Multilingualism and the Development of African Languages: A Case Study

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DECLARATION

I declare that the thesis hereby submitted to the University of Limpopo for the degree of Doctor of Philosophy has not been previously submitted by me for a degree at this or any other university, that it is my own work in design and in execution, and that all material contained herein has been fully acknowledged.

Thembinkosi E. Mabila

20 August 2007

DEDICATION

This thesis is dedicated to the three most important women in my life: my lovely wife **Nkateko,** beautiful daughter **Nsovo** as well my caring mother **Cinisile**. To my brother **Xolani**

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Above all, I would like to direct my thanks first to my Lord, God Almighty who through Jesus Christ has given me strength to see through it all.

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ABSTRACT

This thesis reports a case study of multilingualism and the development of African languages conducted in the Mpumalanga province. The study aimed to establish whether mother tongue terminology (in particular SiSwati) would cope with the requirements of the teaching and learning of mathematics. The data in this study came from more than one source. First, an analysis was done of *The Multilingual Mathematics Dictionary for grades 1 to 6* (2003). Second, by means of a structured questionnaire the beliefs of educators about and their attitudes towards the use of the mother tongue terminology in the teaching and learning of mathematics were collected. Indeed, educators are expected to play a vital role in the implementation of the Language in Education Policy (LiEP) of the 14th July 1997. Third, data on the applicability of the mother tongue terminology in the learning of mathematics was obtained by means of a mathematics test specifically designed for this study and administered to learners. The data was analysed using multivariate analysis. The results show that in the development of the SiSwati terminology the most widely used methods were, in descending order, "coinage" and "paraphrase". While the results show that Curriculum Implementers hold a positive belief about the use and value of the mother tongue in the classroom, they however show that educators strongly believe in the use of English in the mathematics class. The results of the mathematics test show a positive understanding, on average, by learners of the various terminologies found in the dictionary, although some difficulty in understanding tasks using a few terms was established. This was particularly the case with questions that required the skill of inference. In essence, the study concurs with the proponents of the process of African language modernisation and

points to possible shortcomings. It is hoped that future language development projects, in particular those commissioned by the Department of Arts and Culture through the National Language Service, will benefit from the findings and recommendations of this study.

NGALOKUFISHANISEKILE

Lona mculu ubika ngeluhlolo luvo lwetilimi letinyenti nekutfutfukiswa kwetilimi tase Afrikha. Kuloluhlolo luvo umfundzi uhlose kutfola kutsi emagama elulwimi lwekutalwa ikakhulu SiSwati lingasentjentiswa ekufundzeni nekufundza tibalo. I-datha yaloluhlolo luvo yatfolakala ngekuhlatiya I-dictionary yetibalo yelibanga lekucala kuya ebangeni lesitfupha, leyatiwa ngekutsi I *Multilingual Mathematics Dictionary for Grades 1 to 6.* Loluhlolo luvo luphindze lwahlolisisa tinkholelo tebahleli betemfundvo (Curriculum Implementers) ngekusebentisa emagama elulwimi lwekutalwa uma kufundziswa tibalo. Kute kutfolakale umphumela ngekulinga kusebentisa lulwimi lwekutalwa eklasini letibalo, imibono yebafundzisi (bothishela) yadzingeka kutsi itfolwe ngobe ngibo labadlala indzima lendze ekushicileleni ipholisi yelulwimi kutemfundvo (Language in Education Policy - LiEP). Imibuto lehleliwe (Structured Questionnaire) yasentjentiswa kukoleka idatha mayelana nemibono yebafundzisi nobe bothishela. Kusentjentiswa kwemagama elulwimi lekucala kwabuye kwahlolisiswa ngekuniketa bafundzi sivivinyo setibalo lesibhalwe ngeSiSwati. Lesivivinyo sasihlelelwe loluhlolo luvo. Lemibono (idatha) leyatfolakala ngaloluhlolo luvo lephuma etindzaweni letehlukene esifundzeni sase Mpumalanga, yahlatiywa ngeluhlatiyo lwe Multivariate. Imiphumela yaloluhlolo ikakhulukati macondzana ne kutfutfukiswa kwemagama eSiSwati ikhombisa kutsi emagama lamanyenti kule dictionary yetibalo atfutfukiswe ngendlela lebitwa ngekutsi yi – Coinage, ilandzelwe yi – Paraphrase, bese kutsi imiphumela mayelana nebahleli betemfundvo, ikhombisa umdlandla ngekusentjentiswa nekwemukelwa kwe lulwimi lekucal eklasini. Imiphumela iphindze ikhombise kutsi bafundzisi (bothishela) banenshisekelo lenkulu ngekusentjentiswa kwe lulwimi lwesingisi eklasini letibalo. Isampuli yebafundzi ikhombisa imiphumela yekutsi bafundzi bayawevisisa lamagama eSiSwati latfolakala kulencwadzi ye dictionary yetibalo. Noko lihlandlana lebafunzi aliwevisisanga kahle lamagama. Loku kwavela kakhulu emibutweni ledzinga lwati lekutsatsisela. Ingcikitsi yaloluhlolo lolubhalwe kulesifundvo kugcizelela kuhlelwa nekutfutfukiswa kwetilimi tase Afrikha lubuye lukhombise tihibe letingaba khona kuletingucuko. Umfundzi uyetsemba kutsi imiphumela yalesifundvo itawusita kwengetelela imitamo yekutfutfukisa lulwimi,

ikakhulukati leto letisebentelana nelitiko letebuciko nemasiko ngekuchumana ne National Language Service.

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CHAPTER 1

ORIENTATION TO THE STUDY

1.1 INTRODUCTION

A decade after the demise of the apartheid regime, an event potently symbolized by the first multiparty and multi-racial elections in 1994, South Africa took stock, on the occasion of the celebrations of the first decade of democracy, of achievements of the new dispensation. One of the areas in which a careful look has been urgent is that of education, one of the pillars of the discriminatory regime for decades, through the infamous Bantu Education Act of 1953. The latter was a legal way of separating the education for blacks from that for whites (McLean and McCormick, 1996) and a barrier to the socio-economic advancement of black South Africans (Branford, 1996).

In referring to education, the issue of language of instruction and/or learning comes to mind. Indeed, the apartheid language policy "was one of the tools for advancing the goals of apartheid" (Kamwendo, 2006: 53), besides serving to define racial groups in support of apartheid, being used as an instrument of nationalist mobilization and reinforcement of the political power of the white minority, and serving to gain access to certain rights and privileges, such as job opportunities (Webb, 1996: 139). One compelling illustration is the decision to discourage the teaching of English, believed by apartheid thinkers to constitute a potential threat to white privilege because it would presumably bring with it knowledge among the educated blacks (Rose and Tunmer, 1975).

Given its central position in South Africa's socio-political history, language will continue to be one of the sites of the struggle for social, educational and economic transformation (Beukes, 2004) and development because of its potential role in education, administration and the economy, and nation-building (Mesthrie, 2006). Language-in-education policy has been an important leitmotiv among linguistic human rights advocates, because education is "a key site for the implementation of linguistic human rights. Consequently, the choice of the medium of education is the

most crucial variable for maintaining the world's linguistic diversity when all children attend school" (Skutnabb-Kangas, Phillipson and Kontra, 2001: 149).

The skewed language policy of the past in favour of speakers of English and Afrikaans relegated the majority of South African blacks to the bottom of the socio-economic scale because of their mediocre education and lack of skills. There therefore arises a need for a re-examination of the use of language in education. Indeed, the sociolinguistic profile of South Africa shows that the overwhelming majority of South Africans, almost 80 percent of the population, use an African language as their home language (*Statistics South Africa,* 2001). On the other hand, English and, to a lesser extent now, Afrikaans, are, regrettably, still dominant as languages of learning and teaching.

This scenario is according to Saville-Troike (1984), Cummins and Swain (1986), and Bell (2003) responsible for stunting learners' cognitive growth, and thus result in "poor performance in content tests" (Bell, 2003: no page). Thus, Bell (2003) also observes that there are also strong indications that testing and assessment in the second language (L2) disadvantages learners. In addition, Anstrom (1997: 35) notes:

> All too often, second language learners are asked to participate in tests that make unfair assumptions about their English language proficiency in order to assess their content knowledge. Furthermore ... second language learners when measured against their native English speaking peers, may fail to meet mainstream instructional goals.

Baker (1993: 175) feels that learners in a second language education programme lag behind their peers in areas such as mathematics and science. The explanation he offers is that "this may be because their second language skills are insufficiently developed to be able to think mathematically and scientifically in their second language" (Baker, 1993: 175). This view is supported by Cummins and Swain (1986: 39), as well as Saville-Troike (1991: 1), who states that:

> Certainly second language learners are at a disadvantage trying to understand instruction and express themselves in a foreign language, especially when they must compete with other learners who have already mastered their first language.

Not only does the second language itself hinder the learners understanding; the educational system as a whole tends to expect lower achievement of learners studying

through a second language. This manifests itself in a variety of ways; one of these is that the curriculum and levels of assessment for second language learners may be "watered down". Saville-Troike (1991: 6) calls this 'instructional bias', which she defines as "teaching subject content to children's low level of English".

It is against this backdrop that the need for the development of South African indigenous languages has become too urgent to ignore.

1.2 STATEMENT OF THE PROBLEM

Since 1994 South Africa's Department of Education has been faced with the daunting task of transforming many aspects of its systems to improve its output – and throughputs. One such challenge has been the provision of education through languages that enhance access. This view has been repeatedly trumpeted in various forums a by the current Minister of Education, Naledi Pandor. One such forum is the National Assembly during her introduction of the education budget vote 15. The minister argued that "Language can and has been used as a tool of exclusion in our schools…the previously marginalized languages of our country require attention and affirmation. In this regard it is my view that we need to develop a language policy that vigorously and effectively promotes South African indigenous languages in all our schools" (Pandor, 2005:5). This means that education through the mother tongue has become a necessity as this promotes effective learning and teaching.

Consequently, the view, among others, that "future matric results be written in learners' own languages" was acknowledged in unison after ten years of South Africa's democracy at the meeting of the Council of Education Ministers held on the 21st of February 2005 (SABC News, 22 February 2005). Notwithstanding this ringing acknowledgement, little has been done with regard to the development of mother tongue education. This has been revealed by the concern raised by the Minister of Education, Naledi Pandor, that "the proposal posed serious financial challenges for her department" (SABC News, 22 February 2005). Most people, especially in the Department of Education, believe that this initiative will increase the matric pass rates as learners will be spared the struggle of grappling with English, a second and third language for most

South African black learners. Hence the urgent need for quality mother tongue resources to enhance the teaching and learning of school subjects.

Mother tongue instruction entails that South Africa should engage in a robust process of language development (in particular terminology development) that will see its official African languages elevated to a status where they can serve as media of instruction, specifically for subjects such as mathematics, natural sciences, and technology. This is necessary, if one considers the important finding by Saville-Troike (1984) in a study on learners in Canada. She found that most of the learners who achieved best in content areas at the beginning of schooling, as measured by tests in English, were those who had the most opportunity to discuss concepts in their native language.

Language planning experts and language stakeholders are increasingly arguing that recent language practice in South Africa has been decidedly retrogressive in nature (Kwamwangamalu, 2000a: 52). Thus, It may be argued that the above considerations may be the reason why the Department of Arts and Culture, through the National Language Service's (NLS) Terminology Coordination Section (TCS), began several projects, including the school project whose "primary focus was the documentation of existing terminology, and facilitation of the development of terminology in the African languages for new concepts that appear in the teaching materials for Grades 1 to 6" (*Multilingual Mathematics Dictionary*, 2003: V).

The school project referred to earlier saw the production of a glossary of terms compiled by the TCS. Indeed, to quote the dictionary's preface, "this glossary[1] of terms is the first of its kind" (*Multilingual Mathematics Dictionary*, 2003: V). It can thus be said that, indeed, the dictionary is a giant step towards the affirmation of African languages (isiXhosa, isiZulu, Sepedi, Xitsonga, Sesotho, Tshivenda, Setswana, isiNdebele and SiSwati) as languages of learning and teaching in South Africa.

Commendable as this process may be, an overview of the dictionary reveals some terms which, though translated from English, seem as if they may be more confounding to especially learners of mathematics in the grades that they are intended for. The

[1] The terms 'dictionary' and glossary are used interchangeably in this study as synonyms. This is in line with the fact that the *Multilingual Mathemaatics Dictionary for Grades 1 to 7,* which was studied in the present research also used them as such.

following are examples of some of the words which may compound learners understanding of mathematics if mother tongue is to be used as a medium of instruction.

First the terms "exponent" and "power"

English	SiSwati (S)/ isiZulu (Z)
Exponent -	*I-eksponenti (S), Umpindaphindi (Z)*
Power -	*I-eksponenti (S), Umphindaphindi (Z)*

An examination of these two terms reveals that the word "exponent" has simply been translated using the method called borrowing to obtain the SiSwati equivalent *i-eksponenti*. Looking at the word the first impression is that this is not a problem as it has followed one of the well-known methods of translation: borrowing. However further perusal of the dictionary reveals that the SiSwati equivalent of the term "power" is also *i-eksponenti*. This is likely to confuse learners when they are taught "power" and "exponent" in these African languages in the context of mathematics.

Furthermore, the equivalents of the same terms in isiZulu reveal a similar confusion, despite the fact that in the case of isiZulu the translation was not done through borrowing. For example, both exponent and power have been defined through their isiZulu equivalents as *umphindaphindi*, literally translated this means *a number that repeats others.*

Now if the dictionary and other materials of the same nature are to be a worthwhile resource, the two words above pose a problematic situation. This arises because "power" and "exponent" in mathematics are not the same concepts and should not be denoted by the same term. For example, in the number 4^2, 2 is the exponent, whilst 4^2 as a whole is a power. The exponent is "written above and to the right of a number to show how many times that quantity is to be multiplied by itself" (*Longman Dictionary of Contemporary English*, 1995: 481). In contrast, power in mathematics means that "if a number is raised to the exponent 2" (as is the case with 4^2), "it is multiplied by itself 2 times" (*Longman Dictionary of Contemporary English,* 1995: 1103). In brief, the difference between a power and an exponent is in the fact that the former is a shortened representation of a number multiplying itself, whilst the latter is a component of a power. This is because as understood through the two different definitions, a power has a base

and an exponent. In the case of the example used in this section, 4 is the base while 2 is the exponent.

Looking at this distinction between power and exponent, it is clear that confusion may arise in the classroom in case where the educator has to explain the difference between multiplying powers of the same base $4^2 \times 4^2$ and those with a different base $4^2 \times 3^2$, as can be exemplified in the following case: in the mathematical expression $4^2 \times 4^2$ the answer is 4^4, whereas in the expression $4^2 \times 3^2$ the answer is $(4X3)^2$. In the first expression, the same base is important as it gives right to the learner to add the exponents, whilst in the second expression different bases apply[2].

The second example is the terms used as equivalents for the sign/symbol "positive" (+)

-ngetulu kwaziro (S)
-ngaphezu kwecanda (Z)
-ngaphezu kwaziro (Z)

Both the SiSwati and isiZulu translations of the term "positive" for the symbol/sign (+) leave much to be desired. These equivalents also raise questions as to whether the usage of this terminology for learning and teaching can indeed achieve the desired aim of the ministry of education to improve access to education for all South Africans through the removal of language barriers. For example, the isiZulu versions for positive are: *ngaphezu kwecanda* and *ngaphezu kwaziro*. In the isiZulu language zero is also known as *Icanda*, a term which means "egg" as well. The SiSwati version of positive is *-ngetulu kwaziro*. The SiSwati and the second version of isiZulu are similar in that their literal meaning is *above a zero*. The first version of isiZulu (*ngaphezu kwecanda*) literary means *above a zero*, or, even more interesting, *above an egg*. However, it may be argued that learners are likely to misconstrue the meaning of the term *above an egg* in a mathematics context. The focus thus perhaps needs to be on the problem that may result from the first interpretation: *ngaphezu kwecanda*, which literary means *above a zero*. Similarly with the SiSwati version, especially if one considers that the dictionary is meant for grade 1 to grade 6, this usage of terminology is likely to create misunderstanding where learners have to assume that a positive sign means something

[2] I am indepted to my collegues in UNIFY – Mathematics for ensuring that I achieve vivid understanding and explanation of mathematics concepts like '*Exponent*' and '*Power*'. Thanks to Dr Kabelo Chuene and Dr Kwena Masha for sharing their knowledge without envy. Moreover, I would like to thank Prof. H. Siweya (the Director for the School of Mathematics and Computational Sciences) for validating this information.

which is above the numbers zero. Perhaps this misconception can even be represented as follows: $0^{?}$, where '0' is the number zero and '?' is something the learners imagine to be above the zero.

Considering the concept of monosemy, that is, the fact that "a term should have one meaning only" (Mtintsilana & Morris (1988: 111), one can conclude that the terminology discussed here cannot be simply accepted for use in the classroom.

The third important example comes from the following: equal to (=) as well as the adjective equivalent

equal to (=) -	*-lingana na* (S)
equivalent (adj) -	*-lingana na* (S)

For these terms, the SiSwati equivalents are identical in that they are both *lingana na*. The translation of these terms may confuse learners because contrary to what the SiSwati terms suggest, in English "the equal to (=)" sign and or phrase is defined as "a sign used in mathematics to show that two things are the same size, number, or amount". On the contrary the adjective equivalent in mathematics means "having the same value" (*Longman Dictionary of Contemporary English,* 1995: 461). In other words, something equivalent is that which is equal in value, or worth. Morever, in chemistry equivalent refers to the comparative quantity of an element which posesses the same chemical value as other elements, as determined by actual experiment and reference to the same standard (*Webster's Revised Unabridged Dictionary*, 1913: no page).

These, among several others encountered in the dictionary, show that, although the work undertaken so far to develop the multilingual dictionary is without doubt a worthwhile endeavor, it still leaves much to be desired. This situation underscores the importance of careful planning coupled with extensive and critical evaluation of terminology development for learning and teaching purposes in South Africa. The present study may, thus, be considered as a timely contribution to the noble aim of achieving mother-tongue instruction is South Africa.

1.3 AIMS OF THE STUDY

This study aimed firstly to critically review the process through which the National Language Service developed the terminology for the *Multilingual Mathematics Dictionary* for grades 1 – 6, in particular with regard to the new concepts that appear in the teaching materials for grades 1-6. Secondly, it aimed to compare this process with the established linguistic frameworks / theories for terminology development. The study also intended to determine through the empirical investigation of educator's experiences, whether or not the terminology in the dictionary will cope with the teaching and learning requirements of mathematics, especially in the light of the discussions provided in the available literature on the role of language in learning. This entailed establishing the appropriateness and acceptability of the terms that have evolved as a result of this undertaking. By achieving the above aims, the study was expected to contribute to the effective development of African languages and, in so doing, to raising their status to languages of learning and teaching.

With these aims in mind, the study proposed to answer the following questions:

1. How did the National Language Service team develop the terminology in the *Multilingual Mathematics Dictionary* intended for use in the teaching and learning of mathematics?
2. What theoretical considerations of language development may have informed their work?
3. What are the experiences of the educators in teaching mathematics by using the *Multilingual Mathematics Dictionary*?
4. Can the terminology in the dictionary cope with the demands of teaching and learning mathematics?

1.4 OBJECTIVES OF THE STUDY

This study had the following objectives:

- to establish an understanding of the process through which terminology for content subjects such as mathematics and science is developed; and

- to determine the efficacy of the African languages terminology in the *Multilingual Mathematics Dictionary* for its intended purpose.

1.5 RESEARCH METHODOLOGY

This section offers a brief introduction of the research design, methodology, sample, as well as discussions about validity and reliability. All these crucial issues are discussed at length in Chapter Four.

1.6.1 Research Design

A research design is the string of logic that ultimately links the data to be collected and the conclusions to be drawn to the initial questions of the study. According to Yin (1989: 2) typically, research designs deal with at least four problems:

- What questions to study;
- What data are relevant;
- What data to collect;
- How to analyze the data.

This study attempted to investigate how terminology for the *Multilingual Mathematics Dictionary* was developed using the SiSwati language as a case study. "Case study refers to the collection and presentation of detailed information about a particular issue, participant or small group, frequently including the accounts of subjects themselves. As a form of qualitative descriptive research, the case study looks intensely at an issue, individual or small participant pool, drawing conclusions only about that particular issue, participant or group and only in that specific context" (Yin 1989: 3). For example, the research conducted in the study intended to make a descriptive analysis of the SiSwati terminology found in the *Multilingual Mathematics Dictionary*. Researchers in case studies do not focus on the discovery of a universal, generalisable truth, nor do they look for cause-effect relationships; but, emphasis is placed on exploration and description (Armisted, 1984: 78). Since, the study also intends to compare the process undertaken to develop these terminologies, the

primary source of data for the study was the Department of Arts and Culture's *Multilingual Mathematics Dictionary for Grade 1 to 6*.

In order to attain these aims (see Section 3), this study used two main information gathering techniques, viz, document analysis and questionnaires. The combination of a variety of information gathering techniques enabled triangulation and a greater level of data analysis so that research findings will be more acceptable (Mwanje, 2001). Triangulation, according to Merriam (1985), is one way in which researchers can combat attacks on the validity, reliability and generalisability of research studies such as the one proposed here. In addition, triangulation also gives research comprehensive information about the study topic and eliminates over-reliance on one single source of data.

A review of the processes preceding the production of the dictionary was conducted to establish, amongst other information, how the project was conceived and what the preliminary plans for undertaking this project were. This is in line with the method consisting in collecting referential materials suggested by Merriam (1985) to ensure case study validity and reliability.

The analysis of the data involved a variety of techniques. Firstly, the terminology was analysed through careful study and comparison with established theories of translation. Secondly, Discourse Analysis (DA) was used, especially with regard to open ended questions in the questionnaire. DA as a research strategy has been variously defined (Frohmann, 1994). One way which was followed in this study was to see DA as a research tool in approaching and thinking about a problem. In this sense, Dickens *et al.* (1994:28) allude to the fact that "DA is neither a qualitative nor a quantitative research method, but a manner of questioning the basic assumptions of quantitative and qualitative research methods". DA does not provide tangible answers to problems based on scientific research, but enables access to the ontological and epistemological assumptions behind a project, a statement, a method of research (Dickens *et al,* 1994:54). In other words, employing DA has enabled the study to reveal the hidden motivations behind the choice of a particular language of instruction. "Expressed in today's more trendy vocabulary, Critical or Discourse

Analysis is nothing more than a deconstructive reading and interpretation of a problem or text (while keeping in mind that postmodern theories conceive of every interpretation of reality and, therefore, of reality itself as a text. Every text is conditioned and inscribes itself within a given discourse" (Frohmann, 1994:365). Discourse Analysis did not provide absolute answers to the problem investigated in this study, but enabled the researcher, as Frohmann (1994:367) claims, "to understand the conditions behind the problem and make us realize the essence of this problem, and its resolution".

1.7 RATIONALE FOR THE STUDY

Among research undertaken on issues of multilingualism in South Africa, little or none, to the best of my knowledge, has been carried out on the critical evaluation of terminology in South African indigenous languages developed for educational purposes. This flies in the face of interesting proposals for the implementation of language policy (Pluddemann, 1999; LANGTAG, 1996). For example, Pluddemann (1999: 335) rightly argues that "perhaps the key to the promotion of multilingualism in South African education is the development of African languages in terms of standard orthography, vocabulary elaboration and modernisation, the creation of technical registers, and a raised status". Consequently, raising the status of African languages for purposes of language learning across the curriculum would require the creation of appropriate learning materials in the African languages. The present study, although planned as an individual undertaking, will now form part of a body of data designed for terminology development, and, thus, meshes with the recognition of a need for a critical review of classroom practices in the South African education system.

1.8 SIGNIFICANCE OF THE STUDY

In view of the above, the importance of the present study cannot be overestatied. Reviewing the process through which new terminology for mathematics was developed for the dictionary would have both theoretical and practical implications. First, it may contribute to an understanding of theories of language development, particularly the

development of terminology within a diverse and multicultural society like South Africa. It can also be of benefit to language planners and educators in as much as the terminology developed is relevant. Furthermore, given the acknowledgment by the editorial committee of the dictionary that their "product does not claim to be comprehensive or entirely without errors and scope of improvement" thus making a call for "feedback" (*Multilingual Mathematics Dictionary*, 2003: VI), the present study may be considered as a welcome endeavour to fill the gaps.

1.9 ORGANISATION OF THE STUDY

This thesis is divided into six chapters

Chapter Two focuses on the literature reviewed prior to conducting the study. In this chapter relevant theories and arguments by different authors are explored. In particular, literature in the field of language development and the role of African / indigenous languages in the teaching and learning of mathematics and science is explored.

