and K. They mostly used lectuing and question and answer. In addition teacher M involved learners by asking some to write solutions on the board. Most learners enjoyed writing on the board and that raised their level of confidence with the topic. This method kept both the gifted and slow learners involved. Noticeably, teacher D mainly used the lecture method. When trying to let learners discuss in groups or pairs, they only made noise and never came up with

answers after discussions. They also did not answer her questions when she asked. Eventually the teacher had to go on teaching, writing the solutions on the board whilst they copied them into their workbooks.

With regards to the teaching resources, teacher K mainly used the texbook and the whiteboard during the lesson. Unlike the other teachers who mostly used textbook and chalkboard as the teaching resources, teacher C mainly used the white board to illustrate some concepts and draw diagrams. She also used computer and data projector for the classwork and homework activities.

5.6.7 Encouragement of interaction and discussion in class by the teacher

Most often teachers C, K, M and S encouraged learners to interact with one another. Learners were allowed to have discussions either in pairs or in groups. This allowed bright learners to explain challenging concepts and the slow learners could ask questions from their peers. When the groups struggled they indicated by show of hands and the teacher assisted them.

On the other hand, learners from teacher D"s class rarely interacted with one another. No effective discussions on content were held. The teacher did not encourage learners to discuss either in pairs or in groups since they were more chaotic when given such opportunity.

5.6.8 Adequacy of time given to learners to do classwork

Learners from schools K, C, M and S had adequate time to write the classwork activities. They had enough time to discuss activities with their teachers and among themselves. The engagement and involvement in class enabled them to help one another so that everyone developed an idea of how the problems should be done. However, learners from class D did not spend time very effectively. A lot of time was wasted by learners (speaking mostly in vernacular) asking many irrelevant questions for each and every WP that was written on the board. They also had unnecessary discussions and did not co-operate during the lesson. As a result the bell rang when the learners had not done much. The teacher did not even have time to wrap and summarise her lesson.

5.6.9 Usage of textbooks in class by the learners

Except for class C, only the teachers had the textbooks with them and the learners did not have any. Learners only copied the activities from the boards. Teacher C, on the other hand, did not have a textbook as she had prepared her lessons on the computer. However, her learners made use of their textbooks when they referred to some methods of doing some WPs. Also, Teacher C gave her learners homework activities which were taken from the textbooks. By the way, only Teachers C and M gave their learners some homework while Teachers K, S and D did not give any. Instead, learners from school K were told to complete their classwork activities even later.

5.7 Conclusion

From this discussion, it was evident that there are problems associated with teaching and learning of word problems. Among others, teachers and learners indicated that the English language has an impact in learning word problems. To an extent, learners indicated that frequent use of home language, isiZulu in this case, also affected their level of competency in English. That could contribute to the way they perform in WPs. However, it was clear that the challenge lay not only with the language, but also with mathematization. Some learners, especially from the English medium schools, did not have problems with understanding English in the statements, neither were they affected by their home language. But they had a challenge translating the English statements into mathematical equations.

As much as this study supports most of what has been stated in the literature review and the theories, it is worth mentioning that for many learners who were unable to do the word problems correctly, the main challenge was with mathematization. This was observed with many learners who were able to write the relevant operations such as‟ +‟, ‟–„„ „x‟ for the given WP. Because of poor mathematization (such as correct translations), learners could not proceed with the solution of the problem. The following could be deduced from the participants‟ responses and support what is stated by the literature:

- Lack of Mathematics vocabulary might hinder learners‟ performance (Austin & Howson, 1979).

- Translation from English to own language, then Mathematics poses a challenge to many learners (Setati, 1998). Moreover, some information may get lost during translation (Barnett-Clarke & Ramirez, 2004).). Furthermore, one may lack synonyms in his or her own language.
- Writing in an unfamiliar language (other than one‟s own) such as Mathematics poses difficulty for many learners. It is noted that Mathematics itself is a language on its own with its own vocabulary and terminology (Setati, 1998).
- Lexical ambiguities such as polysemy and homonymy may cause confusion to many learners (Durkin and Shire, 1991).
- Classrooms should be conducive for learners to freely express themselves (Moll, Ggultig, Bradburg & Winkler, 2001*).*)
- Teacher should encourage learners to use English inside and outside the classroom situations.

CHAPTER SIX

CONCLUSIONS AND RECOMMENDATIONS

6.1 Introduction

The purpose of the study was to investigate the impact of language in the teaching and learning of Mathematics for the English second language learners in the five FET schools within Mtubatuba district, in Northern KwaZulu-Natal. A special focus was on word problems (WPs). This research was guided by three research questions, namely: (a) Why do some learners experience difficulty with interpreting certain English statements in a word problem and translating them into a mathematical statement?, (b) What are some of the words that some English second language learners within Mtubatuba district have difficulty with? and (c) How can learners be assisted with regards to interpreting these "difficult" words so that they can correctly translate word problems?

To provide answers to these research questions, the researcher decided that eliciting responses from learners and teachers would be the best way to achieve the aims of the study. The worksheets were administered with the learners from the five schools and a wide range of responses were obtained. Thereafter, a selected group of learners were interviewed. On the other hand the teacher questionnaires were administered with the Mathematics teachers from the same five schools. Moreover, the lesson observations with the same teachers were conducted. The research instruments used were seen to be the most appropriate to gather data in order to achieve the aims of the research.

6.2 Reflective comments

Having taught Mathematics at FET level for ten years, I had sufficient insight to conclude that the teachers experienced problems teaching word problems. On the other hand, the findings of this study have revealed that learners also encountered difficulties with the learning of word problems.

Conducting the research assisted me to answer the three critical questions as discussed in the three sub-sections below:

6.2.1 Difficulties experienced in the teaching and learning of WPs

This study has revealed that the challenges that the teachers experienced in the teaching of word problems were based on many factors. The most common factors that emerged from this study were:

- Lack of understanding English in the statements.
- Inability to translate English statements into mathematical equations.
- Lack of exposure to some Mathematics vocabulary such as „consecutive" „twice as much as", „doubled and then added to", „squared".
- The manner in which WPs are phrased rendered some problems for many learners.
- Lack of fundamental knowledge of word problems from the lower grades.

Contrary to the teachers" response that learners had problems understanding the English statements, the majority of learners responded that English was not a problem to them. Instead, the common factors to which learners attributed their challenges were:

- Very little exposure to word problems.
- Failure to write English statements mathematically.
- Less exposure to English due to teachers allowing the use of isiZulu more than English during teaching and learning.
- Too much wording in the word problems which ends up confusing.
- Little exposure to mathematical terms such as „consecutive", „integers".

From the factors above and also from the learners‟ responses, it can be concluded that understanding English statements was not much of a problem. It was evident from the worksheet activities that the problem with learning word problems lay more with mathematization. Moreover, in general, most learners did not have problems with Mathematics vocabulary except for „consecutive‟ and „integers‟. Although they showed understanding of the procedures associated with terms such as „sum‟,„product‟ „difference‟ and so on, they could not translate the English statements into mathematical equations.

6.2.2 Strategies to improve teaching and learning of WPs

The learners‟ interviews and teachers‟ questionnaires allowed both learners and teachers to have inputs on what they thought would improve teaching and learning of word problems. Some common strategies which the teachers suggested were:

- Giving more time for learners to construct mathematical statements on their own.
- Engaging in one-on-one teaching with some struggling learners.
- Code-switching from English to isiZulu when necessary.
- Let learners work through the worked examples first for proper understanding.
- Rephrasing the problem and breaking it into sections.
- Use of diagrams and illustrations.
- Giving learners more activities on word problems.

In addition, common strategies suggested by learners to improve learning of WPs were:

- Teachers should give learners activities on word problems more frequently thereby ensuring more exposure.
- Textbooks should be made available to learners so that they will practice solving of word problems anytime.

- Teachers should have time to explain the approaches on how to do word problems.
- Learners have to be encouraged to use English more often than using vernacular.

6.2.3 Some words posing a challenge in translating WPs

Words or a combination of words such as „greater than", „smaller than", „as twice as", „doubled", „increased by", „decreased by", „maximum", „minimum", were indicated to pose a challenge to many learners. In addition, Teacher K suggested words such as „twice as much", „doubled and then added to", „at least", „at most", „square of", „squared" as challenging in word problems. It should be noted that „at least" and „at most" are mostly used in linear programming. If such words provide a challenge, it might be the reason that some learners perform badly in linear programming, as indicated by Teacher D that failing to use these words appropriately caused learners to misinterpret statements in linear programming and in financial Mathematics. Furthermore, comparisons such as „twice as older than" were also indicated to be problematic in WPs. Furthermore, Teacher C claimed that words such as „difference", „volume", sum, and so on, could be quite confusing to learners when answering. In addition, it was noted that failure to understand such words starts from as early as the primary school level.

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6.3 Limitations of this study

The researcher acknowledges that it is difficult to generalize the research findings from the small sample of learners and teachers from few schools. Moreover, the research has been conducted in one small district in one out of nine provinces in South Africa.

With the focus group interviews, some learners might not have been confident enough to say all they wanted to say. Furthermore, there is not much relevant related literature on language and WPs. To me, this suggests that it might be possible that very little or no research has been done on this aspect.

Some teachers‟ responses were too short. Using only the questionnaires with the teachers had some shortcomings in that most teachers did not give full answers to some questions. Should any other instruments such as interviews had been used, more explanations would have been given.

Having been the long serving Mathematics teacher at the FET phase for the past ten years, I had preconceived the idea of the challenges with WPs. Hence, it was hard for her to completely eliminate her existing knowledge that teachers and learners experience difficulties in the teaching and learning of word problems. Therefore, this might have some influence on the research.

6.4 Implications for further research

Using the findings from this study, I hope that Mathematics teachers can find it necessary to find more ways to improve teaching of word problems. Moreover, it transpired from this study that some learners feel threatened to ask or answer questions in the presence of their peers. From the previous researches it is mentioned that the classroom environments should be conducive for effective learning to take place. Therefore, teachers should find ways to establish classroom environments that will enhance learning of Mathematics. Research in this aspect would be of value to the teachers.

This study has revealed among other things that learners‟ home language plays an important role in the learning of WPs. However, the limitation of this study is that the research was done only with the small sample of three learners from each of the five schools around Mtubatuba. I believe that a more detailed study on the impact of home language will be of benefit. Furthermore, it could be of interest to research whether the teachers‟ home language has an impact on his or her teaching. From this study it could be observed that learners who are taught by the English first language teachers perform better than those taught by the English second language speakers.

6.5 Conclusion

This study has allowed me to investigate the extent to which English impacts on the teaching and learning of word problems in some FET schools. The research study has highlighted some important aspects that require more research. Apparently, English as a language is not much of a reason why the learners perform poorly in word problems, but the mathematization is rather the main cause. It is recommended that such researches on Mathematics education at school level should be made available to the Mathematics teachers who interact directly with the learners on a daily basis. That could inform them of the common factors that cause learners‟ poor performance and assist teachers to improve on their teaching.

More often teachers expect that learners be attentive and be more involved in their schoolwork, particularly in word problems. This expectation, which Wehlage *et al* (1989) refers to as the psychological investment, has to be facilitated by teachers themselves by creating conducive atmosphere through interesting and stimulating lessons. For the learner to enjoy the Mathematics lessons and for him/her to be actively involved in their schoolwork, they need to master visual, symbolic and language skills in various modes. According to Roux (2003) this implies that learners should be exposed to various interrelated experiences which encourage them to read, write and discuss Mathematics.

References

Adler, J. (1991). Towards democratic Mathematics education in South Africa. In Julie C. (Ed.), *People's Mathematics: early ideas and debates* (pp.54-82). Cape Town: University of Cape Town.