Chapter Three explores relevant literature in the field of translation. Particularly, this chapter explores translation as a means for language development. It also presents views about translation approaches relevant to the development of African languages, and adopts an approach which according to the researcher is ideal for language modernisation and elaboration.

Chapter Four offers an extended discussion of the research methodology. The chapter discusses pertinent issues such as the characteristics of the sample, the validity and reliability of instruments used in the study, as well as present arguments for the methods of data collection used in the study.

Chapter Five presents and analyzes the data and offers a discussion of the results and findings of the study.

Chapter Six presents a summary of the results and findings and makes conclusions from the results of this study. It also offers recommendations based on the findings of the study.

CHAPTER 2

LANGUAGE IN EDUCATION

2.1 INTRODUCTION

> There is a false but pervasive belief ... that children should 'get into English' as soon as possible or they will be retarded in learning (Saville-Troike, 1991: 5–6).

This quotation, which referred originally to the United States of America, could just as well pertain to certain beliefs held by many people regarding language in education South Africa. More and more primary schools are introducing English, a second language (L2), as the language of learning (or medium of instruction) at an early stage. This is done in the belief that it will improve the learners' fluency in English and promote good overall academic achievement.

Bell (2003: no page) rightfully, argues that, "unfortunately, this may be far from the truth. It is possible that, by using a second language from too early on, we are stunting the development of our learners' mother tongues, impeding the development of their cognitive/academic abilities, promoting negative attitudes towards the mother tongue, and resulting in low achievement in conceptual subjects such as mathematics and science".

In this context this chapter discusses some key themes of the study already introduced in Chapter One, which are devided into five conceptual sections in this chapter. The first begins with a detailed discussion of the historical context of language policy development relevant to this study, in particular the Anglicization period in South Africa's education, the Afrikaans only education as well as the current multilingual policy.

The second section reviews and describes the type of second language education programmes currently advocated in South Africa and offers a brief exploration of problems and advantages with early immersion education, underdevelopment of the first language and cognitive academic ability, as well as communicative vs. cognitive language proficiency.

Thereafter, the third section discusses mother tongue education and the negative attitudes towards mother tongue education. It also gives an extensive review and explication of the Language in Education Policy [LiEP] (1997) and its shortcomings. These shortcomings are believed to be symptoms of behaviour which may mainly be attributed to language prejudices. This section also presents some evidence of such prejudices.

The fourth section deals with the issue of second language education and mathematics and science achievement. The section looks at various positions (for instance, Anstrom, 1997; Cummins and Swain, 1986; Saville – Troike, 1991). It concludes by advocating for mother tongue education, especially for subjects with specialized types of language such as mathematics.

The fifth and last section offers an extensive review of SiSwati, the African language from which the data for this case study were researched. This section also gives a brief description of how SiSwati developed as a standardized language variety. Towards the end of the section the researcher in this study explores significant aspects other than education, which normally have effects on the development of language, namely, religion, media and literary culture. The section is then concluded by revisiting the concept of attitudes against African languages, with particular reference to SiSwati (see Section 4.1).

2.2 LANGUAGE POLICY DEVELOPMENT IN SOUTH AFRICA

In order to examine the process that led to the current factors such as attitudes towards African languages in the country, "it is necessary to sketch some background to language policy struggles in South Africa" (de Klerk, 2002: 31). The issue of language in education in South Africa has remained contested for some time (Makua, 2004; Makalela, 2005). Over the past two centuries, South Africa's colonial and white minority governments have used language policy in education as an instrument of cultural and political control (ANC Policy Framework for Education and Training, 1994). This is clearly espoused by a review of the evolution of language policy in South Africa (Makua, 2004: 39). The language question in South Africa can be devided into seven historical epochs:

- Pre-colonial South Africa
- The arrival of the Dutch settlers in 1652
- The invasion of English colonizers in 1795
- The Dutch-English bilingual system from 1910 to 1925
- The rise of Afrikaans with apartheid policies in 1948
- The 1976 Soweto Students uprising
- The multilingual policy provisions of 1996

According to Makalela (2005: 149) "With regard to the pre-colonial era, there are virtually no written records of literacy and education, where the medium of teaching and learning can be discerned". The reason for the lack of records (for instance, books and other modern sources of information) among other factors, is that "early Western anthropologists and ethnologists substantially omitted African materials as they were comfortable that the peoples of Africa have not yet risen to the stage of education which can produce written records of important events or institutions" (Makalela, 2005:150). One angle from which to view this history is thus that of the domination of colonial languages (first Dutch and later English), complexly interrelated with the development, construction, and codification of various mother tongues. De Klerk (2002) observes that the nine African languages that are currently official languages of the country were largely developed into their present standard forms, first through the activities of missionaries (cf. later discussion on the history of SiSwati in section 2.11) and later through the efforts of the Afrikaner Nationalist government that came into power in 1948. During the early years of the colonial period, which started in 1652 with the settlement of the Dutch at what is currently known as Cape Town, Dutch was a compulsory medium in the schools. In Makua's (2004: 40) words "The overall economic, political and cultural strategies of the Dutch settlers influenced their language policies[3]". From the later part of the eighteenth century, under British administration, the education of African children was conducted mainly by missionaries. After initial education in the mother tongue, instruction was in English, emphasizing an Anglocentric curriculum. Thus, the period was popularly

[3] Although Makua (2004: 40) refers to "language policies", the researcher in this study is of the opinion that it is appropriate to refer to language practices rather than policies since there may be doubt whether there were language policies then.

known as the Anglicization period (1795 and 1806) which aimed at the promotion of English mainly through the Anglican missionary schools.

During this time, indigenous languages were used in both religious and non-religious instruction at lower grades. These languages were codified by missionaries as an aid in proselytizing the indigenous peoples. First, it is noted that missionaries from different European countries such as Germany, England, and Holland were deployed in various parts of the country to evangelise the natives. Not fully understanding the varieties spoken, the missionaries encoded closely related dialects, in the same way as a non-English speaker would encode the Northern and Southern English varieties in the United States as distinct languages. For example, the Sotho dialects were encoded separately as Southern Sotho, Northern Sotho and Western Sotho later renamed seSotho, Sepedi, and Setswana, respectively (Makalela, 2005:151-2). Even though the intention of the missionaries was to spread the Christian gospel, the outcome was that in codifying these languages they made decisions about where to draw boundaries in a continuum of varieties, which aided, with other colonial policies and practices in the construction of ethnic groups (Alexander, 1989).

Education being largely under the control of the church till 1953, the teaching materials were prepared to teach natives in their own 'languages' for at least four years, which was in line with Britain's well known language in education policy in the African colonies. Taken together, the missionary encoding was based on differences perceived by foreign ears (see Makalela, 2005) to further both the evangelization and colonization missions. Added to the fact that they did not, to all intents and purposes, speak these languages themselves, the missionaries balkanised indigenous African language varieties with artificial boundaries.

The systematic non-use of African languages in public domains and education beyond grade 4 gave way to the rise of a Dutch Creole, Afrikaans, that had already evolved by 1925. Afrikaans emerged through contact between the Dutch masters with Africans and Malay people—the latter having been brought to the Cape as slaves. It became an official language in 1925[4], replacing Dutch, and was dually used

[4] Proving the above assertion is Phaswana's (2003) article titled *Contradiction or affirmation? The South African language policy and the South African national government.* In the article Phaswana (2003: 119) writes: "A great

with English. At the birth of official apartheid in 1948, the National Party ensured that Afrikaans became a fully-fledged language for use as the medium of learning and teaching, side by side with English. This apartheid language-in-education policy was infused with unequal language proficiency demands for school pupils in the country. This was replaced in 1997 with a new policy based on non-discriminatory language use and the internationally accepted principle of mother-tongue education in the context of a multilingual framework (Heugh, 2002: 171).

2.2.1 Afrikaans-only Education in South Africa

As Anglicization took hold in the country, resistance by white speakers of Dutch/ Afrikaans also dramatically ensued. De Klerk (2002: 32) observes that by 1875 resistance to English dominance became linked with attempts to forge political unity among white speakers of Afrikaans. "Black" varieties of Afrikaans and, black speakers of Afrikaans were not part of the struggles against English. Thus, during the early part of the twentieth century Afrikaans became increasingly associated with Afrikaner nationalism and resistance to English colonialism. In 1948 the Nationalist Party (NP) came into power and the official policy of apartheid started. Malherbe (1977) and Van Rensburg (1999) note that under the apartheid regime, linguistic purity came more and more to be associated with racial purity. Thus, the NP government poured massive resources into the development of Afrikaans so that it could be used up to tertiary levels as a medium of instruction in all content areas. Publishing in Afrikaans became a common occurrence. According to Webb *et al.* (1992, cited in de Klerk, 2002: 32 - 33) this resulted in a language which in the early twentieth century was still regarded by many as a "slang," having 180 technical dictionaries in the early 1990s.

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challenge to Dutch was mounted by Afrikaans speakers who claimed that Dutch, as enshrined in the constitution, referred to Afrikaans as well. Because of the endless resistance waged by Afrikaners against the policy of official recognition of Dutch, but not Afrikaans, in 1925 an amendment to Act 137 of the constitution made Afrikaans one of the official languages. However ... essentially that 1925 amendment replaced Dutch with Afrikaans as the official language and thus its legal equality with English was written into the constitution". Phaswana, N. 2003. 'Contradiction or affirmation? The South African language policy and the South African national government.' In Sinfree Makoni, Geneva Smitherman, Arnetha F. Ball, and Arthur K. Spears (eds), *Black Linguistics: Langauge, Society, Politics in Africa and the Americas*. London: Routledge, pp. 117 – 131.

Under the Nationalist government an infrastructure was also created for the development of African languages. A language board was established for each language to oversee the standardization of these languages. African languages were used in state-funded broadcasting and as media of instruction at the primary level (mainly grades 1 to 4) in schools for black children. Language planning projects in South Africa were part of the larger social groups and the hierarchical organisation of South African Society, with black South Africans at the lowest rung of an exploited workforce. The key difference between the development efforts for Afrikaans and other languages is that Afrikaans was developed for high-status functions, whereas the African languages were relegated to low status functions. In fact, Alexander and Heugh (1999:5) appropriately put it that the government was "underdeveloping them quite deliberately".

Against this backdrop, it is no surprise that, with a few exceptions the leadership of the black liberation organisations opted for English as a lingua franca. English began to be seen as a language of liberation, or at least a neutral unifying language amongst oppressed South Africans (Alexander and Heugh, 1999).

Under the 1953 Bantu Education Act, mother tongue education was compulsory for African language speakers in the early grades, with a sudden transfer in the later grades to Afrikaans and/ or English, in practice generally to English. Initially this transfer was after the eighth grade. By the mid 1970's, it was so after the fourth grade, mainly because of the resistance to mother tongue education. After 1979, it was so after grade 3. This language policy was combined with an impoverished curriculum that was geared toward preparing black people for subservient positions in South African society.

Heugh (1995) laments: "What we find, then, for African language speaking children was essentially an early-exit model of bilingual education. Whereas these children were exposed to a subtractive bilingual model of schooling, English and Afrikaans speaking (mainly white) children were exposed to a limited form of additive bilingual education". This lamentation finds justification in the fact that, as de Klerk (2002: 34) points out, for Afrikaans and English speaking children all the conditions for them to acquire the other official language were set up. This means that while learning in the medium of their mother tongue, conditions were conducive for them to acquire a second language successfully.

In the 1970's, resistance to mother tongue education gained force, first channeled through trade unions and strikes, and then spearheaded by the South African Student Organisation (SASO) under the charismatic leadership of Steve Biko.

In 1974 the government issued the *Afrikaans Medium Decree* which forced all schools to use Afrikaans when teaching blacks mathematics, social sciences, geography and history at the secondary school level. Justifying this move, Punt Janson, then Deputy Minister of Bantu Education was quoted as saying:

> "I have not consulted the African people on the language issue and I'm not going to. An African might find that 'the big boss' only spoke Afrikaans or only spoke English. It would be to his advantage to know both languages."

The policy was, rightly, deeply unpopular amongst black South Africans since Afrikaans was regarded as the language of the oppressor. On 30 April 1976, children at Orlando West Junior Secondary School in Soweto went on strike, refusing to go to school. Their rebellion spread to other schools in Soweto. The students organised a mass rally for 16 June 1976, which turned violent when police responded with bullets to children's stone-throwing. That day, 566 children died at the hands of the police. The incident triggered widespread violence throughout South Africa, which claimed further lives.

2.2.2 Current Multilingual Policy in South Africa

After the "Soweto Uprisings", i.e., the violent clashes in 1976 between police and students who were protesting the enforcement of Afrikaans as a medium of instruction, the language question arose again in South Africa. Throughout the 1980s and 1990s it became the subject of debate among many political forums. Illustrative of this is the de Lange Commission's (1981) acknowledgement of "the complexity of the language situation in South Africa" and recommendation for "extensive research in the area" (Makua, 2004: 61). Following what Makua (2004:62) refers to as a "more focused and relevant language debate", during the early 1990s a political framework for a new democratic South Africa, including a new constitution with constitutional clauses protecting language rights was established. Eventually, on July 14, 1997, the Minister of Education announced a new Language-in-Education policy for public

schools in South Africa. Central to the new policy is its commitment to promoting multilingualism as a valuable national asset (Department of Education, 1997: 2). As Pluddemann (1999: 327) puts it, "the significance of this move (to promote multilingualism) lies in the elevation in status of the previously marginalized African languages to a position of full equality with Afrikaans and English, formerly the country's only two official languages". Even though in Gauton's (2006: 29) terms "in reality some of the official languages are more equal than others". In the current multilingual society, South Africa has very clear policies which generally promote respect for and use of all official languages.

However, while Section 29.1 of the Constitution (1996), the Pan South African Language Board (PANSALB), and the *LiEP* (1997) also reflect that, the use (and consequent status) of English continues to spread, both through the popular media as well as through the education system. Bell (2003: 2) thus correctly notes that in education, multilingualism is not merely a "feel good" policy; it also has very strong scientific reasons why it should be promoted. One such example of empirical evidence is the *Third International Mathematics and Science Survey* (TIMMS), which measured the mathematics and science achievement of more than 500,000 learners from 15,000 different schools in 41 countries, South Africa included. In 30 of these countries English is not the home language of the majority of the population, thus the tests were translated into the majority of the home languages. The results of the TIMMS survey reflect that in the grade 8 category, South Africa came last for both mathematics and sciences. The TIMMS survey thus reflects that language was a major factor in the performance of South Africans particularly with regard to farm and township schools.

Any actual changes towards multilingual education would probably begin slowly at the local level of school governing bodies, which have the responsibility of formulating and implementing language-in-education policies for their schools. With recognition of such empirical evidence (viz. TIMMS survey) South Africa has been involved in the search for the right type of language in education programme. Researchers have suggested arguments for and against the use of African languages. For example, authors and researchers such as B.G. Bell, Kathleen Huegh, Peter Pluddemann, and Zola Wababa are proponents of bilingualism, while Neville Alexander is concerned with reversing the hegemony of English in favour of African languages. The researcher in this study

believes that there is a need for progressive types of educational programmes emphasizing the use of African languages in a manner that will help promote multilingualism and the eventual status of African languages.

2.3 TYPES OF SECOND LANGUAGE EDUCATION PROGRAMMES

While South Africa has a second language system of education, often from the early primary levels, it should be remembered that there is no single model of second language education (Baker, 1993: 152; Bell, 2003: no page). 'Second Language Education' is a term used to describe a variety of education programmes, some of which may have significant differences to others. Three important distinctions between different models of L2 education programmes concern (a) the goals of the programmes (that is, transitional *vs.* maintenance programmes), (b) the degree of immersion (that is, partial *vs.* total immersion), and (c) the time at which immersion begins (that is, early, delayed and late immersion).

2.3.1 Transitional vs. Maintenance Programmes

One of the primary distinctions within second language education is that between "transitional" and "maintenance" programmes (Baker, 1993: 152). On the one hand, a transitional programme has the goal of ultimately assimilating learners, both linguistically and socially, into the dominant language and culture. On the other hand, a maintenance programme has the goal of reinforcing the home language and sense of cultural identity of the learner, as well as developing proficiency in the second language, thus promoting bilingualism.

2.3.2 Bilingual vs. Immersion Programmes

Bell (2003: no page) reveals that "Closely linked to this distinction is a second one between 'bilingual' (or 'partial immersion') and 'immersion' (or "total immersion") programmes." The distinction between these two programmes is best summarised by Baker (1993: 158) who mentions that:

> In a bilingual programme, a learner may study some subjects in the mother tongue, and the others in a second language. This form of partial immersion is most commonly found in maintenance bilingual education programmes, since partial immersion programmes allocate equal time and status to both the first language and the second language. A well-known example is the *Heritage Language Programme* in Canada. In a total immersion programme (sometimes called a 'submersion programme'), however, the learners study all learning areas through the medium of the second language

This is the case with most South African schools (referred to as Model C schools) where even though on paper learners are said to be doing first language, in essence most if not all (as is the case with some schools) of them use English as a second language to an African language or Afrikaans.

According to Bell (2003: no page) "total immersion is more commonly found in transitional programmes, as it is thought by some to be the quickest route to fluency in the second language and assimilation into the dominant culture".

2.3.3 Early, Delayed and Late Immersion

Second language education programmes also differ as to when immersion begins (Baker, 1993: 158). Early immersion programmes immerse the learner in the second language between the ages of 5–6 years, delayed immersion programmes between 9–10 years, and late immersion programmes between the ages of 13–14 years.

A review (Saville-Troike, 1991; Heugh, 2003; Bell, 2003) of different types of international bilingual education programmes as discussed ealier suggests that the

different forms of second language education achieve different results, that is, some are more successful than others. In South Africa, many schools are now adopting early immersion programmes. Bell (2003: no page), though, suggests that this is a model which has several important flaws, and which, in terms of internationally standardized mathematics and science tests, produces dismally poor results. Using the results of the *Third International Mathematics and Science Survey* as an illustration, he, believes that the maintenance of a bilingual education system, achieved through a delayed partial immersion model, is best for South Africa. This is so if one considers the "...false but pervasive belief that children should 'get into English' as soon as possible", a fact which several authors (such as, Cummins and Swain, 1986; Saville-Troike, 1991), contend, stunts cognitive development". In line with this, the Cape Argus Online (2006) observed that:

> ... a majority of studies also support the proposition that bilingual education affords children numerous cognitive advantages over monolingual children. Mother-tongue education also affirms children in their self worth and in their identity. Conversely, children who are submerged in education through their second language demonstrate loss of self-confidence and low self-esteem. Research also provides evidence that literacy transfers across languages ... thus, learning to read in the mother-tongue makes learning to read and write in an additional language easier.

In view of the preceding discussions in this section, one would expect a positive correlation between low levels of first language proficiency and cognitive academic ability. The next section below explores this possible link.

2.4 UNDER-DEVELOPMENT OF THE FIRST LANGUAGE AND COGNITIVE ACADEMIC ABILITY

It is widely believed (for example, Cummins and Swain, 1986: 80–84; Saville-Troike, 1991; Anstrom, 1997) that a unitary cognitive academic proficiency (that is, "thinking skills") underlies all language performance, and may be expressed equally through either a first language/ mother tongue or a second language. This cognitive academic proficiency is developed primarily through the first language in the early years, and may then be transferred to and expressed in a second language later on. If a learners' first language remains underdeveloped, then so does that learners' cognitive academic ability. Thus, when that learner attempts to acquire a second language and pursue his or

her studies through the medium of a second language, that learner may bring a lower cognitive academic proficiency to the task and be disadvantaged. As Saville-Troike (1991: 2) notes:

> When students begin learning a second language, they do not start learning all over again, but interpret meaning in terms of what they already know – not just about language, but about the context in which it is being used, and about strategies for social interaction. This means that the process of second language learning is heavily dependent on prior experience and apparently also on the nature and level of first language development.

The development of particular lexical items or syntactic structures in the first language does not appear to be an important factor in the development of general cognitive academic ability. Rather, it is the higher order mental strategies, sometimes called 'thinking skills', developed and implemented through the first language initially, which can be transferred into the second language, and improve academic achievement in and through the second language. As Saville-Troike (1991: 4) comments:

> In addition to the higher level of language skills required to interpret written text, it is also important to recognise that academic success requires such strategies as listening or reading for the main point, generalising, making logical inferences from known information, and constructing more complex schemata – strategies which are not specific to a particular language. Again, once these strategies have been developed in the native language, they apparently transfer quite readily to academic tasks in a different language.

In line with this, Mabila's (2001) study of Mozambican school learners in the Mpumalanga province of South Africa suggests that a learner who has developed literacy in his or her mother tongue for several years and who subsequently moves to a second-language educational system will invariably increase his or her chances of performing better in the new language than a learner who has studied in the said education system from the very beginning through the second language. Although this finding goes against the popular South African opinion of "the earlier the better", it is supported by international research over the last twenty years.

For example, in what has become a 'classic' in this area, Skutnabb-Kangas and Toukomaa (1976; cited in Saville-Troike, 1991: 5) investigated immigrant Finnish children in Sweden. It was thought at that time that the younger the children were when they begin school in their new language; the better they would do in terms of second language acquisition and overall academic achievement. They found, however, that the

children who adapted and performed the best were those who began education through their second language between the ages of 10–12 years.

This finding, which at that stage was unexpected, has been confirmed by research from other places. For example, Gonzalez (1986; cited in Saville-Troike 1991: 5) compared the performance of two groups of Mexican children in the 6th grade in US schools on English language reading comprehension tests. The one group had received two years of Spanish language education in Mexico followed by four years of English language education in the USA. The other group had received no Spanish language education in Mexico, and six years of English language education in the USA. Contrary to popular expectations, the children with two years of first language education outperformed in English those who did not have first language education even though those coming from first language education had received less English language education. Closer to home, Williams (1998, cited by Skutnabb-Kangas, Phillipson and Kontra, 2001: 151) illustrates the same point using the cases of Malawi and Zambia.

After reviewing similar research, Cummins and Swain (1986: 49, 87) reach the conclusion that an initial period of mother tongue education is imperative to achieve a higher level of mental maturity, which can then be transferred into second language education:

> The immersion results suggest that older learners may be more effective than younger ones in some aspects of second language learning, most notably in those aspects associated with literacy-related and literacy-supported language skills. Older learners who are more cognitively mature and whose first language proficiency is better developed ... acquire cognitively demanding aspects of second language proficiency more rapidly than younger learners.

"It is vitally important that learners fully develop their mother tongue, because in so doing they also develop their cognitive academic abilities, their thinking skills, and their academic intelligence" (Bell, 2003: no page). Bell (2003: no page) further maintains that "to achieve full mother tongue and cognitive academic development, the home language needs to be used as the medium of instruction at least for the first few years of primary school at a minimum. Without this, learners enter second language education mentally under-developed, which disadvantages not only their language acquisition, but also their overall academic success, and, in particular, their maths and science achievement".

2.5 COMMUNICATIVE VS. COGNITIVE LANGUAGE PROFICIENCY

The foregoing discussion needs to be understood in the light of the 'communicative-cognitive' distinction. The popular opinion that 'earlier is better' with regard to second language education may possibly be based on the appearance of second language proficiency created by face-to-face social interaction, not on the less visible cognitive academic proficiency which is required for successful second language education. Observing a child who seems comfortable interacting in a second language in a relaxed social context with friends may lead to the conclusion that the child is now ready to undertake a full-scale education programme exclusively through the medium of the second language. This is an erroneous conclusion, caused by the confusion of communicative proficiency with cognitive proficiency:

> The point to note is that although the second language immersion children were able to interact in face-to-face play situations with first language children after several years in the programme, it took some six to seven years in the programme to produce average performance on second language achievement tests. (Cummins and Swain, 1986: 105).

A very important distinction in second language education is that between "communicative language ability" and "cognitive-academic language ability". This distinction was first formalized by Cummins (1984) after investigating an area of failure in the early Canadian immersion programmes. He noticed that children would spend a few years in a sheltered class, during which they received content lessons in their first language and language lessons in the second language. When the children were assessed as proficient in the second language, they would then enter mainstream education in which they studied everything through the medium of the second language.

Many of these children performed very poorly after being mainstreamed. This led Cummins (1984) to recognise that the aspect of the second language in which they were assessed as proficient (namely, Basic Interpersonal Communication Skills, or BICS) is not the same aspect required for successful studies through the medium of a second language (namely, Cognitive Academic Language Proficiency, or CALP). According to Cummins' conceptualization of language, BICS, which is embedded in a rich linguistic and paralinguistic context (for example: repetitions, facial expressions, and realia.), is a

useful and necessary part of language in social-communicative situations. However, BICS alone does not represent full proficiency in a language.

For more cognitively demanding academic tasks, proficiency in context-reduced CALP (for example. words on a bare page) is required. Without CALP, a student pursuing advanced academic studies through the medium of a second language is seriously disadvantaged. However, with the emphasis on communicative language teaching, and the more readily visible (and hence measurable) nature of BICS, Cummins found that language educators tend to concentrate disproportionately on BICS, and neglect CALP, even though CALP is more important for academic success.

As Cummins has noted, there is a direct relationship between CALP and educational achievement (1984: 142). Cummins' distinction has withstood the test of time and repeated investigation. Saville-Troike (1991: 3) recognises that:

> While students can often negotiate meaning in face-to-face interaction even with extremely limited linguistic skills, because of the familiarity or redundancy of the extralinguistic context in which it is situated, their attainment of a high level of academic competence requires the ability to decode and encode meaning in context-reduced tasks, such as reading and writing.

In a major synthesis of research into second language education issues, Anstrom (1997: 5) found that the distinction between communicative and cognitive language abilities is still an influential explanation for the lack of success of immersion programmes:

> Second language students encounter a variety of difficulties in achieving academic success in first language schools. These difficulties may be related to language, educational background, socio-economic status, psychological trauma, or any combination of these factors. Research indicates that the process of learning academic language requires much more time than that needed to learn language for interacting on a social level with English speakers. Ability with social language is usually developed within the first two years of arrival in an English-speaking setting; however, the language needed for learning academic content may require five to eight years, or longer, depending on the age and prior educational background of the learner. This situation is exacerbated at the secondary level due to the higher cognitive demands of the curriculum.

2.6 MOTHER TONGUE EDUCATION IN SOUTH AFRICA

As already indicated in the section on historical context, de Klerk (2002: 29) correctly observed that "much of the current international discourse on global linguistic diversity revolves around concerns about the human rights, cultural and linguistic survival of numerous minority groups in the face of globalization, and the expansion of English". This is true because it is from this perspective that mother tongue promotion and education becomes an important political and linguistic tool to assist in the empowerment of marginalized communities. According to de Klerk (2002) some scholars argue that it is necessary and desirable to protect minority mother tongues, just as it is necessary to protect endangered species. Thus the promotion of mother tongue use is an essential goal for those interested in redressing injustice and inequity associated with the hegemony of high status majority languages. Despite this view, proponents of mother tongue caution that "an emphasis on mother tongue can (still) be for exclusion, for pacification or for empowerment" (Skuttnabb-Kangas and Cummins 1988: 394). Thus, in de Klerk's (2002: 30) own words "the struggles around languages in South Africa provide an illuminating case study of how the promotion of mother tongue education has at various times in South African history served a range of purposes".

Despite the wealth of findings showing the positive spin-offs of mother tongue education, many people still carry negative attitudes towards mother tongue education. This often results in people holding different views about the learning of African languages and their use thereof in education. The next section explores this issue.

2.7 NEGATIVE ATTITUDES TOWARDS THE MOTHER TONGUE

In an interview by the *Sunday Times*, a 16 year-old Fortunate Mokgehle stated: "We don't find our mother tongue that important. You don't make overseas calls in your mother tongue; you don't use it in everyday life. It's not useful", (*Sunday Times*, 22 July 2001). In a similar case, another Cape Town young female learner had this to say about going for special mother tongue lessons that her mother insists she attends every

Tuesday and Thursday afternoon: "I mean, why?" she pouts. "Like why do I need this? If it wasn't for my mom I wouldn't bother", (*Sunday Times*, 29 February 2004).

Who can blame teenagers for shunning their mother tongues? For them, English is the future, a language that represents progress, opportunities and modernity. The ability to speak English has become a new status symbol (*Sunday Times*, 22 July 2001).

These sentiments are contradicted in a study by Mark Data (cited in the *Sunday Times*, 22 July 2005) for the PANSALB, which found only 12 percent of 2 160 households surveyed wanted English as the only medium of school instruction. A far greater number, just over 40 percent, preferred English to be taught alongside the home language; and about 37 percent wanted mother-tongue teaching in all state-funded schools and universities.

What is interesting is that it is not only the learners who project negative attitudes towards learning mother tongue. Some black parents want English for their children and are vocally opposed to the introduction of African languages. A case in point is the Capricorn High School in Polokwane, Limpopo, where language policy implementation "ruffled feathers" (City Press, 29 February 2006) leading to the principal of the school facing "misconduct charges over the issue of language policy at schools" (*City Press*, 29 February 2006). This rather anecdotal evidence could be buttressed by empirical evidence from de Klerk (2001: 34) about Afrikaans-speaking parents in the Eastern Cape moving their children to English medium schools and Kwamwangamalu's (2003: 68) observation of the trend towards "unilingualism" (use of English only) in urban black families.

What is further interesting is the fact that the parents do not simply demand the teaching of English second language to their children, but expect the schools to teach their children English first language. Responding to what he called "imperialism" Limpopo MEC for sport, arts and culture, Mr Joe Maswanganyi, launched a tirade attacking the proponents of the events which unfolded at the Capricon High School:

> The recent discussions about African languages in schools are an attempt to undermine the achievements of our revolutionary democracy. In the process, the same victims of imperialism and colonization are being brainwashed into believing that perfecting English must be at the expense of African languages…Those who are undermining our African languages have become

> irrelevant to our cause of building a new society (*Northern Review*, 31 March 2006).

Backing this view, a furious Mpe Mabuse, the political education officer of the Congress of South African Students (COSAS) in Limpopo said, "the organisation will fight to ensure that the policy advocated by Maswanganyi is implemented throughout the province" (Capricon Voice, 2006).

Counter to this position, Baker (1993: 175) feels that learners in some forms of second language education do not suffer worse attitude and adjustment problems than their peers, but this seems to be the result of their parents' values and beliefs. Baker's view can best be summarized by one parent's. Nico Prinsloo remarked:

> What the MEC for sport and all of us (including Cosas) must however keep in mind, is that none of the indigenous languages makes us competitive in the global village ... although we support patriotism amongst our children, it is a fact of life that patriotic children who cannot communicate with the rest of society have little chance of being successful in a competitive world ... what we must also keep in mind also is that the learners and parents who criticized the language policy, did not sell out their birthright (*Northern Media,* 31 March 2006).

Prinsloo's statement can be critisised because he based his argument on the fact that the African learners concerned "can already speak an indigenous language" (*Northern Media,* 31 March 2006), which suggests that he sees no value in learning to read and write an indigenous language. This is perhaps a legitimate concern, but what concerns the researcher in this study is the question of whether Prinsloo is not referring to a 'competitive world' where English is preferred in terms of employment opportunities, disregarding arguments for the value of mother tongue in education.

Where the home language of the learners is a low status language, however, attitudes become influential. With regard to this, Saville-Troike (1991: 7) observes that:

> Educational programs for second language learners do not exist in isolation from the school, school system and communities in which they are embedded ... Here we are in a larger realm of the effect of attitudes on instruction, learning opportunities, motivation, and cognitive demands. Language does not exist in a vacuum, and how it is developed, and for what purpose, lies beyond but is inextricably intertwined with language form and use.

Cummins and Swain (1986: 18–19) also recognise the differences that language status has on the attitudes of second language learners and the resulting success of their overall education:

> Specifically when the home language is different from the school language and the home language tends to be denigrated by others and selves and where the children come from socio-economically deprived homes, it would appear appropriate to begin initial instruction in the child's first language, switching at a later stage to instruction in the second language.

There is a very close link between the learners' attitudes towards their first language and culture, their motivation at school, and their overall academic achievement. Cummins and Swain (1986: 101) recommend that the first language is used extensively in the early years of school, not simply to make the children feel good, but also to ensure that they improve their overall academic performance.

Acceptance of the first language in the home and school is clearly, then, one of the first steps in creating an environment where learning can occur, an environment which fosters feelings of self-worth and self-confidence. But acceptance of the first language is only the beginning. Active encouragement to make use of the home language in school is equally important. This can be done in a variety of ways. One way, of course, is to use the language as a medium of instruction, which not only enhances learners' comprehension, thereby improving academic performance, but also provides concrete evidence that the first language is a useful and valued tool.

These negative attitudes against mother tongue education are further denounced by Webb (1999: 355) who also underscores the "mismatch between policy and practice which is found in the domain of language in Education" (see section 10.1). Everyday experience shows that this is particularly apparent in the case of the preferred language of learning and teaching. Webb (1999) thus shows clearly the dominance of English through statistics that show a totally disproportionate relationship between English as a language of learning and teaching, and the inverse, equally disproportionate relationships in the case of African languages.

2.8 MISMATCH IN POLICY AND PRACTICE

According to the results in Webb's (1999) study, there has been a decline in the choice of an African language as a first language of learning and teaching, and an accompanying increase in the choice of English: whereas an average of about 25 percent of the pupils in the former Department of Education and Training (DET) schools were taught in English in the late eighties, more than 60 percent of the schools in four provinces outside the Western Cape selected English as first language of learning and teaching in 1997. Webb (1999) argues that "this phenomenon, the increasing dominance of English in a country in which it is the second (or third) language of 90 percent of the inhabitants, is surely, an unequivocal denial of the constitution and its underlying philosophy".

However Webb (1999: 357) identifies some reasons for the inability to realize language policy objectives. These may be summarized as follows: under-availability of financial, human and educational resources. Webb (1999) also identifies, following other researchers, such as: Bokamba (1993); Bamgbose (1991); Kashoki (1993), three possible explanations for the situation, namely the sociolinguistic character of South Africa, the inadequate language policies, and the apparent lack of political will.

Of interest to this study is the second explanation, the inadequacy of the language policies. The national language-in-education policy of South Africa as described in the Constitution of 1996 (section 29) stipulates that:

> Everyone has a right to receive education in the official language or languages of their choice in public educational institutions where that education is reasonably practicable. In order to ensure the effective access to, and implementation of this right, the state must consider all reasonable educational alternatives including single medium institutions, taking into account (a) equity (b) practicability and (c) the need to redress the results of past racially discriminatory laws and practices

The schools act determines in summary, that:

1. The provinces must formulate their own language-in-education policies in line with the national policy;
2. The governing body of a (public) school determines the school's language policy, subject to relevant provincial acts;

3. The use of language policy for racial discrimination is prohibited; and
4. The use of language proficiency tests for the purpose of admission to the school is prohibited.

Thus the provisions and general shortcomings of the language-in-education policy can be summed up as follows: aims; language of learning and teaching; language study; multilingualism; policy implementation assessment; language policy development; language of learning and teaching policy.

1. Aims

The department of education declares itself committed to three aims, namely (a) the promotion of multilingualism (b) countering disadvantages resulting from mismatches between home languages and languages of learning and teaching and (c) building a non-racial nation and contributing to citizens' full participation in society and in the economy.

2. The language of learning and teaching

In this regard the policy makes four statements:

a. It accepts the principle of additive multilingualism;
b. It accepts any official language as possible language of learning and teaching;
c. It stipulates that learners (in practice: parents and school authorities) select their language of learning and teaching; and
d. It describes the bases upon which disputes about the language of learning and teaching must be handled (in particular the principles of rights, equality, redress and practicability) as well as the way in which such disputes must be resolved.

The policy documents do not recommend any specific language of learning and teaching model, but do suggest that two such models are considered practical: the use of a first language as a language of learning and teaching and a structured bilingual approach.

3. Language Study

The department's policy on the study of languages is formulated as follows:

From grade 3 onwards, all learners shall be offered their language of learning and teaching and at least one additional approved language as subjects. From grade 5 onwards, one language must be passed; and from grade 10 to grade 12 two languages must be passed.

4. Multilingualism

The policy expresses quite a strong position on multilingualism. It obligates schools to promote multilingualism by requiring of them that they stipulate how they will do it and it suggests that they (i) use more than one language of learning and teaching and/ or (ii) offer additional languages as fully-fledged subjects and/or (iii) apply special immersion or language maintenance programmes, particularly in cases where learners home languages are not used as languages of learning and teaching.

5. Policy implementation assessment

The policy documents also contain directives for assessing policy implementation. The department proposed that language managers be appointed in school districts and that these officials monitor the language policy implementation of schools actively, for instance with questionnaires to Stakeholders, and with interviews. They also proposed that the Pan South African Language Board be approached to assist in the policy implementation assessment

6. Language policy development by governing bodies

Though the policy lists the principles to be followed, it gives no explicit direction on how the governing bodies are to go about developing their language policies. Hence, in view of this, Webb (1999: 361) argues that whilst the philosophy of individual choice and the devolution of decision making accords nicely with a democratic approach to policy making, it is essential that decision makers be enabled to make informed choices. Thus the two documents (Schools Act and LiEP) give no indication that the department intends doing this.

7. Language of learning and teaching policy

Given the strong stand on multilingualism in the policy documents, one would expect a clear and comprehensive directive on the language of learning and teaching. This is not the case. Contrary, the actual policy statement on the language of learning and teaching is unexpectedly general and inexplicit. It reads, simply, that "The language(s) of learning and teaching in a public school must be (an) official language(s)".

As rightly noted by Webb (1999: 361), there is also an ambivalence concerning the notion of multilingualism, expressed in the shifting use of the terms *multilingualism* and *bilingualism.* This ambivalence creates the impression that the department is not sure whether a multilingual approach is feasible, thus reflecting negatively on the philosophy of multilingualism. Given the sociolinguistic realities of the country and the strong support for multilingualism one would have expected a stronger stand on the language of learning and teaching.

Besides the general shortcomings outlined by Webb (1999) the policy documents are also deficient in the following ways:

1. They give no direction on the language(s) to be used by school authorities in their communication with educators, learners and parents, which means that an opportunity to provide credibility for the African languages as working languages in official contexts could be lost.
2. They pay no attention to the dire need for additional language learning programmes.
3. They make no reference to vital issues such as changing the negative attitudes to the African languages, countering the hegemony of English, and most importantly the provision of educational material in these languages.
4. They display a disturbing lack of linguistic insight into the nature of human languages. They state, for example, that the African languages are somehow 'semantically and syntactically' inadequate, presumably in technical usage.
5. The policy in particular, is not careful enough in its reference to the need to develop and expand academic, scientific and technological vocabulary as Webb (1999: 362) states: "the view they express is an oversimplified view which unintentionally lends support to the common objection against the African

languages, namely that they cannot be used as languages of learning and teaching in the higher grades because they do not have the necessary technical terminology, and hinting that they may not happen soon because it takes such a long time to create one's own technical terms". However, it is encouraging to see institutions such as the NLS coming with such progressive documents as the *Multilingual Mathematics Dictionary for grades 1 to 6* (2003).

In addition to these shortcomings, another reason for the widespread hostility towards the use of the mother tongue is what the researcher believes to be a prejudice against African languages prevalent in the African society. The next section presents arguments and evidence for these prejudices.

2.9 LANGUAGE PREJUDICE IN SOUTH AFRICA

As mentioned earlier, language prejudice plays a vital role in the influence for the choice of language of learning and teaching. Because of pervasive overwhelming prejudice, the language policy in education that was proclaimed on 14 July 1997 remains largely unknown and, with few exceptions, is not being implemented. A report by the Western Cape Education Department (2002: no page) observed "also, as professionals, most educators are predisposed to preserving the known above embracing the unknown". Furthermore, the deep-rooted tendency among parents, educators and policy-monitoring staff to regard the subtractive transition to English-medium schooling as the natural and most desirable educational strategy, looms large as a potential hindrance in the way of successful implementation. Awareness-raising campaigns, supplemented by exemplars of good models which demonstrate the benefits of mother tongue education, will slowly remove the remnants of policies of the recent and the more distant past. This view about language prejudice is for example better clarified by the Capricorn High School incident referred to earlier "... which saw the headmaster, Mr. Piet Nel, suspended for allegedly failing to implement an officially-sanctioned language policy" (*Northern Review*, 31 March 2006). In particular "the head master of Capricorn High School, Piet Nel, was allegedly acting against the national language policy which was introduced by MEC Aaron Motsoaledi and which is to be strictly adhered to by schools" (*City Press*, 29 February 2006). In

addition, the *Northern Review* (15 March 2006), revealed that Nel was accused of "deliberately misinterpreting the language policy and conveying the wrong message to parents and learners in his school", and "to be raising one issue after another" regarding the implementation of the language policy and was "forcing pupils to learn English and Afrikaans as a second language, whilst they take African languages as additional subjects. This resulted in learner protests and war of words between the head of department for education, Prof Harry Nengwekhulu and the Capricorn High School learners" (*Northern Review,* 31 March 2006). These are obvious acts of prejudice and injustice to the language policies which seek to enhance the status of African languages.

In a similar scenario at the University of Cape Town, Carohn Cornell, as quoted in the *Multimedia Education Group: Workshop on Multilingualism* (1997), reported that learners often noticed that their multilingual abilities were ignored by their lecturers, and many internalised the negative attitudes towards African languages which were held by many lecturers. Thus, she highlighted the major needs in language development as follows:

- the need to understand which factors aid in the acquisition of English, and
- also, however, the burning need to break down the prejudices associated with the predominance of English, and to begin to regard multilingualism as a resource to be utilised in the learning process

Ogutu (2006: 52) shows that the results of such prejudices invariably elevate the English language to a privileged position, above other languages. Hence, in unison with Limpopo MEC for Sport, Arts and Culture (*Northern Review*, 31 March 2006), the researcher in this study believes that "those who are undermining our African languages have become irrelevant to the cause of building a new society. We commend the education department for the uncompromising stance they have taken against these acts of **prejudice"**[5].

[5] My emphasis

2.10 SECOND LANGUAGE EDUCATION AND MATHS AND SCIENCE ACHIEVEMENT

Baker (1993: 175) feels that African learners in second language education lag behind their peers in areas such as mathematics and science. The explanation he offers (1993: 175) is that "this may be because their second language skills are insufficiently developed to be able to think mathematically and scientifically in their second language." This view is supported by Cummins and Swain (1986), as well as Saville-Troike (1991: 1), who states that:

> Certainly second language learners are at a disadvantage trying to understand instruction and express themselves in a foreign language, especially when they must compete with other learners who have already mastered their first language.

Not only does the second language itself hinder the learners; the system as a whole tends to expect lower achievement of learners studying through a second language. This manifests itself in a variety of ways; one of these is that the curriculum and levels of assessment for second language learners may be 'watered down'. Saville-Troike (1991: 6) calls this an "instructional bias", which she defines as "teaching subject content to children's low level of English."

2.10.1 Science

Some people think of science as a subject in which learners are required to memorise and apply various formulae, label diagrams, weigh-out chemicals and operate microscopes. However, there has been a major shift in recent years, both in South Africa and abroad, towards a constructivist approach to science education. This approach emphasizes the conceptual nature of science, and the high level cognitive processes required to understand and communicate these concepts. *The United States National Science Education Standards* defines 'scientific literacy' in a manner which reveals its conceptual and communicative dimensions:

> Scientific literacy means that a person can ask, find or determine answers to questions derived from curiosity about everyday experiences. It means that a person has the ability to describe, explain, and predict natural phenomena. Scientific literacy entails being able to read with understanding articles about science in the popular press and to engage in social conversations about the validity of the conclusions. Scientific literacy implies that a person can identify scientific issues underlying national and local decisions and express positions that are scientifically and technologically informed (Anstrom, 1997: 14).

Commenting on the fact that second language learners in the US consistently underachieve in science rather than their first language counterparts, Anstrom (1997: 16–17) summarises recent research in the United States of America clearly identifies the fundamental role of language proficiency in science achievement:

> The acquisition of certain linguistic structures of argumentation is thought to be a prerequisite for the kind of advanced reasoning used in scientific communication, the sort of reasoning which scientific literacy seeks to achieve. If second language learners do not have access to these linguistic skills, they will not be able to engage in the level of discussion essential to scientific enquiry, and will have difficulty in science reasoning. In addition, certain linguistic structures, such as logical connectors and specialised vocabulary (both science terminology and vocabulary that may have different meanings in a scientific context) are problematic for second language learners. Moreover, discourse patterns common to science such as compare/contrast, cause/effect, and problem/solution require a high level of linguistic functioning. Thus, cognitive development in science is heavily dependent upon linguistic development.

2.10.2 Mathematics

In a similar manner to the teaching of science, mathematics is also taught and learned in a language-intensive manner. As with their counterparts in the field of science, the United States National Council of Educators of mathematics has prescribed standards for mathematics education which:

> ...emphasize communication and discourse within the context of mathematical problem solving. The standards explicitly recommend that educators pose questions and design tasks that engage learners' thinking and ask learners to clarify and justify ideas orally and in writing (Anstrom, 1997: 24).

The problems that the important role of language creates for second language learners are also clearly recognised. For example, Anstrom (1997: 25), summarising the United States National Council of Teachers of mathematics guidelines, states that:

> Command of mathematical language plays an important role in the development of mathematical ability. The importance of language in mathematics instruction is often overlooked in the mistaken belief that mathematics is somehow independent of language proficiency. However, particularly with the increased emphasis placed on problem-solving, command of mathematical language plays an important role in the development of mathematical ability. Mathematics vocabulary, special syntactic structures, inferring mathematical meaning, and discourse patterns typical of written text all contribute to the difficulties many second language learners have when learning mathematics in English.

It is clear that successful achievement in mathematics and science is difficult enough for learners learning through their first language; and thus significantly more difficult for second language learners. Not only are these two subjects inherently difficult for most learners, but the specialised types of language that mathematics and science need, even from a very early stage compound the problem for second language learners. It is also clear that learners have their best chance of success in mathematics and science if they study it through their mother tongue. These discussions above also seem to indicate that there are several important problems with the early immersion or English only education system. These include the stunted development of the learners' mother tongues, the impeded development of their cognitive academic abilities, negative attitudes towards the first language and poor performance on second language tests.

The following section offers a detailed discussion of SiSwati, one of South Africa's eleven official languages. This is also the African language on which the data for this study were mainly sourced.

2.11 THE SISWATI LANGUAGE VARIETY

According to Lubisi (1997) SiSwati is one of the four major Nguni languages spoken in the Republic of South Africa, the other three being isiZulu, isiXhosa and isiNdebele. SiSwati is mainly spoken by people of whom the majority resides in the former Kangwane (a former so-called Swazi homeland). Up until 1994 it served as

one of the officially recognized regional languages in South Africa. In 1994 it became one of the eleven official languages of this country.

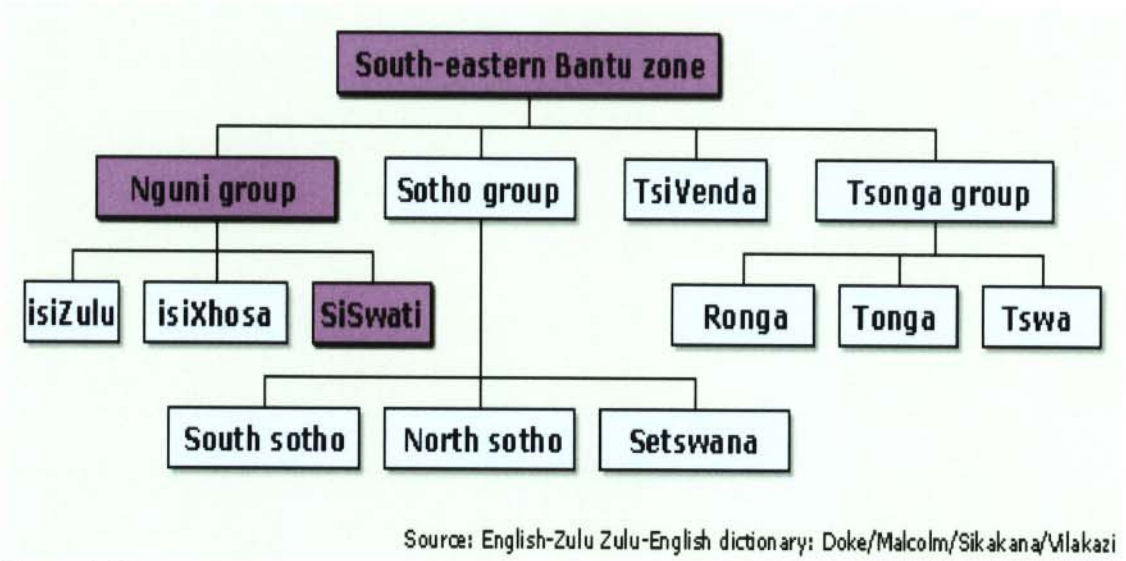
Taljaard (1991:1), reveals that the standardisation of the orthography of SiSwati has a relatively short history, even though the first written SiSwati published material dates as far back as 1846 when the Reverend John Allison at Shisalweni produced a booklet of 118 printed pages with the title: *Tekatekisemi ta la Bawesley Metidosti*, nothing was done thereafter to develop SiSwati until 1968 when it was introduced for the first time in schools in Swaziland.