Adler, J. (1995). Dilemmas and a paradox-secondary Mathematics teachers‟ knowledge of their teaching in multilingual classrooms. *Teaching & Teacher Education*, 11, 263-274.

Adler, J. (2001). *Teaching Mathematics in Multilingual Classrooms*. Dordrecht: Kluwer Academic Publishers.

Aitchison, J.J.W. (1998). *Nought for your comfort. Critique and its denial in South African adult basic education and training*. Pietermaritzburg: Centre for Adult Education.

Aluko, F. (2006). Social science research: a critique of quantitative and qualitative methods and proposal for an electric approach. *IFE Psychology*. 14 (1), 198-210.

Anghileri, J. (1991). The language of multiplication and division. In Durkin, K. and Shire, B. (Eds.). *Language in mathematical education: Research and Practice.* (pp. 95-104). Milton Keynes, Philadelphia: Open University Press.

Arksey, H. & Knight, P. (1999). *Interviewing for social scientists.* London: Sage.

Austin, J.L. & Howson, A.G. (1979). Language and mathematical education. *Educational studies in Mathematics*. 10, 161-197.

Barnes, D. (1976). *From communication to curriculum*. Harmondsworth: Penguin.

Barnett-Clarke, C. & Ramirez, A. (2004). Language Pitfalls and Pathways to Mathematics. In G.W. Bright and R.N. Rubenstein (Eds.), *Perspectives on the teaching of Mathematics.* (pp. 56-66). Reston: The National Council of Teachers of Mathematics.

Baroody, A.J., Lai, M.L. & Mix, K.S. (2006). The development of young children‟s number and operation sense and its implications for early childhood education. In B. Spodek & O. Saracho (Eds.). *Handbook of research on the education of young children.* (pp. 187-221). Mahwah, NJ: Eribaum.

Bell, J. (1991). *Doing your research project: A guide for first-time researchers in education and social science*. Philadelphia: Open university press

Behr, A.L. (1973). *Methods and techniques in educational and psychological research*. Pretoria: J.L. van Schaik Ltd.

Berger, P. & Luckmann, T. (1967). *The social construction of reality*. London: Penguin books.

Berry, J. W. (1985). Learning Mathematics in a second language: Some cross-cultural issues. *For the learning of Mathematics*, 5(2), 18-23.

Bless, C. & Achola, P. (1990). *Fundamentals of scial research methods: an African perspective.* Lusaka: The government printer.

Bogdan, R.C. & Biklen, S. K. (2007). *Qualitative research for education: An introduction to theories and methods*. Boston: Pearson education.

Brown, J.S., Collins, A. & Duguid, P. (1989). Situated cognition and the culture of learning. *Educational researcher*, 18(1), 32-42.

Burger, A. & Silima, T. (2006). Sampling and sampling design. *Journal of public administration*, 41(3), 656-668.

Clarkson, P.C. (1991). Mathematics in a multilingual society. In K. Durkin and B. Shire (Eds.), *Language in mathematical education: research and Practice*. (pp. 237-246). Buckingham: Open University Press.

Cobb, P. (1994). Where is the mind? Constructivist and sociocultural perspectives on mathematical development. *Educational researcher*. 23 (7), 13-20.

Cockroft, W.H. (1982). *Mathematics counts*. London: HMSO.

Cohen, L. & Manion, L. (1994). *Research methods in education*. New York: Routledge.

Cohen, L., Manion, L. & Morrison, K.R.B. (2004). *A guide to teaching practice.* London: Routledge.

Cohen, L., Manion, L. & Morrison, K. (2007). *Research methods in education.* New York: Routledge.

Confrey, J. (1990). A review of the research on student conceptions in Mathematics, science and programming. In Cazden, C.B. (Ed). *Review of research in education* (pp. 3-55). Washington, DC: American Educational Research Association

Cooper, D.C & Schindler, P.S. (2001). *Business research methods*. New York: McGraw-Hill.

Costello, J. (1991). *Teaching and Learning Mathematics.* London and New York: Routledge.

d‟Ambrosio, U. (1985). EthnoMathematics and its place in the history and pedagogy of Mathematics. *For the learning of Mathematics*. 5(1). 44-48.

De Corte, E. & Verschaffel, L. (1991). Some factors influencing the solution of addition and subtraction word problems. In K. Durkin and B. Shire (Eds.), *Language in mathematical education: research and Practice*. (pp. 117-130). Buckingham: Open University Press.

Department of Education (2003). *National curriculum statement grades 10-12*. Pretoria.

Denzin, N.K. & Lincoln, Y.S. (2005). The *sage handbook of qualitative research, 3rd edition*. Thousand Oaks; Sage.

Doise, W (1990). The development of individual competencies through social interaction. In Foot, H., Morgan, M. and Shute, R. (Eds). *Children helping children*. Chi Chester: John Wiley

Donaldson, M. (1978). *Children's minds*. Glasgow: Fontana/Collins.

Driscoll, M.P. (2004). *Psychology of learning for instruction (3rd ed.).* Upper Saddle River, NJ: Allyn & Bacon.

Durkin, K. & Shire, B. (1991). Lexical ambiguity in mathematical contexts. In Durkin, K. and Shire, B. (Eds.). *Language in mathematical education: Research and Practice.* (pp. 71-84). Milton Keynes, Philadelphia: Open University Press.

Ernest, P. (1991). *The Philosophy of Mathematics Education*. London: The Falmer Press.

Ernest, P. (1994). Conversation as a metaphor for Mathematics and learning. *Proceedings of the British Society for Research into Learning Mathematics day conference.* (pp. 58-63). Nottingham: BSRLM. Manchester Metropolitan University.

Ernest, P. (1996). Varieties of Constructivism: A Framework for Comparison. In L.Steffe et al (Eds), *Theories of mathematical learning*. (pp. 335-350). Mahwah: Lawrence Erlbaum Associates, Inc. Publishers.

Essien, A. and Setati, M. (2006). Revisiting the Equal sign: Some Grade 8 and 9 learners‟ interpretations. *African Journal for Research in Mathematics, Science and Technology Education*. 10(1), 47 – 58.

Gee, J.P. (2004). *Situated language and learning: a critique of traditional schooling*. London: Routledge.

Gilbert, N. (1993). *Researching social life*. London: Sage.

Greeno, J.G. (1998). The situativity of knowing, learning and research. *American psychologist*. 53(1), 5-26.

Greeno, J.G. (2006). Authoritative, accountable positioning and connected, general knowing: Progressive themes in understanding transfer. *Journal of the learning sciences*, 15(4), 539-550.

Halliday, M.A.K. & Hasan, R. (1991). *Language, context and text: aspects of language in a social-semiotic perspective.* Oxford: Oxford University press.

Hannafin, M.J. & Hill, J. (2007). Epistemology and the design of learning environments. In R. Reiser & J. Dempsey (Eds.). *Trends and issues in instructional design and technology (2nd ed.).* (pp. 53-61). Upper Saddle River, NJ: Merrill / Prentice Hall.

Hardy, I.M. & Moore, J.L. (2004). Negotiation of meaning in foreign language conversations. *Applied linguistics*, 25, 340-370.

Harre‟, R. (1989). *Social construction of selves as a discursive practice*. Unpublished paper

Hart, K(1981). *Children's understanding of Mathematics.* London: John Murray.

Hiebert, J. & Carpenter, T.P. (1992). Learning and teaching with understanding. In Grouws, D.A. (Ed). *Handbook of research on Mathematics teaching and learning* (pp. 65-98). New York: Macmillan.

Howie, S.J. (1999). *Third International Mathematics and Science Study Repeat (TIMMSR). Executive summery*. Pretoria: Human Sciences Research Council.

Kerslake, D. (1991). The language of fractions. . In Durkin, K. and Shire, B. (Eds.). *Language in mathematical education: Research and Practice.* (pp. 85-94). Milton Keynes, Philadelphia: Open University Press.

Lave, J. & Wenger, E. (1991). *Situated learning: Legitimate peripheral participation.* Cambridge: Cambridge University Press.

Leedy, P.D. (1989). *Practical research: planning and design*. (Fifth ed.), New York: Macmillan.

Lesh, R.A. & Clarke, D. (2000). Formulating operational definitions of desired outcomes of instruction in Mathematics and science education. In A.E. Kelly & R.A. Lesh (Eds.). *Handbook of research in Mathematics and science education*. (pp.113-149). Mahwah, NJ: Lawrence Erlbaum Associates.

Marton, F. & Neuman, D. (1996). Phenomenography and Children‟s experience of Division. In L.Steffe et al (Eds), *Theories of mathematical learning*. (pp. 315-334). Mahwah: Lawrence Erlbaum Associates, Inc. Publishers.

Mathematical Association. (1987). *Maths Talk. (*2nd ed). London: Stanley Thornes Publishers Ltd.

Merriam, S.B. (1998). *Qualitative research and case study applications in education*. San Francisco: Jossey Bass.

Moll, I., Ggultig, J., Bradburg, J. & Winkler, G. (2001*). Learners and learning reader*. Cape Town: Oxford University Press.

Morgan, C. (2001). The place of pupil writing in learning, teaching and assessing Mathematics. In P. Gates (Ed.*), Issues in Mathematics teaching*. (pp. 232-244). London and New York: Ruotledge.

Mouton, J. (2001). *Practice of social research*. Oxford University.

Mthembu, S.G. (2007). *Instructional approaches in the teaching of Euclidean geometry in grade 11, a thesis submitted for the degree of Master of Education.* University of KwaZulu-Natal, Durban.

Mulligan, J.T. (1991). *An analysis of children's solutions to multiplication and division word problems*. Doctoral thesis. Macquarie University.

Newman, F. & Holtzman, L. (1993). *Lev Vygotsky: revolutionary scientist*. London. Routledge.

Ngcobo, A.B. (1997). *South African Students" Understanding of Simple Equations in Year-9 Algebra, a thesis submitted for the degree of Master of Education*. University of Nottingham.

Nolder, R. (1991). Mixing metaphor and Mathematics in the secondary classroom. In Durkin, K. and Shire, B. (Eds.). *Language in mathematical education: Research and Practice.* (pp. 105-113). Milton Keynes, Philadelphia: Open University Press.

Ormrod, J.E. (2004). *Human learning (4th ed.).* Upper Saddle River, NJ: Pearson.

Orton, A. (1994). Learning Mathematics: implications for teaching. In Orton, A. and Wein, G. (Eds.). *Issues in teaching Mathematics*. (pp. 35-57). London: Cassell.

Orton, A. (2001). Psychology of learning and instruction, overview. In Grinstein, L.S. & Lipsey, S.I. (Eds.). *Encyclopedia of Mathematics education.* (pp. 594-602). New York: Routledge.

Orton, A. (2004). Does language interfere with learning Mathematics? In Orton, A. (Ed.). *Learning Mathematics: Issues, theory and classroom practice, 3rd edition*. (pp. 156-174). New York: British Library Cataloguing-in-Publication Data.

Orton, A. & Frobisher, L. (1996). *Introduction to education: insights into teaching Mathematics*. Trobridge, Wiltshire: Redwood Books Limited.

Orton, A. & Orton, J. (1999). Pattern and the approach to algebra. In Orton, A. (Ed.). *Pattern in the teaching and learning of Mathematics*. (pp. 104-120). London: Cassell.

Orton, J. (1999). Children‟s perception of pattern in relation to shape. In Orton, A. (Ed.). *Pattern in the teaching and learning of Mathematics*. (pp. 149-167). London: Cassell.

Orton, J., Orton, A. & Roper, T. (1999). Pictorial and practical contexts and the perception of pattern. In Orton, A. (Ed.). *Pattern in the teaching and learning of Mathematics*. (pp.121-136). London: Cassell.

Patton, M.Q. (2002). *Qualitative research & evaluation methods*. London: Sage

Penchaliah, S. (1997). *Young children's intuitive solution strategies for multiplication and division word problems in a problem-centred approach, a thesis submitted for the degree of Master of Education.* University of Durban-Westville. Durban.