In the Republic of South Africa, including the Former Kangwane Homeland, isiZulu was a medium of communication in every walk of life, namely: schools; churches and other social, economical and educational sectors. When the Former Kangwane Homeland came into being in 1977, SiSwati was introduced for the first time in the Republic of South Africa. In 1978 it was introduced in the lower classes phasing out isiZulu. Now it is amongst the eleven official languages of South Africa. In addition it is now taught in all phases of the Education System, from Grade R until Doctoral degree level.

Lubisi (1997) maintained that SiSwati could even be an older language than isiZulu. Contrary to popular belief, it is not an offshoot from isiZulu. It can be as old as isiZulu, but for some reason or another, it did not develop as fast as isiZulu. Thus Lubisi (1997) argued that "the main factor for the lack of development in SiSwati is that Swazis were far from the sea hence the missionaries came later to the part of the world which they inhabited".

Data available through the *UNESCO World Languages Report* (2000) indicates that the name SiSwati is the official Autoglotonym (name given to the language by native speakers) for the language under study, whilst its Heteroglotonym (name given by the non-native community to the language) is Swazi. The SiSwati language belongs to the Bantu Language Family (see figure 1), which is in the group of languages known as South Eastern Bantu and the subgroup known as the Nguni (Tekela Subgroup). Against what many may think, this language is neither a Creole nor Pidgin. This language is a national language, firstly spoken in the Kingdom of

Swaziland. As such, SiSwati holds joint-official status both in Swaziland and in the Republic of South Africa.



Source: English-Zulu Zulu-English dictionary: Doke/Malcolm/Sikakana/Vilakazi

Figure 1: SiSwati language family tree.

The language's territory is situated in the eastern part of Southern Africa and borders in the west and south on the Republic of South Africa and in the north on Mozambique. Secondly the language is also spoken in the Republic of South Africa in the eastern parts of the Mpumalanga Province that borders on Swaziland. In particular it is mainly spoken in Mpumalanga Province of the Republic of South Africa. Since the borders of the area are not defined, one cannot put a number to the inhabitants. According to data available from the 1996 Census 1 013 193 persons in South Africa indicated that their home language is SiSwati. The distribution in the provinces is as follows:

- 1,3 percent of the population of Gauteng Province,
- 29, 8 percent (±834 133) of the population of Mpumalanga Province.
- In the other provinces there are less than 1 percent. This adds up to 2,5 percent of the inhabitants of South Africa (South African Survey, 1999-2000).

SiSwati has two other well-known varieties, the Thithiza and Yeyeza (though the evidence of this consists of minor differences that are evident in certain areas). The language has existed in written form before 1968. At independence (which was in 1968) the language became the official language of schools, government and religion in Swaziland and has ever since steadily been replacing Zulu in education,

administration, and public life, its use as a written medium having grown rapidly (Rycroft 1981: vii). Before then SiSwati was mainly written in religious publications and the Bible (UNESCO, 2000).

In Mpumalanga Province which has the largest concentration of SiSwati speakers, the following languages are also spoken:

isiZulu	25,2%
Northern Sotho	10,4%
Afrikaans	8,2%
Xitsonga	3,5%
Setswana	2,7%
English	2,0%

In the other provinces the percentages are less than 2 percent or too small to be recorded (*South African Survey*, 1999-2000).

2.11.1 The Development of Standardized SiSwati

Similar to all African languages, SiSwati has been developed into a standard language mainly through the work of missionaries. A number of missionaries who were involved in SiSwati language development and standardisation, either in person or as team leaders, were not members of the SiSwati linguistic community. This is true even though the missionaries studied the language extensively and could speak it fluently. For example, some of the missionaries in question include authors such as: DK Rycroft compiler of SiSwati – English dictionaries, D. Ziervogel co-author of the classic *A grammar of the SiSwati languages* and Taljaard of the National Language Service.

In Swaziland the Swati Language Board looks after the language with regard to spelling rules and terminology. This board also helps to keep watch over the language and its future.

The Swati Language Board in South Africa once worked in conjunction with the one in Swaziland and was part of the Kangwane Homeland government. In 1994 this task was taken over by the Department of Education of Mpumalanga Province and PANSALB. Nationally, the Department of Arts, Culture, Science and Technology looks after the interests of all the languages of South Africa on an ongoing basis. Together they have become responsible for linguistic policy and planning with respect to languages in the country, including SiSwati. Amongst activities that these organisations perform is the modernisation of languages such as SiSwati, for example, The *Multilingual Mathematics Dictionary.*

In both Swaziland and the Republic of South Africa SiSwati is used in education as a medium of instruction and as a subject in primary (elementary) and secondary schools. In 1997 South Africa had 100 primary (elementary) schools, 3 secondary schools and 4 combined schools using SiSwati as medium of instruction. In 1999 in South Africa 12 300 learners wrote the senior certificate SiSwati examinations (matric). In higher education it is offered as a subject for degree purposes by the University of Swaziland, the University of Zululand, the University of South Africa and the University of KwaZulu-Natal (in the latter case only up till 1998). (*Central Statistical Services,* **n.d.)**

According to a UNESCO (2000) report, in Swaziland, and to a lesser degree in the RSA, many English and/or Afrikaans speaking businessmen and farmers speak SiSwati out of necessity. Marriages between Swazi speakers and speakers of other languages may motivate the latter to speak SiSwati. Zulu, Xhosa, and Ndebele speakers would normally not speak SiSwati; even if the speaker knows that his/her audience is SiSwati speaking because the languages are mutually intelligible to a certain degree. The only threat, if any, comes from the growing popularity of English and this is more evident in the Republic of South Africa than in Swaziland.

2.11.2 The Influence of Religion on SiSwati

Religion has played a major role in the history of Swaziland. In the 19th century, missionaries were seen as bearers of knowledge and for this reason they were welcomed by King Mswati. The majority of Swazis claim to be Christians and belong to some or other denomination. Although the traditional belief in the ancestors is still strong they have achieved a working marriage of the two that is acceptable to both the traditionalists and the Church. In this way religion brought literacy and contact with the outside world to Swaziland.

This also applies to the Swazis of the Republic of South Africa, except that many of them have lately joined the Zion Christian Church (ZCC), which has a huge following in the RSA. The rest are all Christian and belong to a variety of denominations, some very informal. Spoken and written forms of SiSwati in religion are used all the time and have been used for a very long time. However, in the RSA isiZulu has frequently been used because the Bible was at first only available in isiZulu.

2.11.3 The Use of SiSwati in the Media (radio, newspapers and television)

In Swaziland SiSwati is used in all media but to a lesser degree in newspapers - there is only one SiSwati newspaper with several English ones. On radio it is used 18 hours per day by the national radio popularly known as *Umsakato Wakangwane*. On national television SiSwati shares the stage with English. Socio-cultural events, especially where the king is present, and internal official news are all presented in SiSwati.

In post-apartheid South Africa SiSwati is used on radio for 24 hours per day by the *Ligwalagwala FM* station which broadcasts from Nelspruit, the capital city of the Mpumalanga province. There are still no newspapers in SiSwati and on television there are weekly regional broadcasts of half an hour by the SABC. Lately, South African Television has seen a welcome introduction of SiSwati continuity presenters. In addition plans are underway for the introduction of two regional television channels

viz. SABC 4 and SABC 5 which will mainly "cater for African languages" (*BuaNews*, 2005). SABC4 in particular will cater for Setswana, Sesotho, Sepedi, Tshivenda, Xitsonga and Afrikaans, and SABC 5 for isiZulu, isiXhosa, SiSwati and Afrikaans. What is worrying, though, is the fact that both channels will also cater for Afrikaans, a language which received preferential treatment during the apartheid era. With SABC 2 currently catering for a majority of Afrikaans programmes, the researcher believes that Afrikaans will see an exponential growth in its coverage by the SABC. This does not however overshadow the excellent work that the SABC is trying to do by affording African languages such SiSwati dedicated channels.

2.11.4 SiSwati Literary Tradition

In 1968 (at the independence of Swaziland) written SiSwati received a major boost in the form of published school books and literary works. Prose, poetry and drama books were written but were exclusively aimed at the school market. Before then the only written SiSwati texts were those dealing with religious issues.

In the RSA the same situation occurred in the early 1980's when the Kangwane Homeland was founded. Mother tongue tuition as well as being a subject at school necessitated the production of books and a number of prose, poetry and drama works were published. In 1991 the University of South Africa started teaching SiSwati as a subject and this opened up another avenue for aspirant writers. The volume is small because of the restricted market and the lack of a tradition of reading among SiSwati speakers.

2.12 ATTITUDES TOWARDS THE KNOWLEDGE AND USE OF THE SISWATI LANGUAGE.

In section 2.7 of this chapter it was mentioned that, besides the role played by prejudice, probably the worst threat to the use of African languages in education is the negative attitudes often potrayed by communities against their mother tongue. It is obvious that the SiSwati language community is not immune from the

misconceptions that create such attitudes. It would not be surprising to find comments such as those made by Fortunate Mokgehle (c.f section 2.7) amongst young people in places where SiSwati is widely spoken. Regarding the issue of attitudes against African languages, in particular against SiSwati, the UNESCO (2000) report reveals that in Swaziland the language is not an issue since all the speakers use it everyday in all walks of life and they accept it as part of their heritage and culture. Therefore they expect it to stay that way.

Unfortunately, in South Africa the opposite is true as the report observed that "...not enough is being done to promote use of the language and that it will, in the end, be replaced by English in all public walks of life" (UNESCO, 2000: no page).

2.13 CONCLUSION

This chapter has revealed a number of important arguments relevant to the research project conducted during this study. For example, the chapter opened by demystifying the "false but pervasive belief that children should get into English as soon as possible or they will be retarded in learning". Then a detailed overview of South Africa's evolution of LiEP was provided along with different views (Cummins and Swain, 1986; Saville-Troike, 1991; Baker, 1993; de Klerk, 2002; Huegh, 1995). Issues about mother tongue education; in particular the overwhelming negative attitudes and resistance to first language learning were explored. The chapter has discussed the current national language-in-education policy, with emphasis on its shortcomings. Finally, the chapter looked at the development and standardization process of SiSwati. Some evidence of SiSwati as a written and studied language up until university level was revealed. It is clear from this chapter that along with other authors, the researcher believes that the role of mother tongue in education is crucial. Evidence for this opinion is based on empirical data from the *Third International Mathematics and Science Survey* (TIMMS) (Cf.: sections 2.2.2 & 2.3.3), a study whose results amongst others showed that most learners who wrote mathematics in a second language (mainly English) performed poorly. This belief is also supported by the researcher's observation of arguments about the role of "Second Language Education and Maths and Science Achievement" (Cf.: section 2.10).

CHAPTER 3

TRANSLATION AS A MEANS FOR LANGUAGE DEVELOPMENT

3.1 INTRODUCTION

The need for the promotion and development of African languages was discussed in Chapter Two. Taking this need into cognizance, this chapter explores arguments for the translation of African languages as a means for developing them into languages of teaching and learning. The translation processes (in particular approaches and guidelines), as well as associated problems are explored with the aim of estaishing understanding in this field. The researcher in this study narrowed down the discussions to those translation processes believed to be appropriate to a translation project geared to develop mother tongue education. This includes looking at the process of term creation in African languages. In the end the researcher adopted the guidelines and strategies offered by Gauton (2002) as a model through which African languages can be developed.

3.2 LANGUAGE DEVELOPMENT/ MODERNISATION

In South Africa, the development of indigenous languages has taken centre stage along with the promotion of multilingualism. Since 1996, and even perhaps prior to that, South Africa's language planners realized that language development has three concrete objectives to be taken into consideration:

1. The development of a standard orthography and spelling system for a particular language.
2. The elaboration and modernisation of the vocabulary of that language.
3. The creation of new registers such as those used in education, the legal system, journalism and report writing.

(LANGTAG Report, 1996: 68)

More importantly the LANGTAG report further indicates that language development also has more indirect aims such as:

- elevating the status of a language so that its speakers will be willing to use it in high-status domains. In this way language development is an important step in the general upliftment of a community;
- the economic benefits of making science and technology more accessible;
- the need to reconcile science and technology and the domestic culture;
- the need to counteract ... subordinate attitudes to cultures of technologically advanced countries which education in a non-national language might promote.

LANGTAG Report (1996: 68-9)

These statements reflect the reasons why a worthwhile endeavour such as the production of *Multilingual Mathematics Dictionary* is crucial for this country. As such, it is argued by the *LANGTAG report* (1996: 69) that language elaboration is probably the most critical domain that needs attention. First, it is postulated that fast and efficient elaboration of the African languages will help in changing attitudes towards them, improve school performance, and help in the upliftment of communities. This view was earlier highlighted in Chapter 2.

The second reason for developing African languages in the domain of education is summed up by Gauton's (2006: 29), changing George Orwell's well known satirical phrase "some languages are more equal than others". This is also because in Gauton's (2006: 29-30) words "there is no denying that English tends to dominate political and public discourse. As for Afrikaans, it has well developed terminologies in most technical subject fields and a much stronger terminological tradition than the south African Bantu languages, due to the preferential treatment that it enjoyed *vis-à-vis* the Bantu languages during the apartheid era". Terminology development is crucial for the education system as it is the main mechanism used to spread the developed form of any language. Several authors (for example, Bell 2003; Saville-Troike, 1991; Cummins and Swain, 1986) argue that well-developed African languages will enable children to acquire the basic skills that may later be transferred to another language for success in learning.

In addition to a lack of terminology in most specialist subject fields, the South African Bantu language translator must also contend with the reality posed by the situation faced by the various National Language Bodies (NLB's). This reality stems from the fact that

the NLB's "which replaced the apartheid era language boards, cannot possibly keep up with the demand for standardised terminologies as needed by the Bantu language translator on a daily basis" (Gauton, 2006: 30).

However, Eastman (1983: 8) warns that the elaboration process (such as is recommended in the LANGTAG report) is often administered by institutions where little is known about who accepts and who rejects newly proposed technical terms. This is one of the main issues investigated by this study. Eastman (1983: 8) further indicates that there is a common fallacy that language development must be driven by the Government. As reflected in this document (see Chapter 1, section 1.3), this study also seeks to shed light on this fallacy.

3.3 THE TRANSLATION PROCESS

According to Nord (1991, 1992 & 1993) successful language development is possible through the adoption of a functional approach whereby the translation is determined by the aims, demands and requirements of the initiator of the translation, for instance the person(s) who asked for the translation in the first place. Nord (1992) further argues that this functional approach needs to be adapted to the notion of "loyalty", a concept which suggests that the translator has the responsibility to ensure that the translation conforms to the expectations of:

- the author of source text (ST);
- the reader of the target text (TT);
- the initiator of the translation.

This responsibility is what Nord refers to as "loyalty". As a result of exercising this "loyalty", Nord (1992: 40) believes that the translator becomes the so-called "expert" in as far as the two cultures and procedures of translation are concerned. In view of the functional approach, translation of terms from one language to another can then be applied in a step-by-step process which is outlined as follows:

1. The client gives the translator a source text and a translation brief as to why, for whom, and for what purpose, he/she wants the source text translated. In this step it is important for the translator to try and get as complete a translation brief as possible. This can be achieved through asking the following three fundamental questions:

- Who is the text being translated for? Who are the intended recipients?
- What is the motive behind the translation?
- What is the purpose/ intended function of the translation? For what will it be used?

2. Read through the translation brief and the ST to be translated.

3. Try to form a general impression about whether the translation brief is compatible with the ST. In other words, does it seem possible to translate the given ST according to the brief provided? If it seems immediately obvious that the ST and translation brief are incompatible, discuss it with the client, and start again with step 1. With regard to this step Nord (2001) strongly advises that it is up to the translator to educate the client if necessary.

4. In this step, the translator should analyse the ST by answering each of the following questions:

- Who is transmitting the text? (That is, who is the author or sender of the text?)
- To whom is the text being transmitted? (That is, who is the intended readership?)
- What for? (That is, what is the author's or sender's intention with the communication?)
- By which medium? (By means of which medium, for example, written, is the communication being transmitted?)
- Where? (That is, what is the origin of the communication, for example, South Africa?)
- When? (That is, when is/ was the communication transmitted?)
- Why? (That is, what is the motive for the communication?)
- With what function? (That is, what is the intended function of the communication? for example to inform, to persuade, and to instruct.)

- On what subject matter? (That is, on what subject matter does the sender communicate?)
- What? (That is, what is the content of his or her communication?)
- In what order? (How is the communication constructed?)
- Using which non-verbal elements? (Which non-verbal elements such as graphics, stage directions, or layout are used?)
- In which words? (That is, which register is being used, for example. formal or informal?)
- In what kind of sentences? (What is the sentence/ syntactic structure of the communication?)
- In which tone? (That is, which tone is being used, for example: persuasive, or sarcastic?)
- To what effect? (That is, a summary of all the previous questions)

5. Analyse the translation brief, using the same set of questions as in 4. Ensure oncemore that the translation brief and the ST are compatible. If not, go back to step 1 and discuss it with the client.

6. Do the actual translation. Depending on the translation brief, one will preserve certain elements of the ST, whilst adapting other elements. The degree to which one preserves and adapts elements of the ST is determined solely by the translation brief. If the brief, for instance, states that:

- you have to translate the text for a target reader(ship) with basically the same profile as the source reader regarding age, social class, and education level, then the translation will preserve most of the elements of the ST.
- you have to translate the text for a target reader(ship) with a different profile from the source reader, regarding for instance age (for example, the target readers have very little formal education), then the translation will adapt most of the elements of the ST.

7. At this stage, one can deliver the finished product to the client.

8. If the TT meets the requirements as set out in the translation brief, then the client will be satisfied.

The process outlined above can be illustrated through figure 2 as follows:

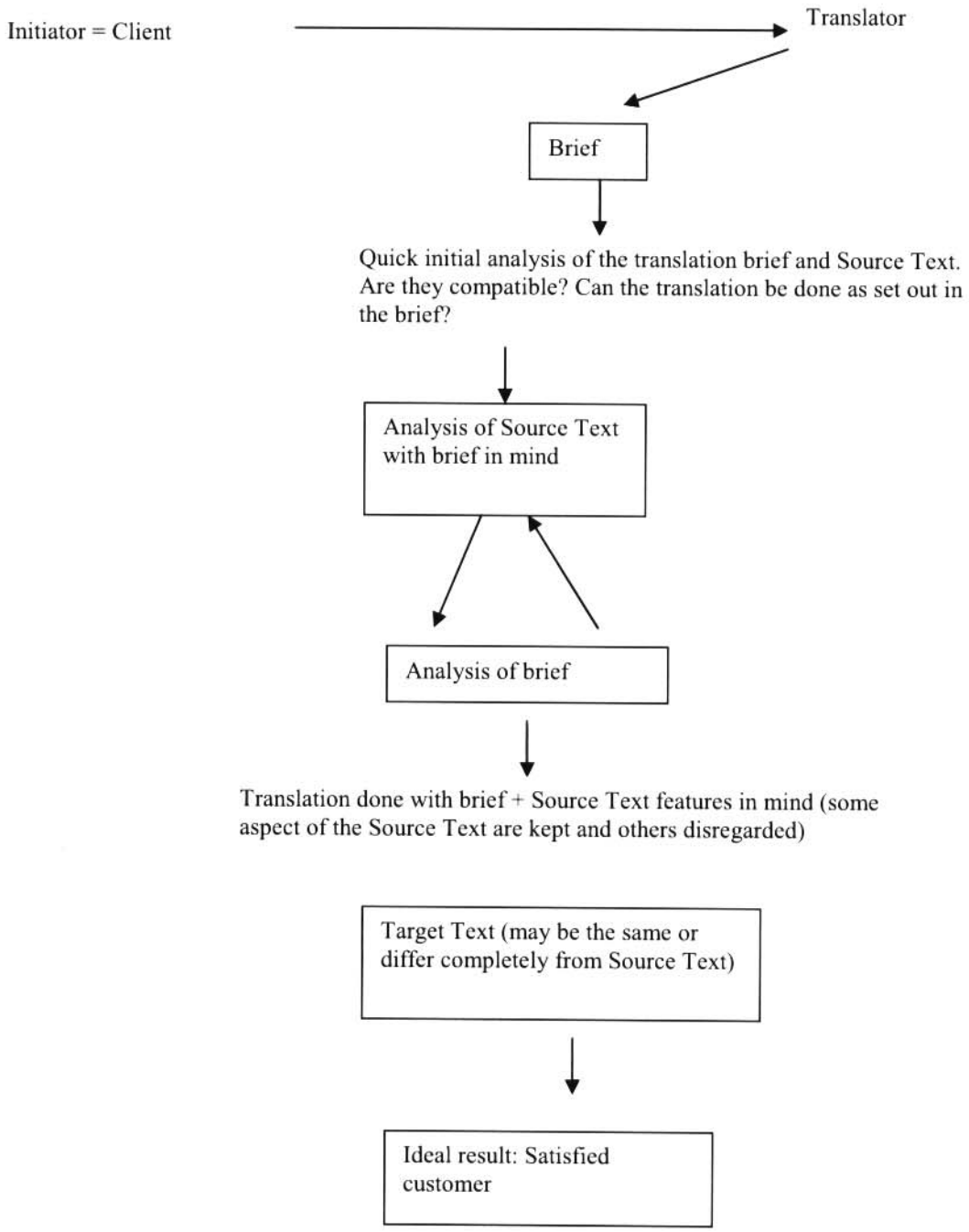


Figure 2: Translation Process

The functional approach as advocated by Nord (1991, 1992, 1993) is effective for successful translation. However, this effectiveness appears to be true in cases of well developed languages. With regard to African languages, the opposite is often true. How can the functional approach be effective in languages where "there are woefully few technical dictionaries and terminology lists and/ or glossaries..., and this coupled with the lack of guidance regarding which terms should be regarded as standard as well as regarding term formation strategies" (Gauton, 2006: 30). Gauton (2006:30) further laments this situation which according to her "puts the translator working into the South African Bantu languages in the unenviable position of having to create terminology when undertaking almost any translation task, and not only technical translations". Noting this important issue, Gauton (2002: 5) earlier made an equally important conclusion:

> The single biggest problem that translators who translate (from a language such as English) into the African languages have to contend with, is the lack of terminology in the African languages in many of the specialist fields such as for example, chemistry, mathematics, computer science, and economics.

The researcher is of the opinion that the statement above is relevant, especially if one considers the fact that Nord's (1991, 1992 and 1993) functional approach to translation can be understood to be relevant only in cases of well developed languages (that is, those with developed sources such as dictionaries, official terminology, terminological databases and orthography).

Another problem with an approach like Nord's (1993) is that it neglects the realities that African languages face, for example, those noted by Gauton (2002: 5). This neglect continues despite the knowledge of important observations made by prominent linguists such as Chomsky (1975: 48) who appropriately warns:

> In fact, although there is much reason to believe that languages are to a significant extent cast in the same mold, there is little reason to suppose that reasonable procedures (not involving extralinguistic information) of translation are in general possible.

The next section explores the process of term creation usually adopted successfully in tasks involving a number of developed languages. Despite the fact that the researcher is of the opinion that the process of term creation as advocated by Cluver (1989) continues to neglect the unique needs of the African languages, it is still

deemed significant to have an understanding in these processes. Later on (Cf.: section 6 of this chapter) the researcher expands on this issue by looking at term creation processes in African languages.

3.4 TERM CREATION IN DEVELOPED LANGUAGES

In an important contribution, Cluver (1989: 48) also mentions the following term creation processes which are predominantly applied in European and modern languages:

a. Word manufacturing or coinage, with the most frequently occurring forms being acronyms, shortenings and word creations. In acronyms the original letters are not pronounced as individual letters, but as words, radar = radio detecting and ranging. These words start as acronyms but soon become normal independent words which take suffixes such as the plural. Abbreviations / shortenings such as ecq = electrocardiograph. In the case of shortenings, these are always pronounced as a sequence of letters and not as words as in the case of acronyms.

b. Blending, where new words are formed by combining parts of two different words, for example. motel < **mo**tor + ho**tel.**

c. Clipping, whereby a word is reduced to one of its parts, for example. maths < **math**ematic**s**

d. Conversion, where the new word is coined by changing the grammatical category of the word, for example, network – converted from a noun to a verb.

e. Derivation which involves adding an affix to a root. Whereas African languages mainly use prefixes (i.e. *li-gremu* for gram and *i-avereji* for average), a language such as English usually makes use of suffixes, for example, *Arrangement* (where *–ment* is a suffix). An example of the use of a prefix is observed in a word like *pre-install* (where *pre-* is the prefix).

f. Semantic transfer, for example, where animal names are used in technical language with a specialised meaning, for example, mouse in computer terminology. Semantic

transfer, is also productive in African languages. This will be pointed out clearly later in section 3.6. Sager (1990 cited in Gauton 2002: 10) also mentions the use of simile, for instance, the naming of a concept in analogy to another familiar one, for example, L-shaped room. According to Newmark (1988: 46) this form of word creation fulfills the two main aims of translation, which are first, accuracy, and second economy.

g. Computer-created names, for example, trade names such as TEFLON

Like Cluver (1989), Baker (1992), Gauton (2002) and Newmark (1988) highlight translation methods and associated problems. Newmark (1988: 48) observes that "it has sometimes been said that the overriding purpose of any translation should be to achieve 'equivalent effect', meaning, to produce the same effect (or as close as possible) on the readership of the translation as was obtained on the readership of the original". According to Newmark (1988: 48) the 'equivalent effect' is the desirable result, rather than the aim of any translation, bearing in mind that it is an unlikely result in two cases: (a) if the purpose of the SL text is to affect and the TL translation is to inform (or vice versa); (b) if there is a pronounced cultural gap between the SL and the TL text.

The next section discusses an approach to translation as proposed by Gauton (2002), which takes into account developmental needs of African languages, especially those in South Africa.

3.5 TRANSLATION APPROACHES RELEVANT TO AFRICAN LANGUAGES

Despite having a progressive language policy (see discussions in Chapter 2), the country (South Africa) has been painstakingly grappling with the challenge of developing and empowering its nine African languages, viz, Sepedi, Setswana, Sesotho, Xitsonga, Tshivenda IsiNdebele, IsiXhosa, IsiZulu, and SiSwati. One area which has witnessed challenges is the field of translation (Gauton, 2002; Baker, 1992; Molepo, 2005; Mbatha, 2005). According to Gauton (2002: 5) "the single biggest problem has been… the lack of terminology in the African languages in many of the specialist fields such as for example, mathematics, chemistry, and computer science." Mtintsilana & Morris (1988: 111), state that the problem identified by Gauton (2002) emanates from "the defining characteristics

of technical terms known as monosemy", which suggests that "a term should have one meaning only". In other words "a term therefore should refer to one concept and each concept is named by a term". In response to this challenge, Gauton (2002: 6-7) offers a step-by-step guide to solve the problem of lack of terminology, while adhering to the requirements of monosemy during translation. These steps which the researcher in this study believes are of crucial importance when a translation project involving an African language is underway, are outlined below:

Step 1: Look for the term in any of the existing dictionaries of the language, as well as in the official terminology of the language. When this search is conducted, Gauton (2002: 6) recommends that the translator must look for any and all existing dictionaries, ranging from general language dictionaries to technical dictionaries. If this does not yield positive results, then the translator can proceed to the next step.

Step 2: Find any existing term lists that deal with the particular subject field. In this regard one can also contact the National Language Service (NLS). If this does not yield positive results, the next step is necessary.

Step 3: In this step Gauton (2002:6) recommends finding parallel texts, for instance, any existing texts in the particular African language on the same subject field as the one in question. This is because according to (Gauton, 2002) sometimes one can find the translation equivalent of an English term in another text that deals with the same subject and that has already been translated into the particular African language. In this case Gauton (2002) suggests the use of resources such as handbooks, pamphlets, etc as well as do searches through the internet. If this yields no results (no translation equivalent), the translator has no choice but to create a term by him/herself.

Step 4: This step is necessary if the three steps above fail to yield positive results. In this step, the translator has already exhausted all the possibilities and has to create a term. Gauton (2002: 6) offers a few important guidelines that the translator must follow to successfully create a term.

Guideline 1: See if you can find a translation equivalent for the term in one of the related African languages, (that is, the Nguni or Sotho languages, Venda or Tsonga). If one of the related African languages already has a term for the concept in question, it means

that half of the work is already done because it is usually easier translating from one African language into another than translating from a language such as English into an African language.

Guideline 2: Find out what the exact meaning of the word to be translated is. The first rule of translation is: You cannot translate a text if you do not understand it. Before one creates a term, one must know as clearly as possible what the source text term means or refers to. With regard to this guideline Gauton (2002: 6) warns that "in the translation of technical texts, this is often a problem as no translator can be expected to be an expert in each and every subject field". For this reason, translators of technical texts tend to specialise in a certain field, for example, Chemistry and Mining. What is problematic is that in South Africa, however, unlike what Nord (1992: 40) expects, "translators unfortunately do not have the same status as in some other countries, and many translators, especially free-lance translators, therefore translate whichever text types they are called upon to translate".

Gauton (2002:7) suggests a simple checklist that translators should consult for ensuring that they are able to "find out what a term means". In this checklist he mentions that the translator should consult:

- a dictionary of the source language (SL) – a good explanatory dictionary will often explain the term that one is looking for;
- a SL technical dictionary that deals with the subject field in question;
- an encyclopaedia, other reference works, CD –ROM's, the internet, etc;
- one could try and figure out from the text itself (or from parallel texts) what the term refers to. This is however not always possible;
- an expert or specialist in the subject field

Guideline 3: One must know and adhere to principles of term creation (discussed in detail in section 6 below)

Guideline 4: When creating terms, one must ideally consult specialists or experts in the field that are also mother tongue speakers of the African language in question. In this way one can standardise terms to a certain extent. Obviously as Gauton (2002: 7)

contends it is not of much use if someone is the only one who can understand and maybe will ever use the terms that he/she has created.

Guideline 5: The translator should make a list of his/her terms (the SL term and its translation equivalent in the TL) so that the terms can be used again later. It is also important not to forget documenting those already existing terms which were found earlier in dictionaries, and other sources, as well as in parallel texts such as specialist articles, and textbooks. In this way one will be able to build his or her own databank for future reference. This is especially useful if one does a lot of translation work within the same subject field. Gauton (2002: 7) also recommends that available computer programmes (software) be used as they make it simple to:

- build and manage a terminological database;
- help in saving time when doing translations that are similar to ones that have been done before. An example of this the CAT (computer assisted translation) software.

Two recent studies in this field, (Mbatha, 2005 and Molepo, 2005) agree with the issues (challenges to translation) raised by Gauton (2002). Mbatha (2005: 59) concludes that culture poses a serious challenge to translation as "it is not easy to translate cultural aspects if the source language and target language are different". In the same vein Molepo (2005) concurs with this as his study *Problems of translating technical terms into African languages with special reference to Sepedi* has found the impact of culture to be true.

It goes without saying that for African languages, languages that are still to undergo vigorous development, much work (especially with regard to language elaboration) still lies ahead. If these languages are to be used, for example as medium of teaching and learning, it will require dedicated translators to engage in activities such as the creation of new terminology. The next section explores such a process.

3.6 THE CREATION OF NEW TERMS IN AFRICAN LANGUAGES

There is a clear difference between translating into an international language such as English and translating into a so-called 'minor language' or 'language of limited diffusion' (LLD's) such as an African language. According to Gauton (2002: 7), this difference also holds water regarding the translation of terminology. In view of this issue, Cluver (1989:254) points out that since the terminographer working on a developing language actually participates in the development / elaboration of the terminology, she / he needs a deeper understanding of the word-formation processes than a counterpart who works on a developed language.

In response to this need, Mtintsilana and Morris (1988) distinguished between term formation processes internal to the language and borrowings from other languages. In addition, they identified the following term formation processes in the African languages:

3.6.1 Semantic Transfer

This process involves the "attaching of new meaning to the existing words by modifying their semantic content...the process also entails a shift in reference rather than sense" Mtintsilana and Morris (1988: 110). It can thus be said that this means that the existing words and new terms are used side-by-side, one in ordinary speech, the other as a term in a special field. An example of this may be seen in the following terms:

		Meaning in 'ordinary' speech	**Specialized modern use**
SiSwati	*Umphatsi*	'holder'	*Umphatsi-luhlelo*: Programme Director *Umphatsi-sihlalo:* Chairperson
SiSwati	*Umnyango*	'door'	*Umnyango (wetemfundvo)* Department (of Education)

The most common form of semantic transfer is semantic specialisation, which entails that a word from the general vocabulary acquires an additional, more technical meaning as in the case of *umphatsi* and *umnyango* above.

The opposite of this process also occurs through semantic generalisation, whereby the meaning of the word is extended. For example:

English: electricity SiSwati: *gesi*

The meaning of *gesi* has been extended from the original meaning 'coal gas (as used for lighting and heat)' to now also include the meaning 'electric light, lamp, electricity'.

In addition, semantic transfer may be well understood by making a distinction between itself and what Newmark (1988: 46) calls 'faithful translation'. In the latter case the translator attempts to reproduce the precise contextual meaning of the original within the constraints of the TL grammatical structures. Faithful translation attempts to be completely faithful to the intentions and the text-realisation of the SL writer. Semantic transfer differs from 'faithful translation' only as far as it must take more account of the aesthetic value of the SL text, compromising on 'meaning' where appropriate so that there is no assonance, word-play or repetition jars in the finished version. It may further translate less important cultural words by culturally neutral words or functional terms but not by cultural equivalents.

3.6.2 Paraphrase

Paraphrase is a productive way in which indigenous vocabularies are extended. For example:

English: psychiatrist =

SiSwati: *dokotela wetifo tengcondvo* 'a doctor of mind diseases'

English: diabetes =

SiSwati: *sifo sa shukela* 'a disease of sugar'

3.6.3 Compounding

In the process of compounding, a term is coined by combining existing words. For example:

English: dictionary =

SiSwati: *sichazamavi* (< si (c/pref) + chaz(a) 'explain' + mavi 'words')[6] 'that which explain words'.

3.6.4 Deideophonization

The process whereby terms are founded by adding a class prefix to an ideophone is known as deideophonization. Examples of this process are as follows:

English: motorcycle =

SiSwati: *sithuthuthu / sidududu* (< ideo. *thu thu thu / du du du* 'idephone indicating the sound of a motorbike')

English: gun =

SiSwati: sibhamu (< ideo. *bhamu* 'ideophone indicating the sound of a gun firing)

[6] It may appear (according to other literature in this field) that there is 'affixation' – and more specifically 'prefixation' in the formation of this word. In the researcher's understanding, Mtintsilana and Morris (1988) subsumes it under compounding.

3.6.5 Synonym Richness of the Vocabulary

Although this is believed to be not a method of creating new terms, Mtintsilana and Morris (1988) argue that it is. In line with Gauton (2002), they point out that the relative abundance of synonyms in African language vocabularies offers both advantages and disadvantages from a terminological point of view. A term may be coined for a foreign concept while a transliteration of the foreign term is also in use, for example, in SiSwati this is true for words such as *Mabonakudze* which means 'that which sees afar'; *ithelevishini* a transliteration of 'television'; *ithivi* a transliteration of 'T.V.' Another example of transliteration concerns the word cellphone. In SiSwati it is called *makhalekhikhini* meaning 'that which rings in the pocket', or *iselulafoni* transliteration of 'cellular phone'.

3.6.6 Borrowing

Borrowing from languages such as English, Afrikaans and other African languages is the major source of new terminology in African languages, for example:

English:	computer	SiSwati:	*i-khompuyutha*
English:	cement	SiSwati:	*semende*
English:	Square	SiSwati:	*sikwele*

Although transliteration seems to be the easiest and most productive method of developing terminology, the language may run the risk of losing its character (Mtintsilana and Morris (1988: 111). A term is sometimes not transliterated except for the addition of a prefix as is the case in the word 'Hifi' which in SiSwati is *I-Hifi*. Mtintsilana and Morris (1989: 112) point out that of all the term creation processes found in the African languages, transliteration occurs most frequently. This is because substantial numbers of terms are adopted from English and Afrikaans, languages which differ markedly morphophenemically from the African languages.

With regard to linguistic borrowing, as early as 1968, (Ferguson cited in Mahlalela-Thusi, 1999: 41) advocated that "the modernisation of a language may be thought of as the process of its becoming the equal of other developed languages as a medium of communication; it is in a sense the process of joining the world community of increasingly intertranslatable languages as appropriate vehicles of modern forms of discourse". In the same vein, Cooper (1996: 149) mentions that

> African languages need to be developed in order for them to be able to capture the rapid expansion of new knowledge, the application of new knowledge to the production of goods and services, an enhanced specialisation of labour, differentiation of institutions and increased orientation toward impersonal and utilitarian values, particularly maximisation of efficiency.

Cooper (1996: 149) further points out that "the orientation of modern societies towards knowledge, technology, production, efficiency, and the specialisation of labour an institutions stimulates linguistic elaboration".

Language modernisation can also be regarded as language elaboration. According to Mahlalela-Thusi (1999: 44). "It is more than developing vocabulary to talk about technology, it is the ability to read the world through one's language, and it is generally a way of thinking in new abstract ways about the world".

3.6.7 Other Translation Problems and Possible Strategies that Can be Used to Meet the Challenges Posed by African Languages

Baker (1992, 10 - 45 and 46 - 81) identifies a number of problems of non-equivalence between source language (SL) and target language (TL) that are often encountered when translating, as well as possible solutions to such translation difficulties.

- The SL word expresses a culture specific concept which is unknown in the target culture, for example words such as 'knighthood'; 'Yorkshire pudding'; 'gargoyle'; and 'yoga' are concepts that are unknown in the cultures of African languages. Conversely, when translating out of the African languages, there are many cultural concepts, artefacts and practices that are unknown to English culture. For

example in IsiZulu the concepts such as, i*sanusi; isangoma;* both of whom mean 'traditional doctor' and *ukulobola* meaning 'to pay dowry'. Newmark (1988: 48) similarly remarks that, in these kinds of texts "equivalent effect is desirable only in respect of their insignificant emotional impact; it is not possible if SL and TL cultures are remote from each other, since normally the cultural items have to be explained by culturally neutral or generic terms, the topic content simplified, SL difficulties clarified".

- The source language word expresses a concept which is known in the target culture, but simply not lexicalized, that is, not 'allocated' a target language word to express it. For example, 'savoury', that is, a (small) savoury dish/ snack which has salt piquant (sharp) and not a sweet taste; 'landslide' in the sense of 'an overwhelming majority'. These words do not have readily available exact and direct translation equivalents in a language such as, isiZulu.
- The source language word is semantically complex. When translating a word such as for example. 'ghetto' into the African languages, it is clear that this word expresses the following complex set of meanings: originally (historically) the Jewish quarter of a city – especially a slum area – occupied by minority group(s); an isolated or segregated group or area. With regard to this point, Newmark (1988:48-49) mentions that "the first problem is that for serious imaginative literature, there are individual readers rather than a readership. Secondly, whilst the reader is not entirely neglected, the translator is essentially trying to render the effect the SL text has on himself. Thus, certainly, the more universal the text, the more a broader equivalent effect is possible, since the ideals of the original go beyond any cultural frontiers". However, in Newmark's (1988: 48) words "the more cultural a text, the less is equivalent effect even conceivable unless the reader is imaginative, sensitive and steeped in the SL culture".
- The source and target languages make different distinctions in meaning. In this case, the target language may make more or fewer distinctions in meaning than the source language, For example, the African languages generally use the same word to refer to both concepts 'blue' and 'green'. What in one language might therefore be regarded as an important distinction in meaning might not be regarded as such in another language.
- The target language lacks a superordinate (that is, a general word to refer to a number of words that form / make up a semantic field). For example, a language

such as isiZulu has no ready equivalent for 'facilities', meaning 'equipment or physical means for doing something, such as washing facilities or conference facilities'. However, isiZulu has specific words (hyponyms) that refer to various concepts that can all be regarded as belonging under the general term 'facilities'.

- The target language lacks a specific term (hyponym). Baker (1992 cited in Gauton, 2002: 10) states that more commonly, languages tend to have general words (superordinates), but lack specific ones (hyponyms), as each language makes only those distinctions in meaning that are relevant to the particular language. For example, some African languages have many specific words that refer to different types of colours of cattle. A language such as English does not make these distinctions in meaning. On the other hand, English has many words for different types of housing such as bungalow, cottage, croft, chalet, lodge, mansion, manor, villa, hall, and hut – that do not have direct equivalents in the African languages.
- Differences in physical or interpersonal perspective. This has to do with where things or people are in relation to one another or to a place, or the relationship between participants in the discourse. For example, English – marry: isiZulu – *gana/-ganwa,* depending on whether one is talking about a woman who is getting married (*-gana*) or a man (*-ganwa*).
- Differences in expressive meaning. Expressive meaning has to do with the speaker's / writer's feelings towards what the word refers to, rather than with the actual meaning of the word. There may therefore be a TL word which has the same basic meaning as the SL word, but with a difference in expressive meaning, for example:
    - English: *Woman* – IsiZulu: *Umfazi.* In isiZulu *umfazi* signifies not only '(married) woman' but also has the added connotation of 'wife'. According to Doke *et al.* (1990: 201) this word can also be used as a term of insult for a loose woman. This word should therefore not be used as the general term for 'woman' because of its negative connotations in certain contexts.
    - IsiZulu: *IZizimbane* is, according to Doke *et al.* (1990: 896), translated as 'native of Mozambique'. However, *iZizimbane* has a negative connotation, and is probably nearer in meaning to the derogatory term *"ikwerekwere"*, used in South Africa today to refer to foreigners from other parts of Africa.

It is usually easier to add expressive meaning than to subtract it (Baker, 1992: 23). In other words, if the TL equivalent is neutral compared to the SL word, the translator can sometimes add the expressive element by means of a modifier or adverb if necessary, or by building it in somewhere else in the text. Furthermore, differences in expressive meaning are usually more difficult to handle when the TL equivalent is more emotionally loaded than the SL word, as is the case with *umfazi* or *ikwerekwere.*

- Differences in form. There is often no equivalent in the target language for a particular form in the SL, for example. English words containing certain affixes (pre- and suffixes) often have no direct/ready translation equivalents in the African languages, for example, casualisation / casualise and buzzwords such as legalese, translationese, and groceteria.
- There is a difference in the frequency and purpose of using a specific term. Even when there is a ready TL equivalent for a particular SL item, there may be a difference in the frequency with which it is used in the two languages, or the purpose for which it is used in a particular language.
- The use of loanwords in the source text. The use of loan words such as *au fait, chic, and alfresco* in an English SL will create problems for the African language translator. In addition to their basic meaning, loanwords such as these are often used for their prestige value, because they can add an air of sophistication to the text or its subject matter. This kind of added meaning is often lost in the translation, as it is not always possible to find a loan word with the same meaning in the TL.

Thus, it is maintained that since the terminographer working on a developing language actually participates in what Eastman (1983) referres to as language elaboration/ development of the terminology, he or she needs a deeper understanding of the word formation process than his or her counterpart working in a developed language. Hence, according to Baker (1992) and Gauton (2002) there is a vast array of possible translation strategies that can be used to solve problems of non-equivalence at word-level.

- Translation by a more general word (superordinate), for example translating English: 'cottage' in isiZulu *indlwana* (literally "small house').

- Translation by a more neutral/less expressive word, for example, translating Zulu *iZizimbane* as 'a Mozambican'.
- Translation by cultural substitution, which is, translating a culture-specific word / expression in the SL with a word / expression that might not have exactly the same meaning as the SL item, but which will have a similar impact on the TL audience. According to Newmark (1988: 83), words resulting from this translation strategy "may have a greater pragmatic impact than culturally neutral terms".
- Translation using a loan word or loan word plus explanation (sometimes in brackets). This is very common translation strategy in dealing with culture-specific items, modern concepts, and buzz words. Once the loan word has been explained, it can then be used on its own.
- Translation by paraphrase using a related word, that is, paraphrasing (= restating the SL item in other words) by using direct / ready equivalent of the SL item in the paraphrase. In Newmark's (1988: 90) terms paraphrase is an amplification or explanation of the meaning of a segment of the text.
- Translation by paraphrase using unrelated words, that is, paraphrasing but by not using a direct / ready equivalent of the SL item in the paraphrase. This can be done by 'unpacking' the meaning of the SL item. That is, by describing it using a number of other words.
- Translation by omission, that is, sometimes a SL word or expression can simply be left out, provided that its use is not vital to the text. Sometimes it is better to simply omit a word, rather than to distract the reader with lengthy explanations. Even though this is a good suggestion, the researcher believes this is unlikely to be a wise move in mathematics and science.
- Translation by illustration. Sometimes it makes sense to simply give an illustration (picture) of a word that has no equivalent in the TL. This can be done if the SL word refers to an object that can be illustrated, especially if there are space restrictions involved and the text has to remain short, concise and to the point. For example, Baker (1992: 42) points out that there is no easy way of translating *tagged*, as in *tagged teabags*, into Arabic without going into lengthy explanations which would clutter the text. In translating the text on the packaging of Lipton Yellow Label tea for the Arabic market, an illustration (picture) of a tagged teabag was used, instead of using a lengthy paraphrase.

Problems of non-equivalence above word level, that is, the target language has no equivalent for a collocation (words that regularly occur together), (fixed) expression or idiom that occurs in the source text.

- The engrossing effect of source text patterning. Translators sometimes get engrossed in the SL and may produce odd collocations in the TL for no justifiable reason.
- Misinterpreting the meaning of a source language collocation. This can happen due to interference from the translator's native language, when a SL collocation appears to be familiar because it corresponds in form to a common collocation in the TL.
- Tension between accuracy and naturalness. Translation often involves a tension / choice between what is typical and what is accurate. The degree of acceptability or non-acceptability of a change in meaning depends on the significance of this change in a given context. Accuracy is an important aim in translation, but the use of established patterns of collocation in the TL: (a) plays an important role in keeping communication channels open, and (b) helps to distinguish between a smooth, natural-sounding translation and a clumsy one which sounds 'foreign'.
- Culture-specific collocations. Some collocations reflect the cultural setting in which they occur and point to concepts which are not easily accessible to the target reader.
- Marked collocations in the source text. Marked collocations are unusual combinations of words. Sometimes they are used in the ST in order to create new images. Ideally the translation of a marked collocation will be similarly marked in the TL. However, this is always subject to the constraints of the TL, and to the purpose of the translation in question.

3.7 CONCLUSION

In concluding this chapter, perhaps it needs to be repeatedly said that in South Africa the Bantu languages, namely: sePedi, seSotho, Setswana, Xistonga, Tshivenda, IsiZulu, isiXhosa, isiNdebele and SiSwati were marginalized and disadvantaged prior to and

during the apartheid era. This is particularly true in as far as the development, elaboration, and standardization of terminology are concerned. Consequently, these languages lack (standardized) terminology in the majority of specialist subject fields which make translation into these languages (and not only technical translation), an activity fraught with challenges (Gauton, 2006: 29).

One of the challenges can be seen in the fact that, whilst using more advanced technology such as corpora is more common in the west (especially in parts of Europe and the Americas), as can be gleaned from the work of authors such as *inter alia* Bowker (1998), Fictumova (2004), this is not however the case in the African continent, and particularly in South Africa. In as far as researchers in this field are concerned (see Gauton 2006: 26), published literature does not attest to the availability and use of corpora in African languages. What is worse is that in South Africa too, despite the obvious need for using corpora in term creation, higher education and other training institutions have generally not yet incorporated the use of electronic text corpora in their training curricula, particularly as far as translation into the African languages (including Afrikaans) is concerned (Gauton, 2006: 29).

Thus, it suffice to reiterate the statement made earlier in Chapter Two that, through an effort such as the *Multilingual Mathematics Dictionary*, the government has taken a worthwhile initiative to develop African languages, in a practical sense. They have taken a giant step moving away from the theory which both the LANGTAG as well as the LiEP advocated. As argued by Mahlalela-Thusi (1999: 43), African language speakers need to redefine and describe their lives using their mother tongues. It is also fair to suggest that, for that to happen there has to be an extensive allowance of the term formation processes described earlier in this chapter.

The question whether the term formation processes discussed in this chapter (in particular those in section 6 of this chapter) and other important considerations for successful translation were applied to the process undertaken to develop the *Multilingual Mathematics Dictionary* studied by this research project is answered in Chapter Five.

The next chapter discusses in detail the research methodology which was followed during this study.