Piaget, J. (1932). *The moral judgement of the child*. London: Routledge.

Piaget, J. (1972). *The principles of genetic epistemology*. London: Routledge and Kegan Paul.

Pimm, D. (1987). *Speaking mathematically: Communication in Mathematics classrooms*. London: Routledge and Kegan Paul.

Robson, C. (2002). *Real world research* (2nd ed.). Oxford: Blackwell.

Roux, A. (2003). The impact of language proficiency on geometrical thinking. *Proceedings of the ninth national congress of the association for Mathematics education of South Africa*, 1, 362-363.

Salomon, G. (1996). Unorthodox thoughts on the nature and mission of contemporary educational psychology. *Educational psychology review.* 8(4), 397-417.

Schell, J.W. & Black, R.S. (1997). Situated learning: an inductive case study of a collaborative learning experience. *Journal of industrial teacher education,* 34, 5-28.

Schutz, A. (1972). *The phenomenology of the social world*. London: Heinemann.

Setati, M. (1998a). Code-switching in a senior primary class of second language learners. *For the Learning of Mathematics, 18*(1), 34 - 40.

Setati, M. (1998b). *Innovative language practice in multilingual Mathematics classrooms*. Johannesburg: Joint Education Trust.

Setati, M. (2002.) Researching Mathematics education and language in multilingual South Africa. *The Mathematics Teacher*, *12*(2), 6 –20.

Setati, M., Adler, J., Reed, Y. & Bapoo, A. (2002). Incomplete Journeys: Code-switching and other language practices in Mathematics, science and English language classrooms in South Africa. *Language and Education*, *16*(2), 128 – 149.

Setati, M. (2008). Power and Access in Multilingual Mathematics Classrooms in South Africa. *South African Journal of Education*, *28*(1), 103 - 116.

Setati, M. & Duma, B. (2009, 29 June-3 July). *When language is transparent: supporting Mathematics learning in multilingual contexts*. Paper presented at the 15th annual congress of the Association for Mathematics Education of South Africa (AMESA), University of Free State.

Shuard, H. & Rothery, A. (1984). *Children reading Mathematics*. London. John Murray.

Singleton, R.A. & Jr. Straits, B.C. (1999). *Approaches to social research*. New York: Oxford University Press.

Skemp, R.R. (1982). Communicating Mathematics: Surface structures and deep structures. *Visible language*, XVI, 281-288.

Skinner, B.F. (1968). *The technology of teaching*. New York: Appleton Century Crafts.

Skovsmose, O. (1994). *Towards a Philosophy of Critical Mathematics Education*. Dordrecht: Kluwer Academic Publishers.

Smith. M. & Lytle, S.L. (2009). Inquiry as stance: practitioner research for the next generation. New York: Teacher college press.

South African Pocket Oxford Dictionary (2002). Cape Town: Oxford University Press.

Strauss, A. and Corbin, J. (1990). *Basics of qualitative research: growing theory. Procedures and techniques.* Newbury Park, California: Sage.

Strydom, H.; Fouche‟, C.B. and Delport, C.S.L (2004*). Research at grass roots. For the social sciences and human service professions*. Hatfield Pretoria: Van Schaik Publishers.

von Glasersfeld, E. (1991). Constructivism in education.In T. Husen and N. Postlethwaite (Eds). *International encyclopedia of education* (pp. 162-163). Pergamon: Oxford.

Vygotsky, L. S. (1962). *Thought and language*. New York: MIT Press/Wiley.

Vygotsky, L.S. (1978). *Mind in society: the development of higher psychological processes*. Cambridge, MA: Harvard University Press.

Vygotsky, L.S. (1989). *Thought and language.* Massachusetts Institute of Technology: Halliday Lithograph.

Watts, M. & Ebbutt, D. (1987). More than the sum of the parts: research methods in groups interviewing. *British educational research journal, 13*(1), 25-34.

Wehlage, G.G., Rutter, R.A., Gregory, A., Smith, N.L. & Fernandez, R.R. (1989). *Reducing the risk: schools as communities of support*. Lewis: Falmer Press.

Wiersma, W. (1969). *Research methods in education: an introduction.* USA: J. B. Lippincott Company.

Winn, W. (2002). Current trends in educational technology research: the study of learning environments. *Educational psychology review*, 15(4), 331-351.

APPENDIX A

LEARNERS' WORKSHEET ON WORD PROBLEMS

Use the separate sheet to answer the ff questions.

Grade 11

Section A:

For each of the following use relevant operation to write mathematical statement and simplify where possible

1. The **difference** between 10 and 7.
2. Determine the **product** of 9 and 8.
3. The **sum** of two numbers is 24.
4. **Average** of 18 and 6.

……..

Section B:

For each of the ff choose the appropriate definition in brackets for each bold word in the given statement:

5. The **perimeter** of a rectangular plot of land is 14m. (sum of the outside edges, to graph, piece of land).
6. 3 and 5 are examples of **odd** numbers. (not even, strange).
7. The **volume** of a certain cylinder is $50m^3$. (knob on radio, capacity).
8. **Even** numbers 18 and 22 have two digits. (although, not odd, flat surfaced).

9. The **area** of a triangle is $90m^2$. (space occupied, place).

10. Two **consecutive** numbers have a sum of 21. (strong headed, next after the other).

11. The **difference** between 30 and 24 is 6. (distinction, answer after subtracting).

12. An example of a **rationa**l number is 5. (thinking straight, written in a form a/b,).

……

Section C:

Answer the following questions.

13. The sum of two numbers is 54 and their difference is 6. Find the numbers.

14. The sum of two consecutive numbers is 17 while their product is 72. Detemine the two numbers.

15. The length of a rectangle is twice its width, while the perimeter measures 6m. Find the length and the breadth of the rectangle. [Note: P=2(l+b)]

16. The perimeter of a rectangular plot of land is 28m. If its area is $24m^2$, determine the dimensions of the plot. [Note: A=lxb]

17. In a two digit number the units digit is four times the tens digit. The sum of the two digits is 10. Determine the number.

18. A two digit number is such that the tens digit is larger than the units digit. If the sum of the digits is 12 and the difference is 4, find the number.

APPENDIX B

LEANER INTERVIEW SCHEDULE

a) (i) Do you experience any difficulty in solving word problems?

(ii) How?.

b) What do you think are the causes for the difficulty you experience in word problems?

c) (i) Is the language in the word problem often or sometimes hard to understand?

(ii) Why?

d) How do you think these problems you encounter can be overcome?

e) Can you correctly translate the English language attached to the problem into the mathematical equation? Explain.

f) How do you think your home language affects your understanding of the problem statement?

g) (i)Do you understand the language your teacher uses and the language in the textbook?

(ii) Why?

h) (i) Do you prefer to learn in your first language or second language?

(ii) Why?

i) When you read a word problem in the textbook what emotion do you feel?

j) Would you prefer it if the question was read out and explained to you?

k) What would be different if you read it out yourself?

l) Do you understand better when your teacher changes from one language to another when explaining to you?

m) Do you think that this is a good practice?

n) Explain how code-switching help you to understand the problem.

APPENDIX C

TEACHER QUESTIONNAIRE SCHEDULE

a) What difficulty do you experience in the teaching of word problems?

b) Is language a problem? If so, how?

c) What are some of the words you think are a problem?

d) When you were in school, in what language did you learn Mathematics?

e) What language do you prefer to use when teaching?

f) Do you code-switch? If so, how often?

g) Do you think code-switching can help the learners understand the word problems? Explain.

h) Do you think home language background influences the teaching and learning of word problems? If so, how?

i) Does the school have a language policy? If so, when was it developed? Is it implemented?

j) With regards to the interpretation of the language attached to the problem, what problems can be observed?

k) What do you think are the causes that many learners experience difficulty with interpreting the English language in a word problem statement and translating it into a mathematical statement?

l) What measures do you take to help learners with language problems in word problems?

m) Are there any other measures you think can be used to help learners with regards to language in the word problems?

APPENDIX D

CLASSROOM OBSERVATION SCHEDULE

1. Teacher‟s code-switching from first language to second language.

Never	Seldom	Often	Always

2. Teacher‟s code-switching from second language to first language.

Never	Seldom	Often	Always

3. Learners‟ code-switching from first language to second language.

Never	Seldom	Often	Always

4. Learners‟ code-switching from second language to first language.

Never	Seldom	Often	Always

5. Learners‟ interaction with one another in English.

Poor	Satisfactory	Good	Excellent

6. Learners‟ interaction with the teacher in English (e.g asking and answering questions).

Poor	Satisfactory	Good	Excellent

7. Learners‟ participation and co-operation during the lesson.

Poor	Satisfactory	Good	Excellent

8. Learners‟ fluency in English.

Poor	Satisfactory	Good	Excellent

9. Teaching method(s)

Less effective	Effective	More effective

10. Encouragement of interaction and discussion in class by the teacher.

Never	Seldom	Often	Always

11. Adequate time given to learners to write classwork

Yes	No

12. Home wok given at the end of the lesson

Yes	No

13. Usage of textbooks in class by the learners.

Never	Seldom	Often	Always

APPENDIX E

INTERVIEW WITH C1

Interviewer (I): Thank you very much C1. Your approach to solving these word problems is very good. With regards to number 3, most learners struggle to write it in terms of the variables like you‟ve done. Why didn‟t you write actual numbers like 12+12 but instead thought of the variables?

C1: Because I‟m familiar with the variables (Saying it in an English accent).

I: Familiar with the variables?

C1: Yes, that‟s correct.

I: So, if one learner would write 12 plus 12 or 13 plus 11, what would you say to him?

C1: Such numbers all add up to 24 but x and y cut it short. So, I‟ll prefer them using the variables. The variables stand for any numbers.

I: In number 4 you were asked to write the average of 18 and 6. I can see from your script you did not respond. What made you not to write anything here?

C1: Mhh…I wasn‟t quite sure which equation to use.

I: But are you familiar with the term „average‟?

C1: Yes.

I: What does it refer to?

C1: I‟m not sure.

I: Alright. When given two numbers what is expected of you to write as their average?

C1: Add the numbers together, divide by the number of digits.

I: Ok. And why didn‟t you write it down therefore?

C1: I‟m not too sure.

I: Infact, you do not have a problem with the term „average‟, it‟s only that you were not too sure whether your thinking was correct or not.

I: In number 5 you chose „piece of land‟ as defining the perimeter instead of „sum of outside edges‟. Why did you think of a piece of land?

C1: I was misled (laughing).

I: In number 9 you said „area‟ will mean the „place‟ whereas you were told that the area of a triangle is $90m^2$. Do you think in this context it means the place?

C1: No, I don‟t think so.

I: So what does „area‟ refer to here?

C1: Space occupied.

I: You did not answer number 10. Why didn‟t you?

C1: Mhh…

I: You were asked about the sum of two consecutive numbers.

C1: I didn‟t know the answer.

I: Was it because you didn‟t know the word „consecutive‟?

C1: I know it but I wasn‟t quite sure what it means.

I: But from the statement you could guess what it refers to?

C1: Mhh..No, I couldn‟t even guess.

I: but strong-headed wouldn‟t be applicable here because we are talking about numbers. So the only response would be „the numbers that are next after the other‟.

I: What made you to write x+y=54 and x-y=6?

C1: „Because here it says „sum of the two numbers is 54 and the difference of the two numbers is 6‟. I understood what sum and difference mean.

I: Why did you use variables instead of actual numbers?

C1: I think it‟s easier when you use the variables than when you substitute the numbers.

I: For number 16 you preferred to use P=4s as a formula for the perimeter of a rectangle, why?

C1: I wasn‟t quite sure which equation are you using?