CHAPTER 4

RESEARCH METHODOLOGY

4.1 INTRODUCTION

This chapter describes the research design, the sampling, the research instruments, and the data analysis, which are appropriate for the research questions raised by the study. The main purpose of this study (in line with the aims outlined in Chapter One) is to research the predominant translation strategies that are applied in translation projects aimed at language development and elaboration. Thereafter, the study will identify educators' beliefs about the 'possibility' of using mother tongue in the teaching and learning of mathematics, more particularly the applicability of the terminology that appears in the *Multilingual Mathematics Dictionary* for grades 1 to 6 (2003). In a similar vein, the study will investigate whether or not the learners can cope with the African language mathematics terminology found in the dictionary. For all intents and purposes, the latter question is worth researching. It is not clear whether the translators involved in the development of the mathematics terminology experienced the types of problems discussed in Chapter Three. Another moot question is whether translation methods used took account of the unique needs of African languages.

To fulfill the purpose outlined here, the researcher elected to use the case study method as advocated by Yin (1994), Tellis (1997) and Denzin & Lincoln (1998): the SiSwati language is the case being studied. Data were collected from respondents (educators, and learners) in primary schools by means of unstructured questionnaires for the Curriculum Implementers[7], structured questionnaires for the educators and a language competency test for the learners. The data collected from the respondents and dictionary terminology were analysed using quantitative and qualitative methods.

[7] In the Mpumalanga province, lately, what is known as subject advisors in the other provinces has been refereed to as Curriculum Implementers (CI's). This study appropriately adopted this term as the research data was collected in the province.

Quantitative research is often termed "the traditional, the positivist, the experimental or the empiricist paradigm," and qualitative is termed "the constructivist approach or the interpretative approach" (Creswell, 1994: 4). The reality constructed by the quantitative researcher is said to be "objective" while qualitative research participants construct reality. Creswell (1994: 4) adds: "...multiple realities exist in any given situation: the researcher, individuals being investigated, and the audience interpreting the study. The qualitative researcher needs to report faithfully these realities and rely on voices and interpretations of informants." The research design of this study was based on these methods.

4.2 RESEARCH DESIGN

Research design is the string of logic that ultimately links the data to be collected and the conclusions to be drawn to the initial questions of the study. According to Yin (1989: 2), research designs usually deal with at least four problems:

- What questions to study;
- What data are relevant;
- What data to collect[8];
- How to analyze that data.

This study attempted to investigate how terminology for the *Multilingual Mathematics Dictionary* was developed using the SiSwati Language as a case study. As already indicated

> Case study refers to the collection and presentation of detailed information about a particular issue, participant or small group, frequently including the accounts of subjects themselves. A form of qualitative descriptive research, the case study undertaken in this research looks intensely at an issue, or small participant pool, drawing conclusions only about that particular issue, or group and only in that specific context (Armisted, 1984).

For example, the research conducted in the study reported in this document intended to do a descriptive analysis of the SiSwati terminology found in the multilingual

[8] To me (the researcher in this study), bullets 2 and 3 mean the same as they refer to the data needed for a given study. I wonder whether bullet 3 should not be 'How to collect data?'

mathematics dictionary. Researchers in case studies do not focus on the discovery of a universal, generalisable truth, nor do they look for cause-effect relationships; instead, emphasis is placed on exploration and description

As the study also intended to compare the process undertaken to develop mathematics and science terminologies, the primary source of data for the study was the Department of arts and culture's *Multilingual Mathematics Dictionary for Grade 1 to 6* (2003).

4.2.1 Quantitative Research Techniques

The quantitative approach focuses on a predetermined design of research components and representations of the participants. The researcher plans and executes his research through the design of the study and its data collection instruments. The respondents are usually not required to give information beyond what is required from them by the predetermined instrument (Makua, 2004: 89).

In this study the quantitative approach was used first, in the descriptive analysis of the SiSwati mathematics terminology, which sought to descriptively quantify and analyse the dominant approaches employed during the terminology development undertaken to compile the dictionary under study. Second, it was used in the structured questionnaire administered to the educators, which sought to quantify the educator experiences, beliefs and attitudes towards the use of African languages in the teaching of mathematics and third, to the learners' mathematics test which sought to quantify their familiarity with the African language mathematics terminology contained in the dictionary.

In quantitative data analysis, a researcher provides charts, graphs, and tables to give readers a condensed picture of the data (Neuman, 2003: 331). Through the tables and the charts the reader is given evidence gathered by the researcher and learns what is in it. This study made use of this mode of data analysis to be able to provide clear and interpretable results. Specifically, the analysis of the data collected for this study was achieved through employing multivariate data analysis. According to Hair

et al (1998: 6), broadly speaking, multivariate analysis refers to all statistical methods that simultaneously analyze multiple measurements on each individual or object under investigation. Any simultaneous analysis of more than two variables can be loosely considered multivariate analysis. Some researchers use multivariate analysis simply to mean examining relationships between or among more than two variables. This study applied multivariate analysis in a number of ways. For example the educator's beliefs about learners' knowledge of mother tongue mathematics will be analysed looking at the effect of different locations where the respondents came from, and their level of education. Similarly, the learners understanding of questions and performance in the mathematics test will be analysed in relation to their different locations.

4.2.2 Qualitative Research Techniques

In qualitative research, the design is not controlled. The freedom of expression in an uncontrolled context is what constitutes the cornerstone of qualitative research. "In a qualitative study...researchers want to understand, and also explain in argument, by using evidence from data and from the literature, what phenomenon or phenomena that they are studying are about. They do not want to place this understanding within the boundaries of an instrument that will limit the data to predetermined boundaries" (Henning, Van Rensburg & Smit, 2004: 6-7).

The qualitative data component of this study focused on the Curriculum Implementers and to some extent educators. The rationale for this was to give the respondents space to express their views in a more in-depth and open-ended way. To achieve this, the researcher asked several open ended questions (cf; Appendix 2 & 5: the questionnaires).

The use of open ended questions as mentioned above helped to ensure that the researcher was deeply engaged in robust qualitative data analysis process, which resulted in interesting findings for this study. According to Gay and Airasian (2000: 244), "Qualitative data analysis is a process of understanding and interpreting the

contents of qualitative data and finding commonalities in it. In order for researchers to make the kinds of links they need to analyse and interpret data, they need to repeatedly read the data until they really know and live their data. The process of analyzing and interpreting data can be monotonous, time consuming and necessarily iterative".

Since in most cases the analysis of data occurs simultaneously with data collection, the first step in data analysis is to manage the data so that they may be studied. Managing data means organizing the collected data. The researcher has to ensure that he or she has dated, organized and sequenced all field notes, record tapes, observer's files.

Unquestionably, data analysis is the most complex and mysterious of all of the phases of a research project, and the one that receives the least thoughtful discussion in the literature. For Thorne (2000: 68), many of the data collection strategies involved in a qualitative project may feel familiar and comfortable. However, in order to generate findings that transform raw data into new knowledge, a qualitative researcher must engage in active and demanding analytic processes throughout all phases of the research. Understanding these processes is therefore an important aspect not only of doing qualitative research, but also of reading, understanding, and interpreting it.

In view of such complexity in handling qualitative data, it is important then to generally appreciate the theoretical assumptions underlying some of the more common approaches that can be helpful in understanding what a researcher is trying to indicate about how data were sorted, organised, conceptualised, refined, and interpreted.

4.2.2.1 Constant comparative analysis

Many qualitative analytic strategies rely on a general approach called "constant comparative analysis". Originally developed for use in the grounded theory methodology of Glaser and Strauss (1967), which itself evolved out of the

sociological theory of symbolic interactionism, this strategy involves taking one piece of data (one interview, one statement, one theme) and comparing it with all others that may be similar or different in order to develop conceptualisations of the possible relations between various pieces of data. For example, by comparing the accounts of two different people who had a similar experience, a researcher might pose analytical questions like: why is this different from that? and how are these two related? In many qualitative studies of which the purpose it is to generate knowledge about common patterns and themes within human experience, this process continues with the comparison of each new account until all have been compared with each other.

The purpose of data analysis in this study was to investigate whether the SiSwati translation equivalents provided in the *Multilingual Mathematics Dictionary for grades 1 to 6* (2003) will be applicable for use in teaching and learning.

4.2.2.2 Phenomenological approaches

Some qualitative methods are not oriented toward finding patterns and commonalities within human experience, but instead seek to discover some of the underlying structure or essence of that experience through the intensive study of individual cases. For example, rather than explain the stages and transitions within grieving that are common to people in various circumstances, a phenomenological study might attempt to uncover and describe the essential nature of grieving and represent it in such a manner that a person who had not grieved might begin to understand the phenomenon. The analytic methods that would be employed in these studies explicitly avoid cross comparisons and instead orient the researcher toward the depth and detail that can be appreciated only through an exhaustive, systematic, and reflective study of experiences as they are lived (Thorne, 2000: 69).

4.2.2.3 Ethnographic methods

According to Thorne (2000: 69) ethnographic research methods derive from anthropology's tradition of interpreting the processes and products of cultural

behaviour. Ethnographers documented such aspects of human experience as beliefs, kinship patterns and ways of living. When a researcher claims to have used ethnographic methods, it can be assumed that he or she has come to know a culture or group through immersion and engagement in fieldwork or participant observation and has also undertaken to portray that culture through text. Ethnographic analysis uses an iterative process in which cultural ideas that arise during active involvement "in the field" are transformed, translated, or represented in a written document. It involves sifting and sorting through pieces of data to detect and interpret thematic categorisations, search for inconsistencies and contradictions, and generate conclusions about what is happening and why.

4.2.2.4 Narrative analysis and discourse analysis

Many qualitative researchers have discovered the extent to which human experience is shaped, transformed, and understood through linguistic representation (Frohmann 1994). The vague and subjective sensations that characterise cognitively unstructured life experiences take on meaning and order when one tries to articulate them in communication. Putting experience into words, whether we do this verbally, in writing, or in thought, transforms the actual experience into a communicable representation of it. Thus, speech forms are not the experiences themselves, but a socially and culturally constructed device for creating shared understandings about them. Narrative analysis is a strategy that recognises the extent to which the stories told provide insights about our lived experiences. For example, in this study discourse analysis was used as a strategy to learn more about the experiences of the Curriculum Implementers and educators from which data were collected through the questionnaires.

4.3 CASE STUDY RESEARCH METHODOLOGY

The history of case study research is marked by periods of intense use and periods of disuse. The earliest use of this form of research can be traced to Europe, predominantly to France. The methodology in the United States was most closely associated with The University of Chicago Department of Sociology. From the early 1900's until 1935, The Chicago School was preeminent in the field and the source of a great deal of the literature (Yin, 1994).

Yin (1994) states that case study is done by giving special attention to completeness in observation, reconstruction, and analysis of the cases under study. Case study is done in a way that incorporates the views of the "actors" in the case under study.

Hamel *et al.,* (1993: 108) were careful not to reject the criticisms of case study as poorly founded, made in the midst of methodological conflict. They point out that the drawbacks of case study were not being attacked, rather the immaturity of sociology as a discipline was being displayed. As the use of quantitative methods advanced, the decline of the case study hastened. However, in the 1960s, researchers were becoming concerned about the limitations of quantitative methods. Hence there was a renewed interest in case study.

A frequent criticism of case study methodology is that its dependence on a single case renders it incapable of providing a generalizing conclusion. Thus Yin (1994) presented a view that considered case methodology "microscopic" because it "lacked a sufficient number" of cases. Hamel *et al.,* (1993) and Yin (1994) forcefully argued that the relative size of the sample whether 2, 10, or 100 cases are used, does not transform a multiple case into a macroscopic study. The goal of the study should establish the parameters, and then should be applied to all research. In this way, even a single case could be considered acceptable, provided it met the established objective.

The literature provides some insight into the acceptance of an experimental prototype to perceive the singularity of the object of study. This ensures the transformation from the local to the global for explanation. Hamel *et al.,*(1993) characterized such

singularity as a concentration of the global in the local. With regard to this Yin (1994) states that general applicability results from the set of methodological qualities of the case, and the rigor with which the case is constructed. He details the procedures that would satisfy the required methodological rigor. Case study can be seen to satisfy the three tenets of the qualitative method: describing, understanding, and explaining.

The literature contains numerous examples of applications of the case study methodology. Denzin and Lincoln (1998: 86 – 104) list several examples along with the appropriate research design in each case. The earliest and most natural examples are to be found in the fields of law and medicine, where "cases" constitute the large body of the learner work. However, there are some areas that have used case study techniques extensively, particularly in government and in evaluative situations. The government studies were carried out to determine whether particular programmes were efficient or if the goals of a particular program were being met. The evaluative applications were carried out to assess the effectiveness of educational initiatives. In both types of investigations, merely quantitative techniques tended to obscure some of the important information that the researchers needed to uncover (Tellis, 1997:3).

The body of literature in case study research is "primitive and limited" (Yin, 1994), in comparison to that of experimental or quasi-experimental research. The requirements and inflexibility of the latter forms of research make case studies the only viable alternative in some instances. It is a fact that case studies do not need to have a minimum number of cases, or to randomly "select" cases. The researcher is called upon to work with the situation that presents itself in each case.

Case studies can be single or multiple-case designs, where a multiple design must follow a replication rather than sampling logic. When no other cases are available for replication, the researcher is limited to single-case designs. Yin (1994) points out that generalization of results, from either single or multiple designs, is made to theory and not to populations.

There have been suggestions for a general approach to designing case studies, and also recommendations for *exploratory*, *explanatory*, and *descriptive* case studies.

Each of those three approaches can be single or multiple-case studies, where multiple-case studies are replicatory, not sampled cases.

In *exploratory* case studies, fieldwork, and data collection may be undertaken prior to definition of the research questions and hypotheses. This type of study has been considered as a prelude to some social research. However, the framework of the study must be created ahead of time. Pilot projects are very useful in determining the final protocols that will be used. Survey questions may be dropped or added based on the outcome of the pilot study. Selecting cases is a difficult process, but plenty of available literature provides guidance in this area (Denzin and Lincoln, 1998: 101). Stake (1995) recommends that the selection offers the opportunity to maximize what can be learned, knowing that time is limited. Hence the cases that are selected should be easy and willing subjects.

Explanatory cases are suitable for doing causal studies. In very complex and multivariate cases, the analysis can make use of pattern-matching techniques. Yin and Moore (1987 cited in Tellis, 1997: 4) conducted a study to examine the reason why some research findings get into practical use. They used a funded research project as the unit of analysis, where the topic was constant but the project varied. The utilization outcomes were explained by three rival theories: a knowledge-driven theory, a problem-solving theory, and a social-interaction theory.

Knowledge-driven theory means that ideas and discoveries from basic research eventually become commercial products. Problem-solving theory follows the same path, but originates not with a researcher, but with an external source identifying a problem. The social-interaction theory claims that researchers and users belong to overlapping professional networks and are in frequent communication.

Descriptive cases require that the investigator begin with a descriptive theory, or face the possibility that problems will occur during the project. Pyecha (1988 cited in Tellis 1997: 4) used this methodology to study special education, using a pattern-matching procedure. Several states were studied and the data about each state's activities were compared to another, with idealized theoretic patterns. Thus what is implied in this type of study is the formation of hypotheses of cause-effect relationships. Hence the descriptive theory must cover the depth and scope of the case under study. The

selection of cases and the unit of analysis are developed in the same manner as the other types of case studies. The research undertaken in this case study was in a way descriptive (see, section 4.2 on research design).

Case studies have been increasingly used in education. While law and medical schools have been using the technique for an extended period, the technique is being applied in a variety of instructional situations. Schools of business have been most aggressive in the implementation of case based learning, or "active learning" (Tellis, 1997: 5).

This investigation is a case study of *Multilingualism and the development of African languages.* It is a case study that affords special reference to SiSwati. Thus, this study examines the *Multilingual Mathematics Dictionary for Grades 1 to 6* (2003) in a way that will expand knowledge about:

1. How the National Language Service (NLS) in South Africa developed the terminology for the teaching and learning of mathematics as it is contained in the *Multilingual Mathematics Dictionary*?
2. The theoretical considerations of language development (with particular reference to relevant translation strategies) which were taken into consideration during the development of the *Multilingual Mathematics Dictionary*?
3. The experiences and beliefs of the educators in the field of teaching mathematics with regard to the *Multilingual Mathematics Dictionary*?
4. Whether the terminology provided in the dictionary will be able to handle (and cope with) the demands of teaching and learning mathematics in the concerned grades?

Yin (1994) as well as Denzin and Lincoln (1997: 90) recommend the use of case-study protocol as part of a carefully designed research project that would include the following sections:

- Overview of the project (project objectives and case study issues) as is covered in section 4 of Chapter One;
- Field procedures (credentials and access to sites) as can be seen in the introduction section of the results and discussion

- Questions (specific questions that the investigator must keep in mind during data collection) cf. data collection instruments;
- Guide for the report (outline, format for the narrative).

The exemplary characteristic of case studies is that they strive towards a holistic understanding of the case under study (Denzin and Lincoln, 1997: 86). Case study research is not sampling research, which is a fact asserted by all the major researchers in the field, including Yin (1994), and Tellis (1997). However, selecting cases must be done so as to maximize what can be learned, in the period of time available for the study.

The unit of analysis is a critical factor in the case study. It is typically a system of action rather than an individual or group of individuals. Case studies tend to be selective, focusing on one or two issues that are fundamental to understanding the case being researched. For example, in the case of this study, the three issues being the process of terminology development in SiSwati, the experiences of mathematics educators, and Curriculum Implementers in the Mpumalanga province, as well as the applicability of the terminology developed for the *Multilingual Mathematics Dictionary*.

Case studies are multi-perspectival analyses. This means that the researcher considers not just the voice and perspective of the actors, but also of the relevant groups of actors and the interaction between them. This one aspect is a salient point in the characteristic that case studies possess (Tellis, 1997: 5). Case study is thus known as a triangulated research strategy. The researcher in this study asserts that triangulation can occur with data, investigators, theories, and even methodologies. As can be seen in this study, triangulation is achieved through the use of various data collection procedures, and the multivariate analysis of the data collected. Stake (1995) states that the protocols that are used to ensure accuracy and alternative explanations are called triangulation. The need for triangulation arises from the ethical need to confirm the validity of the processes. In case studies, this could be done by using multiple sources of data (Yin, 1994). For example, in the case of this study there are multiple sources such as, educators, learners and the primary source itself.

4.4 SAMPLING PROCEDURE

Though the researcher in this study concurs with the view by Denzin and Lincoln (1997: 86), that "case study research is not sampling research", in order to ensure representativity as well as manageability, this study made use of three samples, namely the learners, educators and Curriculum Implementers. The purpose of the study necessitated this choice of respondents. The need to investigate the appropriateness and acceptability of the African language terminologies meant that questionnaires were administered to nineteen (19) educators teaching the grades for which this dictionary is intended. In addition to the educators, five (5) Curriculum Implementers and as well as one hundred and eighty-four (184) learners who are at the receiving end of the decisions taken by the education system. An attempt was made to draw a representative sample (20 educators, 5 Curriculum Implementers, and 184 learners) across the regions in the Mpumalanga Province where SiSwati is widely spoken and taught at school. The schools were purposively selected using contacts (informants) with people (in particular school principals) located in the schools from which respondents were sought. This was mainly done to ensure maximal respondent cooperation and participation so that enough data were collected. Makua (2004: 94) agrees that "purposive sampling is useful in contexts where the researcher needs to reach a targeted sample". Purposive sampling is also desirable in instances where the researcher purposively chooses the region and the respondents for a specific purpose. "The power of purposive sampling lies in selecting information-rich cases for in-depth analysis relating to the central issues being studied. Purposive sampling can be used with both quantitative and qualitative studies" (CEMCA, nd. cited in Makua 2004: 94). The sample for the Curriculum Implementers' component of the study was comprehensive, that is, all participants in the project were targeted to be part of the study.

In addition, throughout the research process, member checks were continuously conducted as according to Merriam (1985) this is another way to ensure validity and reliability of results. Indeed, member checks ensure that the researcher is able to initiate and maintain an active collaboration on the interpretation of data between himself / herself and those who provided the data. In addition, Merriam (1985: 210) also suggests that validity and reliability of findings can also be ensured through engaging in peer consultation, whereby prior to composing the final draft of the

research report, one should "consult with colleagues in order to establish validity through pooled judgments". In other words, this means that the researcher should talk to subjects for feedback about interpretations. Questionnaires were therefore administered to a wide range of first language speakers (learners, educators, and Curriculum Implementers) of the language under study. As already indicated, in order to cover the different dialects of the SiSwati language group, the questionnaires were administered widely within the province (Mpumalanga), districts where SiSwati is a predominant home language. All these considerations ensured that the research conducted in this study eliminated bias as far as possible.

4.5 QUESTIONNAIRES

The nature of the information required from the learners necessitated that the researcher used a competency test, whilst the nature of the information sought from the educators necessitated the use of a structured questionnaire. The open-ended questionnaire was administered to the Curriculum Implementers in response to the nature of the data that were sought from them. The questionnaires were designed as follows:

All questionnaires had **Section A**, which requested the respondents to supply demographic data. This section, amongst others, sought to collect the data about age of the respondents, gender, place of birth, and number of years staying in that place or district. This section also requested the learners to indicate the languages in which they were proficient. It also sought the level of education and position at work (for educators and Curriculum Implementers), while for learners their current grade was sought.

Learners' questionnaire (Section B), investigated the respondent's understanding of and familiarity with selected SiSwati mathematics terminology. For example, respondents were requested to solve mathematics problems set in their mother tongue. The selection of terms, as it may already be obvious, was brought by the fact that, because of the numerous glossary of terms, it may not have been feasible to ask respondents about all of them as found in the dictionary.

The Educators questionnaire (Section B), was largely composed of questions about experiences (attitudes and beliefs) about using mother tongue in the teaching and learning of mathematics. These, amongst other factors, also investigated the

respondents' (educators) experiences and beliefs about using the *Multilingual Mathematics Dictionary*.

Educator's questionnaire (Section C), was mainly meant to investigate the educators confidence in their learners, hence the researcher gave them the same questions the learners were writing to predict by choosing yes or no whether their learners would be able to solve specific problems.

Curriculum Implementers questionnaire (Section B), mainly sought to investigate their experiences, beliefs and attitudes towards using mother tongue in the teaching and learning of mathematics.

4.6 TRUSTWORTHINESS

In order to establish trustworthiness in qualitative research, Koch (1994:176) recommends three criteria, namely, credibility, transferability and dependability.

4.6.1 Credibility

Researchers enhance credibility when they describe and interpret the experiences. In order to enhance the credibility of this study, the researcher filed and stored all the documentation used during the data collection and will make them available if and when people interested require them to prove the credibility of the study. Before producing the final draft, relevant Curriculum Implementers and educators have also been approached to read the research report and discuss the construction derived from the analysis.

4.6.2 Transferability

According to Koch (1994: 977) transferability depends upon the degree of similarity between the contexts. Many researchers prefer to use the term "fittingness". In addition, Koch continues to argue that a study meets the criterion of fittingness when its findings can "fit" into a context outside the study situation and when its audience views its

findings as meaningful and applicable in terms of their own experiences. This study was conducted to determine the strategies / approaches through which the SiSwati terminology was developed for the *Multilingual Mathematics Dictionary for grades 1 to 6* (2003). The study also sought to establish whether the terminology in the dictionary will help in the successful teaching of mathematics in the African language selected for this case study (SiSwati). To ensure transferability amongst others, the researcher intends to make the report to this study available to, first the SiSwati, Sepedi, Xitsonga Language Research and Development Centres as well as Lexicography Units. This will ensure that results from this study are disseminated and transferred successfully to the main stakeholders involved in terminology development.

3.6.3 Dependability

Dependability as an element of trustworthiness means that the process of the study is consistent and reasonable over time and across researchers and methods (Miles and Huberman, 1994: 3). In this study questionnaires and a test were administered. After the administration of these research instruments, for example for the unstructured questionnaire, which mainly comprised of open-ended questions, a similar method of analysis and interpretation was applied to each one of them. This was done without altering the individual responses made by every respondent. After this, the filled questionnaires were filed and stored with the raw data as it was to leave evidence for others who can "reconstruct" the process to reach their conclusions.

4.7 VALIDITY AND RELIABILITY

Trustworthiness in quantitative data inquiry can be established through ensuring validity and reliability. Thus, based on the aims discussed in Chapter One of this research, this study used a number of information gathering techniques, viz, document analysis and questionnaires. The combination of a variety of information gathering techniques according to Mwanje (2001) "enable triangulation" and "a greater level of data analysis" so that research assumptions will be more acceptable. Triangulation, according to Merriam (1985) is one way in which researchers can combat attacks on the validity, reliability and generalisability of research studies such as the one conducted in this study.

It also gives research comprehensive information of the study topic and eliminates over-reliance on one single source of data. According to Tellis (1997) triangulation is the means the researcher uses to confirm the validity (trustworthiness) of the methodology he/she is following. The term comes from the multiplicity of methods of generating data.