I: So did you just assume that this is the perimeter of the square that you were talking about?

C1: Yes mam.

I: But in the previous question there was a formula that you used which is P= 2(ll+b). Why didn‟t you use the same formula instead?

C1: I‟m not sure.

I: Okay. And there is nowhere where you‟ve tried to use the formula of the area. What made you not to use it?

C1: “Cause I assumed that if I got the first equation wrong then I could easily get the second one wrong as well.

I: So you did not even want to make an attempt?

C1: Yes.

I: In a two digit number… (reading number 17), what made you to write the equation 10t+u = 10u+t-10?

C1: Mhh…eh…Word problem is familiar „cause I"m only doing them at the moment. But I think I need a skill somewhere.

I: But why a long equation?

C1: I think I got mixed up with the long confusing statement.

I: This one (pointing at number 18) you never even attempted it. What made you not to attempt it?

C1: Mh…I was misled by the first sentence (of the statement).

I: so you did not want to continue with the second one?

C1: That"s right.

From interview schedule

I: Does it happen that in any case you experience problems with the solving of the word problem? If so, how often?

C1: Most of the time.

I: What do you mean „most of the time"? Do you experience problems or most of the time you don"t?

C1: Most of the time I do (experience problems).

I: But here you have written them very well and it"s like you don"t experience problems.

C1: It takes me a lot of time to understand.

I: What do you think are the causes for the difficulties you experience in word problems?

C1: Mhh…The way the words are grouped in the problem statement makes it not to be able to write into a mathematical statement.

I: Is it the language attached to the problem statement or it‟s actually the mathematical language that gives you the challenge?

C1: Ehh… It‟s actually the mathematical language and not the English.

I: How do you think these problems can be overcome?

C1: Like (teachers to) get some time to explain the problem and the kinds of words attached to the word problem. Also give more problems for a practice.

I: What role should learners play in order to understand word problems?

C1: Get more understanding and be enthusiastic to do your work-determination.

I: can you correctly translate English statement into mathematical statement?

C1: Not all the time.

I: Do you think your home language affects your understanding of the word problems?

C1: I‟m not quite sure about that.

I: Why do you think so?

C1: „Cause my mom is a teacher and in most of the time we communicate in English-even at home. So, I don‟t think my home language affects my understanding.

I: Do you understand the language your teacher uses and the one on the textbook?

C1: Yes I do.

I: Do you prefer to learn Mathematics through your first language or second language?

C1: Second language.

I: Why?

C1: „Cause there are some words that you can‟t put (from first language) into English and it makes it difficult and causes problems. So it‟s better that I learn in English throughout.

I: Would you prefer it if the question was read out to you or you would prefer reading it yourself?

C1: I prefer reading for myself.

I: Why?

C1: „cause you can get more time to think it over then when you‟ve read it you quickly write down the sum.

I: Do you think it‟s a good practice that in other schools they code-switch between isiZulu and English?

C1: I don‟t think it‟s right „cause where they explain it in Zulu you‟ll find that there is some information that they might miss „cause they never explained it in a proper way.

I: Thank you very much C1 for you time and co-operation. I think this info will help me in my studies.

C1: Thanks.

APPENDIX F

INTERVIEW WITH C2

a) Interviewer (I): C2, do you experience any difficulty in solving word problems?

C2: Yes.

I: How?

C2: It‟s because I find it difficult to continue with other words if I haven‟t solved the one that comes after the other.

b) I: What do you think are the causes for the difficulty you experience in word problems?

C2: It‟s because I‟m too indolent to think for a long time especially when I‟m going to think about one thing.

c) (i) Is the language in the word problem often or sometimes hard to understand?

C2: No

(ii) I: Why?

C2:Because the language they use is usually English which is the language we use in our daily lives at school, but if there is no understanding of the word dictionaries are always available.

d) I: How do you think these problems you encounter can be overcome?

C2: The teachers should give us more of these problems so that we will learn to master them.

e) I: Can you correctly translate the English language attached to the problem into the mathematical equation?

C2: No

I: Explain.

C2: Because I‟m not really good in Mathematics.

f) I: How do you think your home language affects your understanding of the problem statement?

C2: No, it doesn‟t, because Mathematics has nothing to do with language but it deals with numbers only.

g) (i)I: Do you understand the language your teacher uses and the language in the textbook?

C2: Yes

(ii) I: Why?

Because since as from my pre-school years I‟ve known that at school I‟ll have to talk and learn everything in English.

h) (i) I: Do you prefer to learn in your first language or second language?

C2: First language.

(ii) I: Why?

C2: Because in nowadays it‟s the main language of communication and it helps us to be able to connect and communicate with everyone world-wide.

i) I: When you read a word problem in the textbook what emotion do you feel?

C2: I first get nervous but try to make myself calm.

I: Why do you get nervous:

C2: It‟s because I‟m not sure if I will be able to correctly translate the problem into Mathematics.

j) I: Would you prefer it if the question was read out and explained to you?

C2: Yes.

k) I: What would be different if you read it out yourself?

C2: There won‟t be much difference except that I will be able to level my understanding to the question and so that I will write on answer being sure of it.

l) I: Do you understand better when your teacher changes from one language to another when explaining to you?

C2: Yes

m) Do you think that this is a good practice?

C2: Yes it is, because kids need to have a better understanding of what a teacher is talking about so if it costs the teacher to go back to other languages he‟‟ll have to.

n) I: Explain- how code-switching help you to understand the problem.

C2: It makes me to understand the problem better so that translation becomes easier.

APPENDIX G

INTERVIEW WITH C3

a) Interviewer (I): C3, do you experience any difficulty in solving word problems?

C3: Yes, sometimes.

I: How?

C3: It‟s because I find it hard to interpret what is it that they expect me to do.

b) I: What do you think are the causes for the difficulty you experience in word problems?

C3: It has to be the vocabulary because they twist their questions.

c) (i) I: Is the language in the word problem often or sometimes hard to understand?

C3: Sometimes.

(ii) I: Can you explain your answer?

C3: I understand English averagely.

d) I: How do you think these problems you encounter can be overcome?

C3: I could practice more problem-solving questions which will get me acquinted with the way they ask questions.

e) I: Can you correctly translate the English language attached to the problem into the mathematical equation?

C3: Sometimes I can, sometimes I can‟t.

I: Explain.

C3: It depends on whether the problem statement is easy or difficult to translate. If it‟s easy I‟m able to translate to Mathematics and solve the problem and if difficult I can‟t.

f) I: How do you think your home language affects your understanding of the problem statement?

C3: It doesn‟t. I don‟t use the language I use at home at school.

g) (i)I: Do you understand the language your teacher uses and the language in the textbook?

C3: Yes I understand the language the teacher uses but I sometimes don‟t understand the textbook‟s langauge.

h) (i) I: Do you prefer to learn in your first language or second language?

C3: First language (English).

(ii) I: Why?

C3: It causes confusion at times to use second language as it is not the one used at school.

i) I: When you read a word problem in the textbook what emotion do you feel?

C3: I don‟t feel any emotions- I am calm.

j) I: Would you prefer it if the question was read out and explained to you?

C3: No, the language (English) suits me just fine.

k) I: What would be different ifthe teacher reads it to you?

C3: It will delay me in starting working, I might also be confused.

l) I: Do you understand better when your teacher changes from one language to another when explaining to you?

C3: Yes, I‟d very much appreciate that, it helps at times. It reduces the level of difficulty.

m) Do you think that this is a good practice?

C3: Yes, I think it is, the aim is to make us learn so we need to understand the work.

APPENDIX H

INTERVIEW WITH D2

a) Interviewer (I): Do you experience any difficulty in solving word problems?

D2: Yes…Ya..‟cause the way they ask the question. That question (pointing at question 14) was so tricky.

I: How are they tricky ,,cause it‟s the simple English that you normally speak?

Mhh…Maybe when there is no numbers I experience difficulty.

I: How?

D2: It‟s because I usually know Mathematics as numbers. Yes.

b) I: What do you think are the causes for the difficulty you experience in word problems?

Mhh…Maybe it‟s the language they use. I‟m more exposed to my home language. Ya.

I: Do you mean your home language affects your understanding of the problem statement?

D2: As I‟ve said they are tricky a little bit. But eyi…when it‟s not my home language I experience some difficulties.

I: But most subjects are in English. Do you experience problems with other subjects as well?

D2: No, but if they can put more numbers maybe I can understand well. When there is no numbers, eish…

c) I: Is the language in the word problem often or sometimes hard to understand?

D2: Ya, in most of the time it‟s hard to understand. As a result sometimes I cannot translate correctly to Mathematics.

d) I: How do you think these problems you encounter can be overcome?

D2: Maybe if I can practice more problems usually or if a teacher can explain to me how I can attack (strategically solve) the problems.

e) I: Can you correctly translate the English language attached to the problem into the mathematical equation? Explain.

D2: Yes, if there are numbers. But if there are no numbers eish…I have some difficuties to translate it to mathematical equation.

f) I: How do you think your home language affects your understanding of the problem statement?

D2: Mhh..[Being taught in my home language] it can help me a lot ,,cause I understand it better in my home language. If I can do or if the teachers can do the practical examples.

I: Practical examples like what?

D2: Mhh…you know when you are doing the lower grade… [For] Example, when you put 2 apples and cut it into half. Things like that.

I: You mean if four apples , as concrete objects, can be brought and explanation given on how Sipho and Mpho can share them?

D2: Yes mam.

I: But now you are in grade 11, there is no such?

D2: Ya, maybe like I said- If I can practice more and more maybe it can be easy.

g) I: Do you understand the language your teacher uses and the language in the textbook?

D2: Yes I do, but with problems it‟s hard to translate to Mathematics.

h) I: Do you prefer to learn in your first language or second language?

D2: In my first language, ,,cause I understand it better.

i) I: When you read a word problem in the textbook what emotion do you feel?

D2: I feel bad ,,cause I‟m not exposed to most of these, especially those that didn‟t have numbers. Ya.

I: You mean you are not exposed to such problems?

D2: Yes, I get some of it in few subjects [topics].

I: Which subjects?

D2: Like in linear programming and financial Mathematics.

I: And you don‟t have problems with in understandingthe staement in linear programming and financial Mathematics?

D2: Mhh…I have some problems. But mostly I attck [solve] those problems.

j) I: Would you prefer it if the question was read out and explained to you?

D2: Yes

k) I: What would be different if you read it out yourself?

D2: If I read it myself I won‟t get some explanations that I need.

l) I: Do you understand better when your teacher changes from one language to another when explaining to you?

D2: Yes mam.

m) I: Do you think that this is a good practice?

D2: Yes, so that we will all understand and answer correctly.

n) I: Explain- how code-switching help you to understand the problem.

D2: Yes it does help me ,,cause it makes me to understand better and know what‟s required of me.

APPENDIX I

INTERVIEW WITH D4

a) Interviewer (I): Do you experience any language difficulty in learning word problems? Explain

D4: Mh… I do but it depends on how a question is phrased or how it is putted [put]. I sometimes don‟t experience problems but sometimes I do.

b) I: What do you think are the causes for the difficulty you experience in word problems?

D4: I think it is the exposure to English itself. I am not too exposed to English you know, I find it sometimes difficult to cope with other questions, although not all of them.

I: Do you mean to say this exposure makes you not to be able to translate English language into mathematical expression? Like for instance this statement (pointing it), won‟t you be able to put it as 2x+2y?

D4: Yes, yes, yes exactly. That‟s what I mean.

c) (i) I: Is the language in the word problem often or sometimes hard to understand?
D4: Yes, sometimes.

(ii) I: Why?

D4: Sometimes I do not understand what the English statement requires me to do as a result I am unable to write the Mathematics equation.

d) I: How do you think these problems you encounter can be overcome?

D4: Eh…doing a lot of problems which are difficult at school may help me you know to overcome these problems ‟cause you find that at school eh sometimes a teacher teaches as in

Zulu whereas he/she should be teaching in English. So when you get in a paper you find that it is written in English so you find it difficult to answer. So if we can be taught in English, not easy English, so that I can be able to answer any question I come over and come across.

I: Do you mean the English contained in the word problems is difficult?

D4: Yes, yes. That English is very difficult to understand.

e) I: Can you correctly translate the English language attached to the problem into the mathematical equation? Explain.

D4: No I cannot do ehh…I really struggle when it comes to that so. But not…it‟s not always the case that I cannot translate. There are sometimes cases where I can translate English into Mathematics. But most of the time I find it difficult.

I: Can that be the reason why you haven‟t got any mathematical writing here (pointing) on the script?

D4: Yes, yes.

f) I: How do you think your home language affects your understanding of the problem statement?

D4: It does have a lot of "infect" „cause in talking IsiZulu and not English so maybe if I can talk English every now and then, there may be some questions I may not find any difficulty at. So it does affect- talking IsiZulu every now and then.

g) (i)I: Do you understand the language your teacher uses and the language in the textbook?
D4: Yes I do, but I need assistance.

(ii) I: Why?

D4: I need the teacher to explain some things to me. When I…when times goes on I think I won‟t be having problems „cause when you find these questions are not difficult. For instance

question 14 I was unable to do. I think it‟s translating English into Mathematics so it made problems. I find it difficult. I don‟t know where it goes wrong. It‟s just I can‟t understand the question.

h) (i) I: Do you prefer to learn in your first language or second language?
D4: Second language.

(ii) I: Why?

D4: Because exams are in English and it is the language of teaching and learning.

i) When you read a word problem in the textbook what emotion do you feel?

D4: Ehh…I feel bad and unsure. Ehh… Oh I think I have a lot of failures in answering questions such as hard as these ones (pointing at the script).

j) I: Would you prefer it if the question was read out and explained to you?

D4: Yes.

k) I: What would be different if you read it out yourself?

D4: There are some words I will not understand and therefore need the assistance of the teacher.

l) I: Do you understand better when your teacher changes from one language to another when explaining to you?

D4: Yes of course.

m) I: Do you think that this is a good practice?

D4: Yes it is. More learners will have a better understanding.

n) I: Explain- how code-switching help you to understand the problem.

D4: It sometimes help but if you use it now and then you turn up to be used to IsiZulu whereas you won‟t write…you won‟t be writing in IsiZulu in the paper. So we mustn‟t drill in IsiZulu. Not that we mustn‟t put IsiZulu at all.

APPENDIX J

INTERVIEW WITH D5

a) Interviewer (I): Do you experience any language difficulty in learning word problems? Explain
D5: Yes, sometimes I can handle them but sometimes I have a problem. My main problem is that sometimes it‟s just because of my vernacular. Sometimes I fail to translate some of the words into my vernacular so that I can understand the whole context. But what I realize is that I mustn‟t try to understand word by word. I must try to understand the whole context than understanding word by word „cause it‟s making it difficult for me to answer the questions that are regarding word problems.

d) I: What do you think are the causes for the difficulty you experience in word problems?

D5: Yes mam, there are some problems as I‟ve said earlier on. It‟s that sometimes I try to understand word by word, rather than understanding the whole context. So if you try to analyse word by word it becomes difficult to answer the question. So I must teach myself to understand what the whole problem is talking about so that I will be able to attack the questions that are in the word problem.

e) (i) I: Is the language in the word problem often or sometimes hard to understand?
D5: Sometimes it‟s a problem.

(ii) I: Why?

D5: When I‟m not able to understand the English in the staement I cannot correctly translate into Mathematics.

d) I: How do you think these problems you encounter can be overcome?

D5: I think the teacher must-most of the time- must let us take care of the problems using the language that we are supposed to use, for an example if say, we are given word problems in English we must do it in English rather than doing it in Zulu-which is our home language-so that when we write exams, „cause when we learn in Zulu and when exams come we will fail to understand what we are supposed to write. For an example if we write financial maths (and) linear programming, that is where word problems usually appear so over there we have to understand what it wants „cause when you fail to understand and if you get the first answer (wrong) , that means the whole thing will be wrong.

I: Don‟t you have problems there in linear programming and financial Mathematics as they contain a lot of English as well?

D5: Yes there are problems. Yes „cause when I try to answer sometimes, I fail to understand what it really wants. So that means I must get used to English, practice it everyday „cause that‟s what I don‟t do „cause most of the time when I‟m in class and answer questions I use IsiZulu „cause some of people in class they say if I use English more than them they will say I think I‟m superior than them but which is not the case. Why I usually do that I want to improve my English but they just discourage me. That‟s why I usually have problems when answering the questions regarding the word problems.

e) I: Can you correctly translate the English language attached to the problem into the mathematical equation? Explain.

D5: In most cases I get lost mam. Yes I get lost a lot.

f) I: How do you think your home language affects your understanding of the problem statement?

D5: Yes, my major problem, I can say, is that mostly in classes we usually use our home language more than English when going problems that are …are…are involving maths that need to be answered in English. We usually use our language-IsiZulu- and not English which makes it hard for us to maybe answer questions when it comes to exams „cause questions in exams are usually asked in English rather than IsiZulu. So that is why we need to understand English rather than knowing the procedure. Because when you do maths sometimes there are formulas that you have to use and you have to know the procedure of how to use them. But when it comes to word problems you have to understand English itself rather than the procedure.

g) (i)I: Do you understand the language your teacher uses and the language in the textbook?

D5: Yes, more often but at times no.

(ii) I: Why do you say so?

D5: Yes mam, as I‟ve said earlier, is that when doing maths problems you have to…you have to understand English „cause questions are in English. To answer word problems you have to understand English and not only procedures-otherwise you won‟t be able to answer word problems.

h) (i) I: Do you prefer to learn in your first language or second language?
D5: Second language.

(ii) I: Why?

D5: Learning in English helps me to get ready for the exams which are in English. Also, English is the language for teaching and learning at schools.

i) I: When you read a word problem in the textbook what emotion do you feel?

D5: I don‟t feel happy because there are many problems that I am unable to translate into mathematical equation.

j) I: Would you prefer it if the question was read out and explained to you?

D5: Yes mam.

k) I: What would be different if you read it out yourself?

D5: There are some statements that will need my teacher to assist me to make sense of.

l) I: Do you understand better when your teacher changes from one language to another when explaining to you?

D5: Yes.

m) I: Do you think that this is a good practice?

D5: Yes, it‟s good. This gives a platform for equal understanding of the statement amongst all learners.

n) I: Explain- how code-switching help you to understand the problem.

D5: Eh…that one really helps a lot ‚cause if we both use IsiZulu and English that makes me have confidence in answering ‚cause if Zulu is included as well as English it gives me a picture of what the whole thing is talking about ‚cause it is made simple as it is simplified for me ‚cause there is Zulu. Sometimes if it is English only it really gives me a problem ‚cause I really fail to understand what it‟s all about.

APPENDIX K

INTERVIEW WITH M1

a) (i) Interviewer (I): Do you experience any difficulty in solving word problems?
M1: Oh I really…I do get some problems.

(ii)I: How?

M1: There are some questions that are a bit tricky. So I try maybe to re-read it so that I can understand.

I: Like which questions maybe from the worksheet?

M1: The age problems were a bit tricky.

I: In what way maybe?

M1: Oh, they ask a question that I don"t understand. Like the digit question in number 18. I couldn"t translate it into maths.

b) I: What do you think are the causes for the difficulty you experience in word problems?

M1: Oh sometimes I tell myself that I understand the question but I don"t. That"s what gets me wrong.

I: And what made you not to get the digits problem correctly?

M1: I think it"s the units, digits thing. I didn"t understand it really.

c) (i) I: Is the language in the word problem often or sometimes hard to understand?

M1: Yes, sometimes.

(ii)I: Why?

M1: Sometimes I don"t really understand what is required of me by the English statement. As a result, I am unable to translate correctly into mathematical equation.

d) I: How do you think these problems you encounter can be overcome?

M1: Oh I think I have to find the previous books like [the ones for] grade 8, grade 5 and grade 7. Now try do and understand those questions. Thereafter, I should try the ones for the upper grades.

e) I: Can you correctly translate the English language attached to the problem into the mathematical equation?

M1: Sometimes, yes.

I: Can you explain?

M1: At times I am able and sometimes I translate incorrectly. For an example in question 13, if you say the sum of two numbers it means those two numbers were added.

I: So, when writing this mathematically, what would you write?

M1: I‟ll say x plus y is equal to 54.

I: And this one (pointing at question 14)- the product of the two numbers is 72?

M1: I‟ll say x times y is equal to 72 because the product is the number [answer] that you get when you multiply.

I: And question 14, the sum of two consecutive numbers is 17?

M1: That one I don‟t understand. Consecutive- I don‟t understand.

I: But you were able to get the sum right?

M1: Ya…I tried.

I: So you were doing guess work?

M1: Ya… But I guessed right (laughing loud).

f) I: How do you think your home language affects your understanding of the problem statement?

M1: Eh…At home I live with people who don‟t understand English. So lot of times we speak Zulu. So I need someone who understands English so I can be able to answer questions.

I: So what do you mean speaking isiZulu at home does affect you when answering questions in English, such as WP?

M1: Yes…Ya. If I were speaking a lot of English at home I think I can perform much better.

g) I: Do you understand the language your teacher uses and the language in the textbook?

M1: Yes I do. I don‟t have a problem with understanding the English as a language but my problem is with the mathematical translation.

h) (i) I: Do you prefer to learn in your first language or second language?

M1: I prefer to learn in both languages.

(ii) I: Why?

M1: The examinations are in English and it is the language of teaching and learning. So I have to be used to it. But at times I prefer that the teacher uses isiZulu a little bit to clarify some words.

i) I: When you read a word problem in the textbook what emotion do you feel?

M1: I feel bad because I first think about whether I will be able to do the problem right. It becomes worse when the problem is talking about digits, consecutive. Like I sai, I don‟t understand those problems.

j) I: Would you prefer it if the question was read out and explained to you?

M1: Yes, so that the teacher might explain some difficult words.

k) I: What would be different if you read it out yourself?

M1: I might have some difficulties with some words and no one will be around to explain those to me.

l) I: Do you understand better when your teacher changes from one language to another when explaining to you?

M1: Yes I do.

m) I: Do you think that this is a good practice?

M1: Yes, it is. It gives us all a chance to understand more that we would do if only English was used.

n) I: Explain- how code-switching help you to understand the problem.

M1: Yes, I think it can help me „cause some questions are a bit tricky so if the teacher comes and explain to you it will make you understand.

APPENDIX L

INTERVIEW WITH M8

a) Interviewer (I): Do you experience any difficulty in solving word problems?

M8: No, I understand English well. Ya, it‟s not hard, you know.

I: So you don‟t have language problems in answering WP?

M8: No, there is no problem.

I: If so, what is it exactly that caused difficulty in you answering correctly these WP?

M8: I think maybe it‟s just the way they were to be done. Ehm…they were too tricky. The questions, I must say they were bit too tricky to such an extent that there are times where I thought I made it all right. And when I got it [solution]my way, I could see that this is what they were asking. But then when I got the script I realised that it wasn‟t the one I was supposed to do it the way I did it.

I: What exactly made it impossible for you to get them right- for example question 13, what made you to get it incorrectly?

M8: That‟s because when I said 48 minus 6 and 48 plus 6 that‟s the number I would get. So one of my problems was [that] I couldn‟t understand [that] they could be done simultaneously. I think that my problem is taking the [English] statement and putting it in a mathematical way.

I: What does it mean to say „sum of two numbers is 54 and their difference is 6‟?

M8: That means, there are two numbers that when you add then will give you 54 and when you minus them they should give 6.