In addition, according to Cohen *et al.* (2000: 105), validity in quantitative data might be improved through careful sampling, appropriate instrumentation and appropriate statistical treatments of the data. In this study the researcher ensured validity through the following considerations:

- Ensuring that there were adequate resources for the required research to be conducted.
- Selecting appropriate methodology for answering the research questions.
- Selecting appropriate instrumentation for collecting the type of data required. For example, regarding the applicability of the terminology in the learning of mathematics, the test was constructed with reference to the leaner material currently used in grade 6. Exercises were carefully selected in order to represent a number of SiSwati terms found in the dictionary.
- Using an appropriate sample, this study ensured that all the respondents came from the SiSwati linguistic community. In addition, learners from the same grade were selected to participate in this study. The question of whether the learners' age was the same will be answered in the analysis of data collected through the learners test designed for this study.

Moreover, Cohen *et al.* (2000: 118) maintain that in order for quantitative data to be reliable, instrumentation, data and findings should be controllable, predictable, consistent and replicable. According to Cohen *et al.* (2000:118), a most important issue in considering reliability of questionnaire surveys is that of sampling. This is because, according to them, an unrepresentative, skewed sample can easily distort the data, while very small samples prohibit statistical analysis.

In this study the researcher ensured validity through:

- Ensuring that the sample was representative of the different regions where SiSwati is widely spoken and taught at school.

- Ensuring that instructions to respondents were clear an unambiguous.
- Motivating all the respondents to be honest by stressing the importance and benefits of completing the questionnaires.
- Ensuring that the questionnaires were not long or difficult to complete.
- Ensuring respondents about the anonymity of the results for the data.

In addition, to triangulate the sources of data for this study, the researcher used three sets of data collection instruments, namely, the Curriculum Implementers' questionnaire, the educator's questionnaire and the mother tongue learners' mathematics test. In addition, the review of the processes (especially dominant translation strategies) used in the production of the dictionary was conducted in order to generate data on which predominant strategies were applied in the translation and development of African language terminology for the multilingual dictionary. This is in line with the second method (collecting referential materials), suggested by Merriam (1985), for ensuring case study validity and reliability.

In addition, to the factors mentioned preceding paragraphs, validity and reliability also entail that data needs to be collected from sites that are relevant to the sought information. In the next section the characteristics / and suitability of the research site are outlined.

4.8 CHARACTERISTICS OF THE SAMPLE SITES

This study was conducted in four (4) primary schools in the Ehlanzeni Regional Municipality of the Mpumalanga Province. The suitability of the sample for this study lies in the fact that all the schools selected are found in a region of the Mpumalanga Province of South Africa where SiSwati is predominantly spoken and taught. The communities in which the schools are situated are mainly in rural and township areas of the Mbombela, Umjindi and Nkomazi district municipalities. In the Mbombela district, the schools selected were Thembalethu[9] and Matjulu primary schools. Whilst, in Umjindi and Nkomazi the schools selected were Kamkhulu and Dindela primary schools

[9] The schools are given pseudonyms (i.e., Thembalethu, Matjulu, Kamkhulu, Dindela) to ensure their anonymity and that of the participants. This is in line with the ethical considerations of this research study.

respectively. Thembalethu primary school is situated 87 kilometers north of Nelspruit in a rural village known as Jerusalema. This village is approximately 25 kilometers from Hazyview which until 2006 marked the border between Mpumalanga and Limpopo provinces. The other school, Matjulu Primary School is situated 56 kilometeres east of Nelspruit in a township known as Matsulu. On the other hand, Kamkhulu Primary School is found in a Township called Umjindini near Barberton, which is approximately 70 kilometers south of Nelspruit. Dindela primary school is situated in Block C of the Sibayeni village which is 124 kilometers East of Nelspruit. In addition, the two schools Kamkhulu and Dindela were of interest to the researcher because of the fact that they are both located in areas which lie along the east and west border of South Africa and Swaziland.

The researcher also conducted a pilot study in order to identify and rectify any shortcomings in the research prior to conducting a large scale data collection process.

4.9 PILOT STUDY

The term 'pilot studies' refers to mini versions of a full-scale study (also called 'feasibility' studies), as well as the specific pre-testing of a particular research instrument such as a questionnaire or interview schedule (van Teijlingen and Hundley, 2002: 33). Pilot studies are a crucial element of a good study design. Though, conducting a pilot study does not guarantee success in the main study, it does increase the likelihood of success. Pilot studies fulfill a range of important functions and can provide valuable insights for other researchers.

One of the advantages of conducting a pilot study is that it might give advance warning about where the main research project could fail, where research protocols may not be followed, or whether proposed methods or instruments are inappropriate or too complicated. In the words of De Vaus (1993:54) "Do not take the risk. Pilot test first." These are important reasons for undertaking a pilot study, but there are additional reasons, for example, convincing funding bodies that your research proposal for the main study is worth funding.

Pilot studies may also try to identify potential practical problems in following the research procedure. For example, (van Teijlingen and Hundley, 2002: 33) indicate that in a recent Scottish study of maternity care the pilot phase demonstrated that the proposed means of distributing the questionnaires would not be adhered to without consulting the research team, the person responsible for distributing the questionnaires from the hospital records department decided that it was better to distribute them through the community midwives. This was despite the fact that the hospital itself had suggested the records department as a means of distribution. Other problems such as poor recording and response rates can also be identified and precautionary procedures or safety nets be devised. Thus pilot studies are conducted for a range of different reasons.

It was in consideration of these issues that the study conducted under this research was piloted before the actual data collection took place. Through the pilot process the researcher was able to determine amongst others:

- Developing and testing adequacy of research instruments;
- Assessing the feasibility of a (full-scale) study/survey;
- Designing a research protocol;
- Assessing whether the research protocol was realistic and workable;
- Establishing whether the sampling frame and technique are effective;
- Identifying logistical problems which might occur using proposed methods;
- Assessing the proposed data analysis techniques to uncover potential problems.

4.10 CONCLUSION

Chapter Four has presented the research methodology which guided the research undertaken in this study. In particular, this chapter aimed to enhancing the researcher understanding of the research tools to be employed in this study. The chapter has most significantly dealt with important aspects in a research project at this level such as data analysis, validity and reliability.

In other words, the researcher in this study has managed through Chapter four to provide a framework through which data collection, analysis and interpretation could be achieved.

Chapter five which follows next will initially present the findings of the data collected through the research instruments introduced in Chapter four and then offer the result and analysis of the large scale data collected for this study.

CHAPTER 5

RESULTS AND FINDINGS

5.1 INTRODUCTION

This chapter presents data and raw results as well as a discussion of the results in the light of the objectives set for the study and the research questions outlined earlier. The findings concern the results of the terminology analysis, those from questionnaires, and from the mathematics test.

The data collected through the educator questionnaire and the learners test were captured using EPIINFO 6, which is a word processing and database statistical programme. The data were converted using DBMSCopy 7 to Stata 8 for analysis. This package was used to analyse data and create tables, whilst Excel was used to create figures for graphical representations from which summaries were drawn.

In short, the data that follow in the next sections provide a context in which the study was conducted. The questions and sources of data are summarised in the data collection matrix revealed in table 1 hereunder:

Research Questions	Instrument for Data Collection			
	Document Analysis	Curriculum Implementers Questionnaire	Educators Questionnaire	Learners Test
How did the NLS develop the terminology for the teaching and learning of mathematics as it is contained in the *Multilingual Mathematics Dictionary?*	✓			
What are the experiences and beliefs of mathematics Curriculum Implementers with regard to using African languages in the teaching of mathematics?		✓		
What attitudes and beliefs do educators of mathematics hold towards using mother tongue in the classroom?			✓	✓
Will the terminology provided in the dictionary be practically applicable for teaching and learning mathematics?	✓		✓	✓

Table 1: Data collection matrix

The first question to be answered in this chapter sought to establish whether or not the collaborators in the development of the terminology for the *Multilingual Mathematics Dictionary* followed a particular translation approach in the development of the terminology found in the dictionary. The data that follow in section 5.2 provide a clear view of how this question was answered.

5.2 HOW WAS THE TERMINOLOGY DEVELOPED?

The translation processes (in particular approaches and guidelines), which were predominantly applied in the development of terminology in the dictionary studied in this research, were explored with the aim of establishing a clear understanding of the question:

How did the National Language Service (NLS) develop the terminology for the teaching and learning of mathematics as it is contained in the *Multilingual Mathematics Dictionary*?

A review of available literature on language development, in particular language modernisation and elaboration, revealed that authors such as Newmark (1988), Mahlalela – Thusi (1999) and Gauton (2002) agree that the challenges and problems posed by African languages to translators require African solutions. As such, solutions such as Nord's (1993) functional approach to translation are believed to be suitable for the translation of African languages. It is on this basis that Gauton's (2002) approach to translation was used as a yardstick to gauge the translation of the terms in the document reported in this study. In his step-by-step process of translation Gauton (2002: 5) strongly recommends that the translator should begin a translation task by, "first, looking for the term in any of the existing dictionaries of the language, as well as in the official terminology and orthography of the language". According to Gauton (2002: 6) the translator must look for any and all existing dictionaries, ranging from general language dictionaries to technical dictionaries. If this first step does not yield positive results, the translator can proceed to other steps. These steps were mentioned in Chapter Three as follows:

Step 2: Find any existing term lists that deal with the particular subject field. In this regard one can also contact the National Language Service (NLS). If this does not yield positive results, the next step is necessary.

Step 3: In this step Gauton (2002: 6) recommends finding parallel texts, for instance, any existing texts in the particular African language on the same subject field as the one in question. This is because according to (Gauton, 2002) sometimes one can find the translation equivalent of an English term in another text that deals with the same subject and that has already been translated into the particular African language. In this case Gauton (2002) suggests the use of resources such as handbooks, pamphlets, as well as do searches through the internet. If this yields no results (no translation equivalent), the translator has no choice but to create a term by him / herself.

Step 4: This step is necessary if the three steps above failed to yield positive results. In this step, the translator has already exhausted all the possibilities and has to create a

term on his / her own. However, Gauton (2002: 6) offers a few important guidelines that the translator must follow to successfully create a term.

It is obvious that this recommendation strongly suggests the use of reference sources prior to developing any new terminology.

The document analysis conducted during this study unexpectedly revealed serious shortcomings as it was discovered that in the dictionary's references the SiSwati collaborators conspicuously left out the important consideration of looking for terms in available dictionaries. This is in contrast to all the other African languages in the dictionary which had applied this basic and most important step. Evidence for this oversight is attached as appendix 1 of this document. The view of the researcher in this study is that, living out the first and most important step in terminology development means that the process of terminology development might have been widely opened to flaws from the beginning. With this oversight, the researcher believes that already existing and well developed terminology might have been excluded. This might have resulted in new terminology being developed (coined) whilst available dictionaries could have provided relevant equivalents.

Madiba (1997) also notes the fact that translating into the African languages is complicated by problems such as lack of reference sources such as dictionaries, glossaries and terminology lists. Hence, according to Mabasa (2005: 19) because of the lack of translation equivalents for many English terms in African languages, terminologists and translators are faced with the task of developing new terms, which require thorough knowledge of the target language and of the subject field (for example, health) as well as knowledge of equivalence relationships and term formation processes. The complexity of the task is complicated by the fact that linguists and terminologists have only recently started to study the nature and systematics of term-formation processes in the African languages.

Further, an examination (document analysis) and classification of SiSwati terminology revealed that the terms found in the dictionary were developed following recommended (Newmark, 1988; Mahlalela-Thusi, 1999; Gauton, 2002) approaches in the manner that is as represented in figures 3 and 4 below:

Key: ST – Semantic Transfer; Comp – Compounding; Para – Paraphrasing; Deid – Deidephonisation; Borr – Borrowing; SRV – Synonym Richness of Vocabulary; Coin – Coinage.

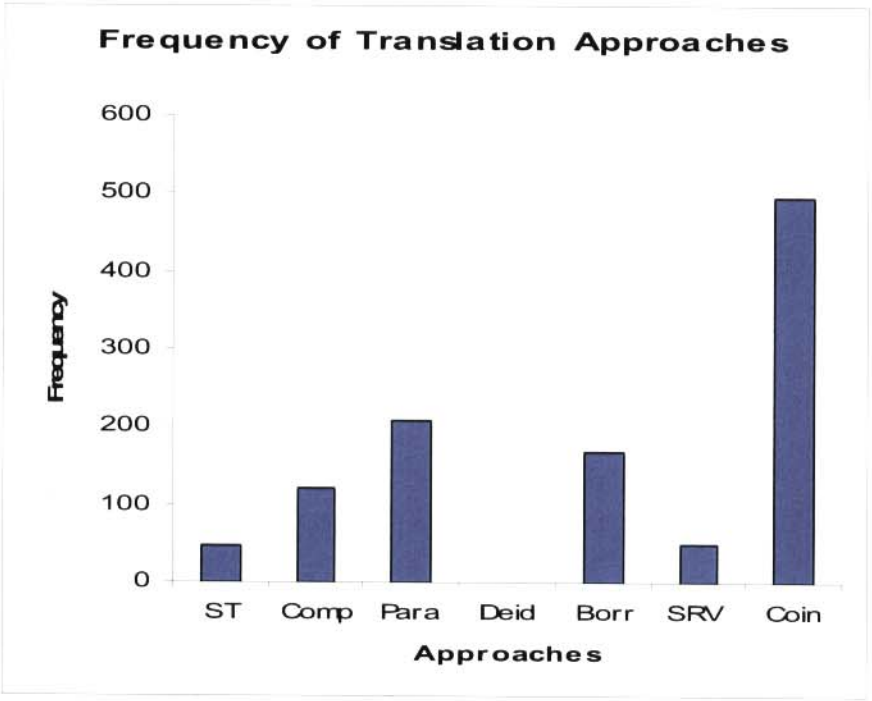


Figure 3: Frequency of translation approaches

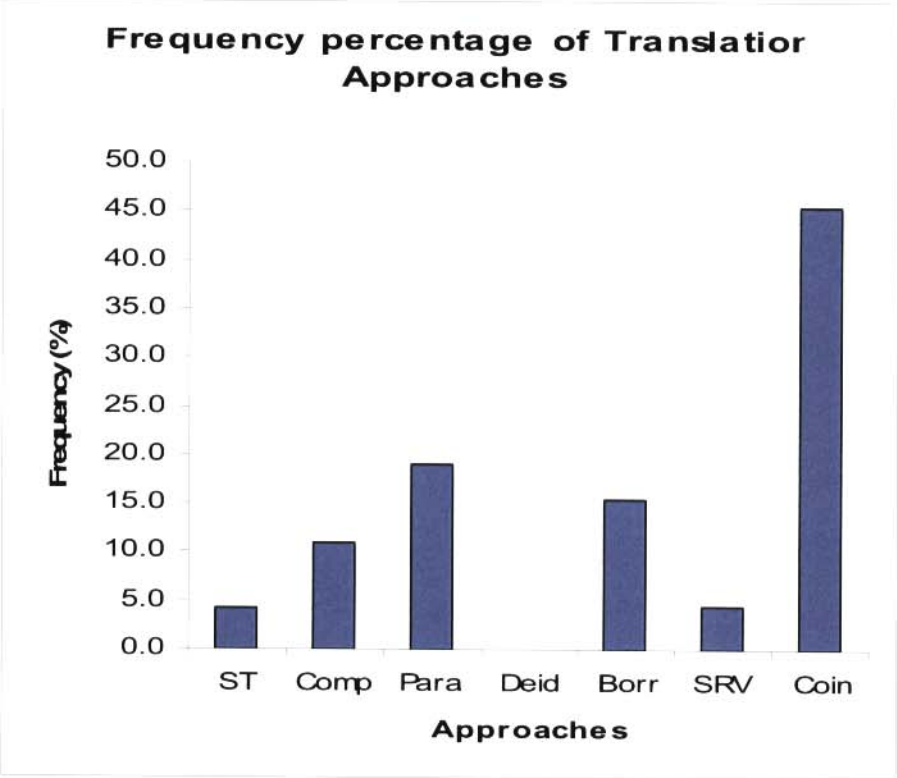


Figure 4: Frequency percentage of translation approaches

This analysis is based on the terminology which is contained in the *Multilingual Mathematics Dictionary for grades 1 to 6* (2003). As was pointed out earlier, the aim of the document analysis was to classify the SiSwati terminology in the dictionary according to the established translation approaches which are also of relevance to the development of African languages. These were found to be as follows (see figures 1 and 2): Out of a total of 1091 SiSwati terms that are found in the *Multilingual Mathematics Dictionary,* 47 were found to have been developed through semantic transfer. In the creation of new terminologies, the most common form of semantic transfer is semantic specialisation where a word from the general vocabulary acquires a more technical meaning (Gauton, Taljard and De Schryver, 2003: 86). The meaning is narrowed down and becomes more specialised. This represented 4.3 percent of the terms in the dictionary. The following table (Table 2) shows a few examples of terminology developed through semantic transfer.

Terminology	Meaning in 'ordinary' speech	Specialised modern use
Licandza	Egg	Nought
Indlela	Road	Method
Ngcondvomshini	Mind-Machine	Computer
Lutsi	Stick	Hand (clock)
Likhefu	Café	Interval
Enhloko	On the head	O'clock
Citsa	Spill	Spend

Table 2: Examples of terms developed through semantic transfer

As was mentioned in the preceding chapter, semantic transfer involves the attaching of new meaning to the existing words by modifying their semantic content. It also entails a shift in reference rather than sense. It can thus be said that this means that the existing words and new terms are used side-by-side, one in ordinary speech, the other as a term in a special field. In this translation approach the word 'egg' for example, extends its general meaning and embraces a new concept which was at first not imagined when the word was created (Sager, 1990: 71). It is thus the researcher's view that in the teaching of a specialised subject such as mathematics, the use of terminology developed as a result of this method may sometimes result in unnecessary ambiguity and confusion. For instance, the term *ngcondvomshini* is sometimes anomalous as it does not necessarily always denote a computer. In addition, *Enhloko* when it is a translation of the term O'clock is also ambiguous as it may refer to an item on the head. In the mathematics classroom, all these terminologies may result in misinterpretation and distortion of the intended meaning.

In addition 50 terms were found to have been translated into SiSwati using the approach known as synonym richness of vocabulary. This entailed a percentage just

marginally higher than the use of semantic transfer, which was 4.6 percent. The following table (Table 3) shows examples of some terms developed in this way:

Terminology	Meanings/ synonyms
Interest (money)	*Intalo; Inzuzo* *Imbuyiselo*
Pay (verb)	*Khokha; Bhadala* *Khokhela; Holela*
Afternoon	*Selimatfunti; Emvakwedina* *Ntsambama*
Total	*Samba; Sekukonhe* *Linani*
Circle (noun)	*Indingilizi; Kakela* *Siyingi ; Indilinga*
Complete	*Cedzela; Cedzisa*
Illustrate	*Bonisa; Fanekisa* *Khombisa*

Table 3: Examples of synonym richness of vocabulary

It is obvious that the fact that some mathematics terms have various synonyms as equivalents is a result of the available different varieties of SiSwati. In an earlier study on the use of Setswana to teach primary school mathematics (Mooko, 2004), it appeared that the development of terminology through an approach such as the one summarized in table 3 may pose some serious problems, especially in case where a particular set of learners in a different location are familiar with a dialect different from a term widely used in their learning material. The researcher in this study believes that Mooko's argument may hold true for the sample population of learners in the Mpumalanga province which is characterised by a number of SiSwati dialects (cf: section 2.11)

The next approach which was used is known as compounding through which 121 SiSwati terms were developed, representing 11.1 percent. In compounding a term is coined by combining existing words. The next table (Table 4) shows examples of some terms in the dictionary that were created through this approach:

Terminology	SiSwati Equivalent	Morphological Structure
Abacus	*Luhlakubhala*	*Luhla (n) + kubhala (v)* list to write
Coin	*Luhlavumali*	*Luhlavu (n) + mali (n)* piece money
Decade	*Umnyakashumi*	*Umnyaka (n) + shumi (n)* year ten
Notation	*Indlelambhalo*	*Indlela (n) + mbhalo (n)* way writing
temperature	*Lizingakushisa*	*Lizinga (n) + kushisa (n)* level heat
Numeracy	*Likhonokubala*	*Likhono (n) + kubala (v)* skill to *count*
Nine	*Sishiyagalolunye*	*Si – shiya (v) + galo (n) + lunye (n)* Pref leave finger one

Table 4: Examples of terms developed through compounding

Table 4 shows that, for some reason, the terminology developers in the *Multilingual Mathematics Dictionary for Grades 1 to 6* (2003) project have shown an 11.1 percent preference of the method known as 'putting existing words together' to create new words/ to form a compound word. According to Finnegan (1994:98) this process is called "compounding". In more specific terms, compounding is a term-formation process whereby two or more free morphemes are combined to form a new term. According to Mtintsilana and Morris (1988: 110) and Sager (1990: 76-77) compounding is a word creation process whereby a new single term is coined by combining existing words or independent terms. Compounding is not unusual as it "occurs in many languages" (Finnegan, 1994: 99). As observed in section 3.6.3 of Chapter Three during compounding prefixation such as in the case of *sishiyagalolunye* [<si (c/pref) + shiya 'leave' + galo 'finger' + lunye 'one'] is subsumed. In addition, several nouns were found to be the result of a combination of 'a noun + noun' or 'noun + verb' (See also the table on the previous page). For example:

Luhlavumali [<luhlavu 'piece' + mali 'money']

Lizingakushisa [<lizinga 'level' + kushisa 'heat'],
Luhlakubhala [<luhla 'list' + kubhala 'to write']
Likhonokubala [<likhono 'skill' + kubala 'to count']

Although the terminologists were successful in employing compounding as a strategy for developing SiSwati mathematics terminology, there may, however, be problems that may result from several flaws that were noticed from available terminology developed through this procedure. Taking, for instance, expressions such as *Lizingakushisa* and *Umnyakashumi,* according to the analysis in this study they are both inappropriately developed. For example *Lizingakushisa* which has been provided as an equivalence for 'temperature' means 'level of heat' and *Umnyakashumi* means 'year ten'. If one looks at the fact that a word such as a decade means 'a period of ten years' to say the equivalent is 'year ten' is obviously wrong as year ten appropriately refers to the tenth year. Similarly, if one understands the meaning of heat in scientific terms, which refers to a process, it goes without saying that temperature cannot mean 'a level of heat', it might rather appropriately be referred to as *lizinga le kushisa* which means "a level of hotness" It is apparent that though on the surface it might appear that the development of terminology through the approach known as compounding may have been successful, careful analysis reveals that there are inadequacies encountered in expressing mathematical concepts such as temperature and decade as exemplified above.

The analysis shows that, after compounding, the most popular approach for the terminology developers was borrowing, whereby 168 SiSwati terms were developed. Through borrowing, terminology developers / translators are able to maintain the meaning of the term from the SL whilst adapting it, especially in spelling and phonology to be suitable for the TL. This represented a percentage a bit above that of compounding, namely 15.4 percent. Table 5 shows some examples of terminology developed through this approach:

Terminology	SiSwati Equivalent
Abacus	*i-abhakhasi*
Account	*I-akhawunti*
Average	*i-avareji*
Binary	*I-bhayinari*
Bill	*I-bhili*
Budget (v)	*Bhajetha*
Cent	*Li-senti / i-senti*
Data	*I-datha*
Gram	*Li-gremu*

Table 5: Examples of terminology developed through borrowing

Mtinsilana and Morris (1988:111) maintain that borrowing is a major source of new terminology in the African languages. As was the case with the findings of this study about the *Multilingual Dictionary of Mathematics* and also in line with Mabasa's (2005) study, there are even different types of borrowing when forming new terms, namely, direct loan, hybridization and transliteration / indirect loan. The example above show that the English words have been adapted[10]. In a similar finding with regard to Setswana Mooko (2004: 188) indicated that this method is flawed mainly because it is not consistent with Setswana word formation. This study confirmed that this is not the case with SiSwati as using a hyphen after the prefix (*i)* is consistent with SiSwati word formation processes. Although this approach has the potential to create

[10] Although the examples given in table 5 show that the words have been adapted, the English form (phonetically) of the word is maintained. Hence, in accordance with Mtinsilana and Morris' (1988), such words have been developed through borrowing.

learning difficulties for learners in Setswana, it is likely not to be the case with SiSwati speaking learners.

With regard to direct loan, it was observed in the *Multilingual Mathematics Dictionary for Grades 1 to 6* (2003) that the creation of some terms involved taking over a source language term into the target language without changing its morphological structure. Sager (1990: 90) indicates that with regard to this method, the term is taken as is from the source language. A loan word, therefore, retains its spelling and this is resorted to when the target language has no equivalent for source language units.