I: So in terms of x and y, the first part will be x plus y, what would be the “the difference is 6”?

M8: I think this would have to be where a bigger number you‟ll get a smaller number when you minus a 6, and that can be…(wanting to put numbers in and not x and y).

I: Not putting in the actual numbers but x and y, what would be the difference?

M8: That means when you minus the smaller number from the bigger number you should get a 6.

I: In terms of x and y?

M8: Then it means x minus y is equal to 6.

I: So those would give two equations: x+y=54; x-y=6 and then solve simultaneously for x and y.

M8: Oh I see. Yes.

I: And with regards to question 14, do you understand what is meant by „consecutive numbers"?

M8: I think it means two numbers which are following each other, with no other number between them. So it will be x plus y is equal to 17.

I: And the product is 72?

M8: When you times x times y…When you multiply x times y is equal to 72.

I: Exactly. That"s what would give x+y=17 and xy+72 then solve simultaneously for x and y.

M8: Oh I can see. Like I said, my problem was not actually with the understanding of the English statement but was with translating the statement into mathematical form.

b) I: What do you think are the causes for the difficulty you experience in word problems?

M8: I guess maybe I don"t know the way it (statement) should be written. I just go the easy part of it- I"m talking of the sums and the…the differences. That"s the only thing I get to focus on. But talking of creating or making an equation- that"s one thing I don"t really have certain[ity]at. So that"s where I lose it. For example, question 17 and 18 on digits- ya, those were kind of difficult. I understand the 15th and the 16th [word problems] „cause that"s where you have to use sometimes general knowledge and use what are given. But for the last two really, it was worse.

c) I: Is the language in the word problem often or sometimes hard to understand?

M8: Not really. Understanding English language is not a problem but it"s only the translation part of it- writing mathematically is often a problem.

d) I: How do you think these problems you encounter can be overcome?

M8: Mhh… I believe that I should get myself used to writing WP. I‟m not used to WP. Maybe I really need to to engage myself more on that kind of problems. And maybe have someone who can do them (WPs) better so that I can learn from them and see how to tackle them. Also, engaging myself to WPs from standard 8 books and other old books would help me a lot.

e) I: Can you correctly translate the English language attached to the problem into the mathematical equation?

M8: Mhh…I‟m not good at that one. Quite infact, no. Even though I don‟t have a problem with English as a language, I‟m unable to write statements mathematically. That‟s my problem.

f) I: How do you think your home language affects your understanding of the problem statement?

M8: I don‟t think it affects me at all „cause I can speak English and understand English while I‟m a Zulu and I use Zulu most of the time. So I don‟t really see a problem with the [Zulu] language.

g) I; Do you understand the language your teacher uses and the language in the textbook?

M8: Yes, I understand the English language as used by the teacher and in the textbooks.

h) (i) I: Do you prefer to learn in your first language or second language?

M8: Second language.

(ii) I: Why?

M8: English is a language used at school for teaching and learning. Also, English is used in tests and examinations. So I should get used to it.

i) I: When you read a word problem in the textbook what emotion do you feel?

M8: I feel very bad as I‟m mostly unable to translate the English statements into mathematical equations. I really become unhappy.

j) I: Would you prefer it if the question was read out and explained to you?

M8: No, I don‟t think so. Only if I need clarity, I will ask my teacher to assist me.

k) I: What would be different if you read it out yourself?

M8: This gives me time to internalise the problem.

l) I: Do you understand better when your teacher changes from one language to another when explaining to you?

M8: Not really because I don‟t have a problem understanding English. If the teacher code-switches to isiZulu, I still understand the problem the same way as I understand it in English. Anyway we don‟t solve problems the Zulu way. So it doesn‟t help me really.

m) I: Do you think that this is a good practice?

M8: It‟s good to some extent since it helps some learners who don‟t understand English to understand even better.

n) I: Explain- how code-switching help you to understand the problem.

M8: Ya that makes it easier „cause there are some words which you find that you do not understand. But when he [teacher]switches to another language, that‟s where you get to understand better. At least it simplifies the whole situation into the simplest form „cause that‟s where you get it more easier.

APPENDIX M

INTERVIEW WITH M39

a) Interviewer (I): Do you experience any difficulty in solving word problems?

M39: Yes, I…I find the…other words difficult. Other words become a problem to me because others were tricky and I didn‟t understand easily. It was hard, I had to try and make me understand.

I: How do you make yourself to understand?

M39: Try it- I always try and try it again and practice it when I am at home.

I: So exactly is the difficulty?

M39: Eh…the problem is the English. It was so tricky- it was tricky to me. I didn‟t understand English.

I: Like which problems were difficult to you?

M39: Ya…the ones talking about the digits. I didn‟t understand that they were talking about the digits that they use in the number. I tried and didn‟t get it well [right].

b) I: What do you think are the causes for the difficulty you experience in word problems?

M39: Maybe the problem is that we don‟t normally use some words, you know. Because if we normally use the words it won‟t be a problem.

I: Can you give the words in these statements that you are not familiar with?

M39: Yes, words like consecutive. That was the difficult one. We don‟t normally use the word consecutive. But when I was doing the problem, I tried to gues it.

I: What do you think consecutive means?

M39: I think it means numbers that are following each other.

I: And which words were familiar to you?

M39: Difference and the sum. We normally use those words and are familiar and I got those problems right- they were not difficult.

c) (i) I: Is the language in the word problem often or sometimes hard to understand?

M39: It is sometimes hard to understand.

(ii) I: Why?

M39: You know, with the problems where they use familiar words like difference and sum, it‟s easy to solve the problem. But with more unfamiliar ones like consecutive, one cannot solve the problem. But if it is linear programming and financial Mathematics I don‟t experience problems.

d) I: How do you think these problems you encounter can be overcome?

M39: I think I have to take the script and try again. Maybe I can overcome the problem. I have to practice it and ask other [my] teacher [to help me] so that I can understand.

I: Not only focusing on these ones, how do you think you can master word problems in future?

M39: I think I have to try harder so that I can domy best- engage myself with different books, read the vocabulary at the back of the books, practice problems, etc.

e) I: Can you correctly translate the English language attached to the problem into the mathematical equation? Explain.

M39: Yes I can write it because I know when they say it‟s the sum it means that I have to add. So I think that if there is a word [variable] I need to use x or y. So I can translate.

I: So how should this (pointing at question 13) be translated?

M39: I think it will be x plus y is equal to 54.

I: And the product of the numbers is 72?

M39: It is x squared plus y squared because the numbers can be squared so that I can times [multiply] it to get product.

I: Why squared? Previously you said x plus y equals 54, and not squared?

M39: I think there it‟s the product- so it‟s a number times another number. So I think I can use squared so that I know that now I times [muliply] multiplicand.

I: So what will be the mathematical equation?

M39: It will be x squared plus y squared equal 72.

I: But if you write „plus‟ are you still multiplying?

M39: No, I‟m not multiplying. I will use the old way. Say maybe 8 times 9 is equal to 72. because if I do 8 plus 9 it means I‟m adding. I have to times [multiply] than add. So I think it‟s wrong [to say x squared „plus‟ y squared].

f) I: How do you think your home language affects your understanding of the problem statement?

M39: I think it affects me because when I read English I just understand it in my own language [have to first translate it to my langauge]. If they ask me something in English I translate it to isiZulu first and [as a result] I don‟t understand it in Mathematics [unable to translate to Mathematics]. I try to Zuluwise it because it is my language [that I understand better] because I don‟t understand it in English.

I: You mean you first translate the statement into isiZulu?

M39: I do that because I think that if translate it to [being in] English it‟s gonna cost me so I translate it into my own language so I can understand it easily.

g) (i)I: Do you understand the language your teacher uses and the language in the textbook?

M39: Yes, sometimes.

I: Why do you say so?

M39: I do understand to some extent. But soemtimes there are words in the English statements that I don‟t understand. That is why the teacher has to switch to isiZulu sometimes so I will understand clearly.

h) (i) I: Do you prefer to learn in your first language or second language?

M39: I prefer to learn in both languages.

(ii) I: Why?

M39: Exams are in English so I have to understand English but when there are [English] words I don‟t understand there must be code-switching to isiZulu.

i) I: When you read a word problem in the textbook what emotion do you feel?

M39: I don‟thave a problem with story problems in linear programming and financial Mathematics. But these ones, eyi…it‟s like I know nothing.

j) I: Would you prefer it if the question was read out and explained to you?

M39: Yes, I will prefer if it‟s read out and explained.

k) I: What would be different if you read it out yourself?

M39: If I read it myself there are words I will not be able to understand and no one will expalin them to me if there is no teacher around.

l) I: Do you understand better when your teacher changes from one language to another when explaining to you?

M39: Yes, I understand better that way.

m) I: Do you think that this is a good practice?

M39: Yes, it is. It gives us all the chance to understand better.

n) I: Explain- how code-switching help you to understand the problem.

M39: It helps me because there are different teachers. It can happen that the teacher try to explain in his or her own way but then if he chooses to tell me in isiZulu- in my own language-I can understand clearly „cause inEnglish he can use words that I don‟t understand. But if he switches to isiZulu it becomes easy.

APPENDIX N

GROUP INTERVIEW WITH LEARNERS FROM SCHOOL K

Interviewer (I): For number 3 I can see that all of us got the different answers. Some said it was 12 plus 12 is 24, others said 23 plus 1 is 24, others said 13 plus 1 is 24. K1, you said 10 plus 14 is 24. Why did you think of these numbers as the ones to give you 24?

K1: Eish…I just thought of these two numbers. They are the ones that came to my mind first.

I: And you K2? Why 12 plus 12?

K2: They make 24 (saying it with ease and laughing).

I: But any numbers can make 24?

K2: Yes mam, I thought these were the simplest, as long as they long as they make 24.

I: And you K3, you chose to use letters „a" and „b", why?

K3: because they can mean any number.

I: Thank you very much. Yes, „a" and „b" can be any numbers. For example, in a+ b=24, „a" can be 13 and „b" can be 11 or any other numbers as long as they add up to 24.

I: K1, for number 5 why did you choose „piece of land"?

K1: I don"t know really, I just chose an answer. (All laughed). The way I came to the answer mam, I can"t think (Laughing).

I: I think you associated the word perimeter, plot of land and rectangular plot of land.

K1: Yes mam, I think so.

I: Why did you think of „even" as meaning the same as „although".

K1: Eish… I just don"t know mam. I only chose „although".

I: Infact, you were directly translating „even" as in English which will mean „although".

K1: Although even 2 does not have two digit numbers but you can say it"s the even number .That is why I said "Although".

I: Can you repeat that?

K1: That"s 2 doesn"t have 2 digits but its even.

I: But the statement reads "Even numbers 18 and 22 have two digits". Would it (even) be same as although (in this case)?

K1: I said "although 2 doesn"t have two digits but it"s and even number".

K2: But mam one could write „not odd" .It would read "Not odd numbers 18 and 22 have two digits"

I: No , I wouldn"t replace „even" by „not odd numbers", .Here I wanted the definition for even. So the word „even" wouldn"t be replaced by „not odd".

I: In section C no. 13 you were substituting backwards, substituted with the numbers such that when added they give 54 but when subtracted they give 6.W hat exactly made you to use actual numbers and substitute by numbers instead of variables?

K2: Because the statement says the sum of the two numbers is 54, difference is 6. Hence I was looking for the numbers that when added will give 54 and when subtracted will give 6.

I: Okay, you were looking for the numbers no matter how you got them.

I: And you sisi, you got it the other way round. How did you think of x and y?

K3: I don"t know (she pauses). Mhh..Because it would be easier to work with letters. I find it easier to work with letters instead of numbers.

I: So you prefer to work with variables instead of numbers?

K3: Infact I don"t really like variables. I thought that method (using numbers) would be wrong.

I: K1, How did you think of 2 and 1 to be the numbers that are to be substituted for in the perimeter question in order to give you the correct answer for the perimeter?

K1: I was just looking for the numbers that I can get then multiply them and that‟s it. And find it very easy to work it that way.

I: K4, it‟s like you want to add more on that?

K4: Yes mam, I …I didn‟t seem to get that 4 (all laughed).

I: You didn‟t seem to get that 4?

K4: Yes mam.

I: Oh you never even got one for the perimeter?

K4: No, I got 1 but then…you must take that when you are talking about it mam. I can see that K1 put a lot of effort in putting this number here. That‟s why she got a correct answer mam.

I: And you used numbers 9 and 8 to get the correct answer?

K4: Oh yes mam. Simply because I looked at the previous question and I got a clue there that what happens is…You asked a question at the end while you‟ve asked the same question at the beginning. However, even if you did not include the other question mam, we would get this correctly mam, it was easy stuff –this is grade 10 work!

I: Is it?

K4: Yes mam. (All laughed)

<u>Based on interview questions</u>

I: Guys, do you experience any difficulties in answering word problems?

K5: Yes mam, I had a problem in question 18 because as you read this thing here, you read the statement that „A two digit number what, what‟-it just confuses your mind! (All agreed).

I: Is it because one can‟t think of a two digit number or …

K5: No…You think of a two digit number but then you‟ll need a digit number…Ya…digit number… It boggles your mind and you‟ll end up getting the wrong answer.

K1: Too much wording makes it confusing!

I: Too much wording makes it confusing? Wow, what a statement!

K1: Mam, mostly I am a doer, I don‟t like speaking too much. I love to do sums but now this too much words…eyi! I have to think about the stateme…nt, I have to think about the su…m.

K1: Mam, about number 4-I don‟t know. I thought it was more complicated (All agreed then all laughed).

I: Yes, most gave different responses. Some said 18 divided by 6, others 18 divided by 2 and others 6 divided by 2.

K1: Like the formula with letters…

I: It‟s like you never knew what „average‟ means?

K1: I do know what average means-you add the sums, you divide by the number of items.

I: Why didn‟t you get it correct then?

K1: Eyi…

I: I can see that was the most challenging one for you.

K1: Mhh (Nodding her head to agree).

I: What do you think are the causes for the difficulties-you have mentioned „too much wording‟. Any other difficulties?

K5: too much wording. If you can write short sentences so that it‟s straight forward.

I: Is English not associated with the difficulties?

K5: No, there is no problem with the English.

I: How can these difficulties be overcome?

K3: Use of short sentences. I also think diagrams are better.

I: but how can you use diagrams in „Sipho is twice as old as Thandi. If Thandi is… "

K3: No, I‟m talking about things like perimeter.

K4: Mam, I find one of the problems to be that eh…Mam we are not used to solving things like this. (Pointing at the worksheet).

I: is it?

K4: Yes mam. We don‟t do number sentences and …story sums. We are grade 11 (all laughed). We do like little solve for x mam, find gradients and things like that mam. So mam, I think as they say practice makes it perfect mam, if we can practice this from the book more, we‟ll find this like easy mam. Yes mam.

K5: another thing is that we do a lot of these in primary schools. So by the time we reach grade 11 it‟s hard to remember it and then we are like we don‟t know.

I: Can you correctly translate the English language attached to the problem into the mathematical equation? For instance, to translate „The sum of two numbers is 54 and their difference is 6. Find the numbers‟. Can you do it?
K2: Yes, I can. And it‟s only the Mathematics that blocked my way.
I: Do you think home language does at all affect the way one understands t he problem statement?
K4: Ya , it does affect your understanding of the question mam.
I: How?

K4: „Cause if you grew up speaking other language, not English, like you come up for the exam and you get a question paper like in English you‟ll have a problem. When you grew up speaking English you would understand it more than the person who grew up understanding Zulu or something. So that‟s why you‟ll have an advantage of understanding better than the one speaking Zulu.
I: But do you think you per se are affected by the fact that you speak isiZulu at home?
K4: Eh…With my maths and English I am not affected that much.

I: Do you prefer to learn maths in your first language or second language?
K1: my first language is Zulu and …Mam, exam questions are in English. So if one reads out the statement in Zulu I end up saying „what‟! I can‟t comprehend what the statement means but it makes it better and much more easier when you put it in English. I think when it is in Zulu it‟s more complicated „cause some words you don‟t understand.

I: Alright. When you read a word problem from the textbook, what emotions do you feel?
K5: I feel mean. When I looked at the statement and have to read…all these words…and I could see that mhh…That‟s too much.
K1: To read, comprehend, understand and then do the sum…No, no.
I: So how would you prefer it to be done?
K1: 10 plus 7, that‟s all. Not too much wording, use diagrams.
K3: Maybe if you can explain the equation, not just words only.

I: Would you prefer it if the question was read out and explained to you?
K2: Rather explain what the question means before looking at it myself.
I: But do you really think that when I explain to you I‟ll be able to do it such that you are able to do it?
K2: When you explain I can ask questions. When I‟m alone I‟m alone and I won‟t be able to ask questions.
I: So do you prefer it to be read to you?
K2: Yes mam.

I: Do you understand it better when your teacher switches from one language to another when explaining to you?

K1: They don‟t do it here.

I: Ok. But would you prefer it or not?

K5: Mam, if the teacher can know the the language that we all understand, it would be better because he or she can explain in English then for a particular concept s/he can change to Zulu just to make more clarity to the learners.

I: But in maths there are no Zulu words that can explain terms like factorise, simplify, and so on. There are no zulu words for these.

K5: You woudn‟t know….

I: So do you think you are deprived of such a chance sometimes?

K5: Not everyday. But in maths, English is perfect.

APPENDIX O

GROUP INTERVIEW WITH LEARNERS FROM SCHOOL S

Interviewer: Do you experience difficulties in answering word problems?

S4: Yes, there are problems. There are difficulties when I‟m solving the problems because sometimes it might happen that I will not understand the question and there are some things I w ill need to… to find so that I will answer the question.

I: Things like what?

S4: Things like maybe if I‟m given the question with numbers, I need to know ukuthi (that) this number is for length or something so that when I substitute (in the formula) I will know that this is for length or breadth.

I: So would you prefer that you are given numbers not just statement without numbers?
S4: Yes, statement with numbers.

I: So, does it make it difficult for you if there are no numbers?

S4: Yes, and the English. Ya, English has an impact.

I: What is wrong with the English?

S4: There are terms that are being used which I‟m not used to them.

I: Like which terms maybe, if you may recall from these questions?

S4: Consecutive.

I: Consecutive? So you never understood what is meant by consecutive?

S4: Yes.

S1: Sometimes word problems are complicated.

I: What is it that makes it to be complicated for you-English?

S1: No, it‟s not the English.

I: Calculations or maths?

S1: Mhh…No.

I: What is it exactly?

S1: Eh…Just can‟t explain.

S3: Oh to add, it might happen that the way the question is asked in Mathematics, it‟s not the easiest way like the English asks the question. So that‟s why we find amadifficluties.

I: The way the question is asked? Is it sometimes easier to answer and sometimes difficult?

S3: Yes, for instance I‟ve got some answers correct here and got others wrong.

I: What do you think are the causes for experiencing word problems?

S1: The causes may be that we are not used to such- word problems. We are not used to them. If we were dealing more often with such in class, it will be really much easier.

I: Is English hard to understand?

S4: I think sometimes they are difficult. Like these ones that we were doing here (pointing at section A), it was easy to understand because we are used to them. Some others we are not used to them. We don‟t understand them the way we should understand them. I think the English language was a challenge.

I: How do you think the difficulties can be overcome as you sometimes experience problems- even in linear programming there are word problems?

S1: I think we should do more of them in the class. Ya. Also using a couple of books with the word problems could be the solution.

S3: Another solution is for the curriculum. Now it‟s the NCS, isn‟t it? The NCS must not flush away the word problems but also include it, not only solving for x nje without understanding the

word problems. The only problems that are known are only „solve for x" nje kuphela. So that"s why we find difficulties with such problems (pointing at activities on word problems).

I: Can you correctly translate the English statement into maths? For example, you were to solve this one (pointing at number 15-perimeter and dimensions problem). Could you correctly translate such?

S4: First, it will depend on the words. For instance, are we used to them. So at times we are able to translate and at times we are not able.

I: I could see that most of you just chose numbers to put in instead of writing statements mathematically. Why did you choose numbers?

I: Do you think your home language isiZulu affects your understanding of WP?

S2: Oh isiZulu does not have an effect because when we are here at school, isiZulu is included as one of the subject. There is no other way to avoid speaking isiZulu because it"s difficult to do away with it.

I: What I mean here is: Do you think if you are an English speaking person, would you encounter difficulties that you experience today? Would it make any difference?

S3: Yes, there would be difference.

I: Why?

S3: Because if you are an English person you are always practising the English. So in (mathematical) problems that need English you"ll not experience difficulties.

I: And why don"t you practice English, even though you are speaking isiZulu?

S3: Oh the reason is (laughing) our background can affect us to speak isiZulu because you might find that (for) some of us maybe there are parents who do not clearly understand English. So it"s compulsory for us to speak isiZulu when we communicate with them.

S4: I think even the English speaking person will also find difficulties in answering such questions because this… I think the way English is used here it‟s not the same as the English that you use when speaking. So it has to do with understanding and translating to maths.

S1: Emh…My mother language-isiZulu-has no influence on those English statements. Even the English speaking person would have difficulties answering these. Ya.

I: Do you understand the language the teacher and textbooks use?

S3: Yes, sometimes I understand.

I: What do you mean „sometimes‟?

S3: Sometimes there are terms that are used that I don‟t understand.

I: Terms like which ones?

S3: Terms like consecutive. I once saw it in Physical science. So I just thought of physical science (when seeing it here).

I: Did the term „consecutive‟ mean the same as in Physical science the way it was used here? In Mathematics it means numbers following immediately after one another, even in science for example it is the waves following immediately after another. Don‟t you think the meaning is the same?

S3: No, I don‟t think so.

I: Do you prefer to learn in your first language? Why?

S1: I prefer to learn in English „cause English is the language we use for communication all over the world; we get examined in English.

I: When seeing word problems, what emotions did you have?

S1: First I thought it was easier but when I went through with the problems I found out it wasn‟t that easier. I haven‟t learnt much…Ya.

S3: I feel it‟s my first time to read these… What do we call them? Word problems. Because mh… I had a feeling…My feelings were that it‟s like I don‟t understand Mathematics clearly. Yes…yes. It was like I‟m dull. I undermined myself.

S4: These questions…When I read them I didn‟t understand most of them. So after that I felt a little bit ashamed of myself. I just felt like I didn‟t know.

I: Sorry guys for that. But let me assure you, you still know your maths.

I: would you prefer it if the question was read out and explained to you?

S4: Yes. Because I think that person who will be reading it out loud will have an understanding of them. So he or she will explain for me and I will understand and know what to do. Later, after practising, I will be able to do it on my own. For these ones it was like I was seeing them for the first time.

S3: No, I don‟t need an assistant because the English says practice makes (it) perfect. If you do practice you find that next time you‟ll not experience any problems. But if somebody read and explained to you, you‟ll find that next time you‟ll get similar problems and you‟ll not solve it.

S1: No, it won‟t make any difference.

I: Do you prefer that the teacher code-switches when explaining to you?

S4: Yes. Because there are some words which are too difficult for me to understand because English is not my mother tongue. So while explaining there are things I will not understand but when he or she code-switches I will understand and do Mathematics on my own.

APPENDIX P

RESPONSES FROM TEACHER C

a) Sometimes the learners don‟t understand the vocabulary used. There is specialised maths vocabulary that the learners should learn. Just like in the language, they have to learn what that word means and how to use it in a particular context.
b) Sometimes. Most of our learners are isiZulu first language, but do speak, read and write English.
c) It is more how the questions are worded or phrased that is the problem.
d) English
e) English
f) No
g) Yes, it can put things into their own language or context that helps them understand.
h) Absolutely. If you have never heard something expressed in a certain way, you may need someone to „interpret‟ it for you before you understand what it is about or how to solve the problem.
i) Yes, in 2008, yes it is implemented.
j) Sometimes there isn‟t an exact synonym for the word in the other language. For example when we talk about consecutive maybe in isiZulu there isn‟t a word for consecutive and you‟ll have to explain what that word means and not just give synonym for it, give examples of what I mean by that word. So if there is no synonym, it might bring problems when one cannot attach meaning to that particular word.
k) The learner has not been exposed to that kind of terminology or phraseology before and needs to be taught how to interpret mathematical language.
l) I rephrase the problem; break it into sections; use diagrams and problem solving techniques and ensure learners have worked through the worked examples first for proper understanding.
m) No.

APPENDIX Q

RESPONSES FROM TEACHER K

a) To come up with a proper strategy that caters for both fast learners and slow learners in the interpretation of word problems into mathematical presentations in order to find answers.
b) Language though not a big problem; but sometimes it is good to illustrate using the vernacular language.
c) Twice as much, doubled and then added to, at least, at most, square of, squared.
d) English
e) English
f) No
g) Yes, some illustrations or examples can be done in another language in order to cater for the slow learners and those who are not competent in English although it is also difficult to code-switch in most mathematical problem.
h) Yes, language leads to understanding the environment. When mathematical word problems are taught in English, this means that those who grew up in a different environment will face difficulties to form concrete ideas in their minds. Linking practical situations to Mathematics may not exist.
i) Yes, was developed in January 2009. The language policy is totally implemented.
j) Learners struggle to give correct answers.
k) Lack of exposure and awareness to everyday problems that involve Mathematics.
l) (i) Giving them more practical examples which are concrete.
   (ii) Much emphasis given on the problematic words such as those in (c)

   (iii) Code-switching when necessary.

   (iv) Much time and interaction to work out problems.

   (v) To scaffold them i.e. to give them time and guidelines until they build up the mathematical statements on their own.

APPENDIX R

RESPONSES FROM TEACHER D

a) Some other problems really they are difficult to teach them but not all of them. Sometimes the problem is with us that really we do not want to listen and learn stories properly.
b) Language really is a problem, because of language that is why I said word problems they are not really easy to interpret them, so we must understand it.
c) Problems like the ones that you interpret under linear programming and under the financial Mathematics.
d) Both languages, that is, isiZulu and English.
e) English, but sometimes when you explain to the learners you see to it (you realise) that others really they do not understand. So you must also interpret that with isiZulu, (which is others‟) vernacular language.
f) Yes I do because other learners they really do not understand if you explain by using English. So code-switching automatically happens because one thing is that other learners they do not understand English so they want you to teach them and do emphasize with isiZulu.
g) Yes, it soes help them because once you interpret the language that is there in a (mathematical) problem it becomes easy to them to understand what the problem is all about.
h) Yes, it influences, because when the question(s) come(s) they do not understand instructions and questions. So if you do not understand all those things it becomes difficult to answer them.
i) Yes it does, from 2007. Yes it is but other learners they do not want to use it, even during break or lunch time they don‟t have a right to use their home language.
j) What I observed is that even if you are busy teaching, other learners when they talk to each other in the classroom they use their home language as well as if they want to ask questions they use home language and if you tell them to use English they rather live (keep quite) without saying anything.

k) Because other learners they are from public schools, it is difficult for them to translate it.

l) It is only that first explain it by their first [additional] language and after that translate it to their home language.

m) Yes.

APPENDIX S

RESPONSES FROM TEACHER M

a) Some learners do not understand. Our kids are not given a chance to read- „cause that‟s what they are failing: to read and to write. Our students lack fundamentals . And if ungenawo amafundamentals ayikho into ongayenza (If one does not have basics fundamental, there is nothing he or she can do). You can ask a grade 12 student what is x plus x, they will say 2x, some will say x^2, 0x and so on. It‟s all because they are lacking fundamentals. Pass requirements also have an effect- as early as the primary level where the learner will go on to the next grade but failing to read and write. If that learner reaches the secondary level, failing to read and write, the problem will only be observed in grade 11 and 12, while it has been neglected all the way. Hence they fail to interpret English into mathematical equations, and so on-like in linear programming and financial maths.
b) Yes, language is one of the factors. Some vocabulary is too much challenging.
c) Twice, comparisons such as twice as older than.
d) English
e) English
f) Yes. Always.
g) Yes. With the help of the teacher code-switching always, learners can have a better understanding of the word problems.
h) Yes, poor vocabulary on the side of the learners.
i) Yes, since the school started.
j) The manner in which problems are presented.
k)

- Additional language [English].
- Teachers do not make sure that they help learners in the interpretation of the language used in the word problems.

l) I take a closer look on each and every learner‟s problem and try and make them understand the language attached to the word problem.
m) Yes, authors should give some hints in each and every word problem.

APPENDIX T

RESPONSES FROM TEACHER S

a) Learners do not understand WPs. They cannot translate textual problems into mathematical problems.

b) Language seems to be a major problem for learners to tackle any word problem. Firstly they do not understand the statement of the problem. They cannot extract meaning from the given statement. In some other cases, even if they have the little understanding but they experience difficulty when it comes to recognising crucial information required to answer or solve the problem. Secondly, learners fail to make a mathematical sense out of verbal statement. Sometimes they even fail to make sense or realise a number like „204" when written in words as „two hundred and four".

It seems learners sometimes think that Mathematics is only about numbers, no words involved.

c) Words like: greater than, smaller than, as twice as, doubled, increased by, decreased by, maximum, minimum, and so on.

d) I learned Mathematics in English with a little bit of isiZulu when my teacher wanted to clarify an important point for more understanding.

e) I prefer using English.

f) Yes, I do code-switching very seldom. A lot of code-switching distracts or impedes learning of English through speaking English.

g) Oh yes I do! But I think code-switching helps learners to develop conceptual understanding rather than the content. For an example, when you substitute some words with other words having similar meaning and also change the sequence of clauses (sentences) in the same WP, learners still cannot solve or answer.

h) Yes, it does influence. Learners who have a background in English have an advantage over learners who have no background. Those with English background can easily narrate (tell a story) about what is taking place in a word statement but cannot solve the problem.

i) Yes. Three years ago. Not implemented.

j) Sometimes learners misinterpret language of the problem, maybe because their English vocabulary is not well developed. Sometimes they also fail to interpret correctly if the problem is deeply embedded into a complex statement with long sentences and specialised language e.g frequency.

k) Their maths concepts are well developed through the language and immediately they are confronted with WPs in English. For an example if the learner is confronted with a problem about a rondavel house he or she can answer questions easily correct. But once some Mathematics which is in learner‟s everyday life is fitted into the rondavel problem, then the learner becomes confused.

l)

1. I first teach or expose my learners to the variety of mathematical terminology or vocabulary that may be required in WPs. e.g

   Greater than $\rangle$ or $\langle$

   Smaller than $\langle$ or $\rangle$

   Greater or equal $\geq$

   Smaller or equal $\leq$

2. I use the number line system to develop the concept of inequality.

3. Then I cause my learners to construct a mathematical statement from a given textual statement. For an example: “Nosipho is 3 years younger than her brother Themba. Express their age relationship using a mathematical statement.

4. Learners are then given a word problem to solve by applying the multi-steps.

m) Integrating Mathematics with other subjects such as English can help because as a maths teacher you end up teaching grammar and sentence construction. In some cases you even teach how to pronounce some words. Teaching learners how to extract most crucial information needed to answer a WP is even more challenging to do.

APPENDIX U

P.O. Box 9786

St. Lucia

3936

10 November 2010

Dear Parent / Guardian

A request to conduct a research with your child

I am Maureen Phathisiwe Sithole , a Masters student from the University of KwaZulu-Natal. My course requires me to research in an area of importance in the teaching and learning of Mathematics. My area of interest is the effect of English language in the teaching and learning of word problems by the English second language learners. This requires me to work with grade 11 learners doing Mathematics.

I therefore request to do a research with your child in this regard. May I ask for your permission to engage your child in answering the worksheet which should take about 30 minutes. Thereafter I will conduct interviews of about 20 minutes each, with some selected learners.

Anonymity and non-traceability will be assured. No real names of persons or institutions will be used in the write-up of the findings of this study. The participants are free to withdraw from the study any time they wish to do so. The findings from the study will only be used for the purposes of the study.

If you have any queries regarding this study please do not hesitate to contact my supervisor, Dr Mudaly at mudalyv@ukzn.ac.za or 031-260 3682. You can also contact me on 0825496346.

Yours faithfully

MP Sithole

(*Researcher"sSignature*) (*Date*)

DECLARATION

I....., parent / guardian of.....agree / disagree that my child participate in the research being conducted by **Maureen Phathisiwe Sithole** concerning the effect of English language in the teaching and learning of word problems by the English second language learners.

Signature Date

....

APPENDIX V

P.O. Box 9786

St. Lucia

3936

10 November 2010

Dear Principal

A request to conduct a research at your school

I am Maureen Phathisiwe Sithole, a Masters student from the University of KwaZulu-Natal. My course requires me to research in an area of importance in the teaching and learning of Mathematics. My area of interest is the effect of English language in the teaching and learning of word problems by the English second language learners. This requires me to work with experienced teachers-people with the necessary expertise in the subject, and also the learners who experience difficulties with word problems.

I therefore request to do a research in your school in this regard. May I ask for your permission to work with grade 11 Mathematics teacher in answering the questionnaire which should take about 20 minutes. May I also engage grade learners in answering the worksheets which should take about 30 minutes. Thereafter I will conduct interviews of about 20 minutes each, with some selected learners.

Anonymity and non-traceability will be assured. No real names of persons or institutions will be used in the write-up of the findings of this study. The participants are free to withdraw from the study any time they wish to do so. The findings from the study will only be used for the purposes of the study.

If you have any queries regarding this study please do not hesitate to contact my supervisor, Dr Mudaly at mudalyv@ukzn.ac.za or 031-260 3682. You can also contact me on 0825496346.

Yours faithfully

MP Sithole

I....., principal of.....fully understand the conditions of this project. I also understand that participation is voluntary and that confidentiality and anonymity in this study will be assured.

Signature	Date
.....	.....

APPENDIX W

P.O. Box 9786

St. Lucia

3936

10 November 2010

Dear Colleague

A request to involve you as a participant in my research

I am Maureen Phathisiwe Sithole, a Masters student from the University of KwaZulu-Natal. My course requires me to research in an area of importance in the teaching and learning of Mathematics. My area of interest is the effect of English language in the teaching and learning of word problems by the English second language learners. This requires me to work with experienced teachers like you, people with the necessary expertise in the subject.

I am asking you to take part in this project by answering a questionnaire which should take about 20 minutes. The process seeks to identify the extent to which English language impacts on the teaching and learning of word problems. Please be as truthful as possible in answering the questionnaire.

Anonymity and non-traceability will be assured. No real names of persons or institutions will be used in the write-up of the findings of this study. The participants are free to withdraw from the study any time they wish to do so. The findings from the study will only be used for the purposes of the study.

If you have any queries regarding this study please do not hesitate to contact my supervisor, Dr Mudaly at mudalyv@ukzn.ac.za or 031-260 3682. You can also contact me on 0825496346.

Yours faithfully

MP Sithole

I....., fully understand the conditions of this project. I also understand that participation is voluntary and that confidentiality and anonymity in this study will be assured.

Signature	Date
.....	.....