On the other hand, hybridization, as was found in the *Multilingual Mathematics Dictionary for Grades 1 to 6* (2003), involves the use of a prefix as a strategy of word-formation, whereby new lexemes are formed through adding an affix to an existing stem or root. Lexemes such as these are called 'morphologically hybrid forms' (Cluver, 1989: 78), as indicated hereunder:

English – Budget
SiSwati – *Bhajetha / i-bhajethi*

Over and above the term creation processes discussed above, transliteration occurs frequently in African language terminology development. Transliteration, according to Sager (1990: 90), is the taking over of the term from another language but adjusting its pronunciation, spelling and morphological characteristics. Although transliteration seems to be the most productive method of developing terminology, an African language may run the risk of losing its character if it allows transliteration to fill most of its lexical gaps. This is mainly because, during transliteration, African language developers may compromise some of the well established and perculiar morphological structures, in the process leading to the loss of the character of the language. In view of this, Mabasa (2005:16) strongly advises that this method perhaps should not be used as a shortcut or first aid, but rather as a last resort, for instance in the fields of medicine and the natural sciences.

Paraphrasing is another productive way of extending vocabulary in indigenous languages (Mabasa 2005: 13). In Madiba's (2000: 214 – 215) view, paraphrasing is a productive way of engineering knowledge and to easily describe foreign concepts. Similar to Mabasa's (2005) findings of a study that investigated strategies that were applied in the creation of terminology for a *Multilingual Glossary of Medical/Health Terminology,* paraphrasing was the second most frequently used term formation strategy as it also required more attention from the translators in the *Multilingual Mathematics Dictionary for grades 1 to 6* (2003). Through the document analysis conducted for this study, the dictionary was found to have 209 terms (19.2 percent), which were developed following this approach. In Mtintsilana and Morris' (1988) terms, paraphrasing is one of the productive ways in which African language vocabularies are extended. Some examples of terms developed through this approach are given in table 6:

Terminology	SiSwati Equivalent	**Meaning**
Decade	*Lishumi leminyaka*	Ten years
Divide	*Susa ngekuphindzelela*	Minus several times
Dividend	*Inombolo lesahlukaniswa*	A number which is minusable
Division	*Kukhipha lokuphindziwe*	Removing a several times
Each	*Loko naloko*	That and that
Minuend	*Inombolo lekususwa kuyo*	A number from which it is removed
Pair	*Lokuhamba ngakubili*	Going in pairs
Percent	*Lokutsite ekhulwini*	Something in a hundred
Period	*Sikhatsi lesincunyiwe*	Time decided / cut
Positive	*Ngetulu kwaziro*	Above a zero

Table 6: Examples of terminology developed through paraphrasing

In Mabasa's (2005: 28) view, the extensive use of paraphrasing as a term formation strategy could be ascribed to terminology developers' need to explain terms in a very clear way. Following her investigation of Xitsonga medical terminology, Mabasa (2005) concluded that the Xitsonga medical terminologies which were developed

through paraphrasing showed that terminology developers needed training in translation. The researcher in this study believes that it can also be said that collaborators in the *Multilingual Mathematics Dictionary for Grades 1 to 6* (2003) needed training in the translation of mathematics terminology. This is mainly because of the meanings of the various terms developed in this process.

Unlike the earlier study by Mabasa (2005) which found that term creation through the use of a more general word is the most popular method for terminology developers in Xitsonga, a closer examination for the current study let us conclude that it is coining that took most of the attention of the translators/ terminology developers. It is through this approach that a whooping 496 SiSwati terms were developed for the dictionary being studied. This approach represented 45.5 percent of the whole task. According to Gauton (2002) coinage or rather term creation is the last resort that terminology should undertake, following failure to yield positive results from a search for equivalents from various sources. Table 7 below shows some examples of terminology that were developed through coinage:

Terminology	SiSwati Equivalent
Abbreviate	*Fishanisa/ Finyeta*
Above	*Ngetulu*
Account	*Sikweleti*
Activity	*Umsebenti*
Before	*embikwa*
Triangle	*Calantsatfu*
Weight	*Sisindvo*

Table 7: Examples of terminology developed through coinage

On the one hand, the high frequency of terminology developed through this approach (coining) also shows the dire lack of mathematics terminology in African languages, as well as the important need for vigorous modernisation of African languages. On the other hand, because coinage means developing a new term which was not in existence in the TL, it is on the surface it is encouraging that unlike borrowing from the SL to empower the TL, the terminology developers undertook a task to create new terms. This realisation made the question of 'whether the terminology as contained in the dictionary will practically be applicable for classroom learning and teaching" even more crucial than before. Section 5.3, which discusses the results of the data collected through the administration of the learners' test, examine this important question. The next section presents the results from the Curriculum Implementers who responded to a questionnaire which sought to investigate experiences and beliefs of Curriculum Implementers.

5.3 WHAT ARE THE EXPERIENCES AND BELIEFS OF CURRICULUM IMPLEMENTERS IN RELATION TO MOTHER TONGUE INSTRUCTION?

It was indicated earlier through the data collection matrix in section 5.1, that the above question was answered through the presentation and analysis of data collected through the unstructured questionnaire which was administered to the Curriculum Implementers. The views of Curriculum Implementers were collected using an open-ended questionnaire which was analysed qualitatively. The qualitative approach was prepared for this sample of respondents in order to allow them to freely expand their views and opinions about using the mother tongue. The qualitative approach was also preferred for this group of participants simply because the researcher felt that the data to be generated from them were going to be manageable, since there were only 5 Curriculum Implementers to respond to this study.

Before collecting the data, permission was sought and obtained from the office of the regional manager. The participants were informed about the researcher's visit prior to the actual date. Everybody agreed that the researcher could be allocated time after their weekly meetings which are usually held on Friday mornings. The researcher ensured that he was present before the meeting and met with the manager who then

arranged for him to meet with the participants after the meeting. At the end of the meeting, the researcher was allowed to brief all those who were present in that meeting and requested them to also ask clarity seeking questions.

During the briefing the researcher highlighted the issue of confidentiality about the respondents' identities and the right to choose whether to participate or not. However, as the researcher was busy with the briefing, it was evident that some of the possible respondents were uncomfortable and unsettled about participating in the research study. This was evident as some even offered scapegoat advices and indicated that in "their opinion, the study was only supposed to be directed at language specialists and mathematics educators". Others would mention "further commitments" immediately after the meeting. As a result and in consultation with the regional manager, it was decided that the researcher should leave the questionnaires to be completed by respondents which the researcher would later collect from the regional office. This decision seemed most convenient in view of the fact that there was one copy of the mathematics dictionary (to be scrutinized by the respondents); the researcher was assisted to make copies for the respondents to take home for the weekend.

The researcher returned on Monday morning to collect the questionnaires. Unfortunately, only one of the respondents had completed and returned the questionnaire. After waiting for about two hours, the researcher was assisted by the regional manager to make calls to the remaining four Curriculum Implementers. All of them agreed to post or send them by fax as they were out in the field supervising examinations. Upon his return to the office a second respondent had faxed a completed questionnaire, but the other three did not. A reminder was sent to the regional manager's office, but several weeks and eventually months went by without any response. As a consequence, findings presented about Curriculum Implementers beliefs about the use of mother tongue in the teaching of mathematics are based on only two respondents. The first step in the presentation of the findings will consist in describing the demographic characteristics of the Curriculum Implementers who responded to the questionnaire.

One of the respondents was male, the other female. Both participants mentioned SiSwati as their mother tongue, and additional proficiency in English and Xitsonga. Regarding their level of education, one respondent held a three-year degree, the other a Master's degree with specialisation in mathematics education. They had respectively 12 and 14 years' experience in the field of mathematics, with six years as curriculum implementer for Respondent 1, and four years as a curriculum implementer for Respondent 2. The results of the questionnaire are presented as follows:

- **Awareness about the document:**

One of the concerns of this study was the awareness about the availability of material for and to enhance the use of African languages in teaching and learning. Since the study aimed to evaluate the African languages terminology in the *Multilingual Mathematics Dictionary for grades 1 to* 6 (2003) the researcher tried to find out more about the awareness of Curriculum Implementers about the dictionary. This is because the researcher believes that *Curriculum Implementers* as the name implies are an important element in the implementation and development of a curriculum. Secondly, by virtue of their position, Curriculum Implementers can easily influence educator and eventually learner attitudes towards the use of African languages in the classroom. Their awareness of such material and what it is meant for is important both for promotion of the aspirations of the LiEP and educator training. Hence the participants were asked the question, "Prior to this day, were you aware about (sic) the *Multilingual Mathematics Dictionary?*" Both respondents indicated that coming into contact with the document for the first time. This finding reveals a bleak picture about the achievement of the aims of the dictionary, viz. to promote the use of African languages in the learning of mathematics.

A similar finding about the lack of awareness about language policy amongst educators was highlighted by Makua (2004). Hence, Makua (2004: 108) indicates that the possible implications of these findings are not encouraging. Likewise, the researcher is of the opinion that the production of an important document such as the dictionary studied in this research must often be succeeded by awareness campaigns for the end-users of the dictionary. Similar to Makua (2004: 109) this

finding shows that this was not adequately done. Of course, for the researcher it is worrying to note that Curriculum Implementers do not know about a document of such central importance.

- **Views about language in the document:**

The question which sought information on the above issue was: "What is your opinion about the use of the language in the *Multilingual Mathematics Dictionary for grades 1 to 6*?"

The purpose of this questionnaire item was to establish the Curriculum Implementers' beliefs and opinions about the African language terminology in the dictionary.

Earlier studies (namely, Mabasa 2005, Mooko 2004) painted a bleak picture about similar projects with regard to Xitsonga medical terminology and Setswana mathematics terminology respectively. In these studies, several shortcomings were cited as reasons for the negative responses about the terminology in the documents studied. According to the current study which focused on Curriculum Implementers' opinions about the language in the *Multilingual Mathematics Dictionary for grades 1 to 6* (2003), the responses from the Curriculum Implementers showed a positive attitude towards the language in the document. The following responses summarises this position:

The mother tongue will help learners understand concepts.

On the other hand, the second respondent said:

It will be good for the learners to understand Mathematics in their mother tongue.

The implications from these responses can be summed up as follows:

- The Curriculum Implementers have been impressed by the level of work that produced such a document.

- They are also generally satisfied with most of the terms, perhaps because as first language speakers of the language they are familiar with them.
- If given an opportunity to implement LiEP with the aid of a document of this nature, there is likely to be little resistance from the side of curriculum advisors.

For the researcher in this study, this finding is very important because according to him Curriculum Implementers play a crucial role in the achievements of educational goals.

- **MT as Language of instruction:**

There were two questions investigating Curriculum Implementers' beliefs about the use of MT as a medium of instruction. These were as follows:

1. In your opinion, do you think it is possible to teach mathematics in African languages such as SiSwati? Please motivate.
2. Do you favour the use of African languages (SiSwati) or English in the teaching of mathematics? Why?

It is important to establish whether or not key players such as Curriculum Implementers believe in the use of MT in mathematics education.

With regard to the first question respondent number 1 responded as follows:

"*Yes, a country like Japan teaches in mother tongue and the country is one of the most literate in science and maths. Secondly, teaching in mother tongue is not new in South Africa*"

The response given by the first respondent with reference to Japan can perhaps be best understood by Mazrui's (2000) opinion quoted in Mutasa (2006: 84):

> No country has ever ascended to first rank technological and economic power by excessive dependence on foreign languages. Japan arose to dazzling industrial heights by 'scientificating' the Japanese language and making it the

> language of its own industrialization. Korea ...'scientificated' its language and made it the medium of its technological development take off.

The implication of this response is that while some of the Curriculum Implementers are positive about MT instruction, there is a strong belief that South Africa cannot achieve its language development objectives without learning from other countries. This view is also held by prominent authors in the field of language planning. See for example, Kamwangamalu (2000b) who cites the case of Swahili in Tanzania, Mooko (2000) who cites the case of Setswana in Botswana, Ogutu (2006) on the case of Kenya as well as Mazrui (2000) and Mutasa (2006) referring to the case of Japan.

In addition, a review of Ogutu (2006) underscores the importance of classroom instruction in the mother tongue in the early years of a child's education, thus, confirming the findings from a large body of research which has proved that cognitive development is achieved faster if the mother tongue, rather than a language of wider communication, is used as the language of instruction in primary education. Referring to the case of Kenya, Ogutu (2006: 55) provides evidence that children learn better in their mother tongue, the language they know best. Ogutu (2006) thus concludes that a start in the mother tongue enables children to perform better in other subjects as well, including a second language such as English. Hence the argument by Ogutu (2006) is that for one thing, young children should communicate in the mother tongue at first for learning to take place easily. In later years they can read and write the other languages they will have learned as subjects in school. The mother tongue is the language already known and mastered by the child at the beginning of formal education. Children who start their formal education through the mother tongue, which they already know, do not need to put extra effort into language acquisition. They can thus concentrate on grasping the content of the subject being taught, be it reading or writing skills, mathematics, science or whatever. The mother tongue relieves the child of academic stress. In fact (Oguto, 2006: 55-56) indicates that it would be easier and most comfortable, with less effort for a learner to communicate at any level of education in the mother tongue.

Other previous Kenyan studies, for example, Nthinga (2003), Ogutu and Kanana (2004), found that learners and instructors in Kenya's second language classrooms have certain tendencies of using the mother tongue effectively, amongst others to,

- facilitate student comprehension;
- enhance student interest, response and participation;
- break classroom tension, probably created by lack of competence in English, or any other foreign language;
- prevent students from getting bored, being fearful and intimidated;
- facilitate self expression and communication;
- have personal conversation; and
- reprimand or correct faults in order to keep discipline and maintain class control.

Thus, Ogutu (2006: 56) concludes that the indigenous African languages bring special attributes to the African classroom.

The second implication of the respondent, specifically with regard to the fact that: *Teaching in mother tongue is not new in South Africa"* is best understood in terms of various authors refered to in this study, namely, de Klerk, 2002; Makua, 2004; Makalela, 2005 who also agree that the use of indigenous languages is not new to South Africa:

- During the latter part of the eighteenth century, under British administration, when the education of African children was mainly conducted by missionaries - initial education was in the mother tongue, later instruction was in English;
- During the Anglicisation period, indigenous languages were used in both religious and non-religious instruction;
- African languages were used by missionaries as an aid in proselytizing the indigenous peoples;
- Education being under the control of the church till 1953, the teaching materials were prepared to teach natives in their own 'languages' for at

least four years;

- Under the Bantu Education Act, mother tongue was compulsory for African language speakers in the early grades;

On the other hand, with regard to the second question on this concept respondent 1 wrote:

Yes, since this dictionary will help us evolve our own meaning and discoveries in maths. The terms will evolve and be fine tuned with time

The implication of this response is that some of the Curriculum Implementers believe that, 'with time' the African language terminology will come to the level of teaching and learning. The main factor with regard to the implication of this finding is that African languages need to be standardized to ensure their capacity to function effectively as languages of learning and teaching.

- **Applicability of the Terminology In the Document:**

'Looking at the dictionary, do you think the African language terminology (SiSwati) in it will help enhance learning and understanding of mathematics concepts in the classroom?'

The purpose of this question was to solicit responses on the opinions of Curriculum Implementers about the capacity of African languages to function as media of instruction in mathematics. From the literature review of this study, several arguments were presented (Cummins and Swain, 1986) about the lack of sufficient capacity for African languages to handle content subjects such as science, mathematics and technology. Hence, the need for the development of African languages to the status of languages for learning and teaching was pointed out by several authors, including, Saville-Troike (1984), Kamwangamalu (2000a), Makua (2004), and Mabasa (2005).

In particular, recent studies (Mabasa 2005; Mooko 2004) stress that terminology found in current documents such as the *Multilingual Mathematics Dictionary* leaves a lot to be desired. These studies posited that stakeholders of such documents may

find it difficult to understand such terminology, let alone use it for beneficial purposes. This view is best summarized by respondent 2 who indicated:

No, some of them are not understandable in SiSwati as we understand them in English, and their pronunciation is difficult.

The implication of this response is that in the case of the SiSwati terminology, the participants are unfamiliar[11] with the language. Hence, they are also unable to correctly pronounce the terms. It is also evident from the response that the respondent seems to find English terminologies more acceptable than African ones. This confirms earlier findings from studies such as Mabasa (2005). In Kembo-Sure's (2006: 13) terms, lack of understanding of African language terminology is tantamount to 'identity crisis.

On the other hand, the first respondent gave a positive answer in this regard. His response to the above question was as follows:

Yes, though it will take sometime since teachers need training on the use of such mother tongue

The implication to be drawn from this response is that though there is a positive response from some Curriculum Implementers about the applicability of the terminology contained in the dictionary document, It appears that this is guided by the awareness that training is a crucial factor to the implementation of LiEP goals. A similar finding was raised by Makua (2004), who correctly pointed out that if African languages are to function as media of instruction training of role players such as educators must be prioritized.

- **How to Improve the use of African Languages:**

The purpose of this item was to establish whether Curriculum Implementers as role players in the field of implementation have a progressive way which can be employed

[11] It might appear puzzling to use 'unfamiliar' since the participants were SiSwati speakers, However, 'unfamiliar' in this case does not mean the terms are not written in SiSwati, but refers to the fact that the terms are not of common usage and well known to the participants.

to promote the use of African languages in education. The question which was asked the respondents was

'What else do you think can be done to improve the use of African languages in the teaching of mathematics?'

The response by Respondent 1 was

Maybe code switching in teaching and writing of exams need to start happening even before the official introduction of the use of MT

The implication of this response can be summed up through Eastmann (1983: 102) who indicated:

> Many professionals studying code-switching continue to debate about the advantages and disadvantages of code-switching for learners. Some proponents of code switching believe that naturally, it is hard to learn anything, not to mention complex subjects like chemistry in a language you don't understand. Code-switching during instruction helps students keep up academically while they are learning. In an English-only chemistry class, by contrast, they would just be wasting their time, sitting through lessons that were mostly meaningless. So, for students learning through a second language, code-switching is clearly a more efficient way to learn academic subjects. But that is not all. Acquiring knowledge through their native language also helps them in acquiring English. That's because it provides context background in subject matter that makes the second language more comprehensible.

In addition, there seem to be more arguments in support of code-switching. For example, on the one hand, code-switching is a form of personal expression and preserving one's culture, on the other, the ability to code-switch signifies a strong knowledge of two languages (Eastman, 1983).

- **Educators' attitudes:**

The beliefs of Curriculum Implementers about educator attitudes were investigated through the following question:

'In your opinion, do you think teachers involved in the teaching of mathematics will prefer to teach the subject in an African language such as SiSwati? Why?'

Available literature points to the fact that the attitudes of teachers come to the fore as they reflect upon the language that they use in teaching. Consciously or unconsciously, their attitudes play a crucial role in language's "growth or decay, restoration or destruction" (Baker, 1988). Their attitudes, too, as part of their cultural orientation, seriously influence their younger students (Shameem, 2004). Hence, the question of what kind of attitudes towards language of instruction educators should have in order for them to teach science and mathematics concepts successfully, is crucial for a study of this nature which seeks to establish the applicability of African language terminology. In response to the above question, one of the respondents indicated:

No, because they have been brainwashed by the previous regime that good teaching is in English. Workshops to undo this are needed. Quoting countries like Japan, Germany and others that use mother tongue.

This statement shows that respondents suggested that educators are likely to hold negative attitudes against MT instruction in mathematics. Moreover, the curriculum implementer pointed out a crucial legacy of apartheid education which unfortunately left the masses of South African blacks stereotyped about the ability and status of their languages. This adversely contributed to the lack of support for development and use of South African indigenous languages as languages of teaching and learning.

This view, (especially the reference to the phrase "*good teaching is in English")* by one of the respondents indicates clearly that to some people "African languages are mainly associated with backwardness and inferiority" (Madadzhe and Sepota, 2006: 130). To further illustrate the relevance of the view from the respondent, one should consider Madadzhe and Sepota (2006:131) who indicate that indeed in South Africa, with the beliefs that 'English is better' "there are some schools...that still discourage students from speaking African languages... in addition, some of the schools do not even offer an African language as a subject. This is despite the fact that the majority of the students in such schools are African".

On the other hand, with regard to the same question, the second respondent wrote:

No, the terms are not familiar in the African languages than in English as I have said above

The finding from the second respondent reveals that some Curriculum Implementers strongly believe that exposure to the English language would truly be advantageous for learners.

The finding above echoes Kembo-Sure's (2006) discussion of the continued use of imported languages and the arguments used to defend this position, the most salient being:

- They are a neutral choice among competing local languages, none of which can be accepted as the languages of the nation.
- They are already standardised and since most teaching materials already exist in these languages it is more economical to continue using them.
- They provide access to the existing knowledge in Science and Technology, which Africa needs badly if it has to develop economically and industrially.
- They provide media for international communication, trade, diplomacy, higher education, and tourism. (Kembo-Sure, 2006: 27)

Historically, English has been found to be the language which most people favour in education. The fact that it has remained steadfast as the language of choice in learning across South Africa in spite of the fact that the mother tongue is being promoted, has supported this finding. In a study conducted a few years ago in the Philippines, Tupas (2003: 4) pointed out that in that country, even language stalwarts often recognize the continuing status of English. Tupas (2003: 5) details the use of English as follows: "1) English as a social stratifier; 2) despite the bilingual education in Filipino and English, all rewards are accrued due to English; 3) the Filipino elite continue to hold on to their power partly through English; 4) it is from the English – competent economic and political elite that the leaders of the country are most likely to emerge". If this view is anything to go by, these findings can be said to be equally true for the Curriculum Implementers in this study.

- **Learner understanding:**

This item was intended to establish the judgments of the Curriculum Implementers about the applicability of the terminology in the multilingual dictionary based on their experiences with learners in lower grades of schooling. The question which investigated this was as follows:

'In your opinion, do you think learners in grades 1 to 6 will be able to handle/ understand the terminology contained in the dictionary?'

One of the responses to this question was

Yes, because that is a very tender age, at this stage kids can learn anything easily.

This view is in line with Mabila's (2001) study which maintains that biological age, and the closely-related age of first exposure, has an influence on language acquisition. It is equally comparable to Towell and Hawkins (1994:15), who mention that

> The major factor which is influential in determining degree of success in attaining native speaker-like judgments is the age at which the learner is first exposed consistently to the language ...The older a learner is when first consistent exposure starts, the more errors he or she makes, indicating a progressive failure to acquire grammatical knowledge.

- **Reasons for support of MT in education:**

The purpose of this item was to establish if the Curriculum Implementers had reasons that guided their support of mother tongue education. So the question in this item was as follows:

'Give reasons why you would like African languages such as SiSwati to replace English as the language of teaching and learning.'

As indicated earlier in the study, Anstrom (1997: 35) notes "All too often, second language learners are asked to participate in tests that make unfair assumptions about their English language proficiency in order to assess their content knowledge. Furthermore ... second language learners when measured against their native English speaking peers, may fail to meet mainstream instructional goals." One of the respondents also concurred with the view by Anstrom (1997) through sharing a similar reason why mother tongue should replace English in teaching and learning. The respondent indicated that African languages should replace English in order:

To enhance understanding, that is concept formation in the mind of learners

and

To assist learners in abstract thinking

Saville-Troike (1991: 1), also states that, "Certainly second language learners are at a disadvantage trying to understand instruction and express themselves in a foreign language, especially when they must compete with other learners who have already mastered their first language".

Another reason given by the respondent was:

To instill our own African values

In Kembo-Sure's (2006: 40) terms, the use of local languages has been observed to enhance cultural pride and self worth in learners. Hence Kembo-Sure (2006) believes that by denying children a chance to operate in their mother tongue, they are condemned to a life of self-doubt that could be referred to as a *'loss of African values'*. This is what Ngugi (1986) calls 'colonising the mind'. It is important, in the globalizing world, that African countries must do everything to protect and develop the indigenous languages while, at the same time teach their children the important languages for international communication. Hence, the responses of the participant reflect a point of agreement with, for example, Kembo-Sure (2006: 41) who contends that

> There is no better way of capturing the thought patterns of a person than through language and there is no more cruel way of destroying a person than by thwarting the full development of his language skills. The systematic exclusion of African languages from the school curricula is an obvious exclusion of their speakers from political and cultural participation in the affairs of their societies.

- **Reasons for not supporting MT in Education:**

The purpose of this item was to establish if the Curriculum Implementers had reasons that guided lack of support for mother tongue education. The participants had to respond to the following question:

'Give reasons why you would not like an African language such as SiSwati to replace English as the language of teaching and learning.'

There are historical and pragmatic reasons why people prefer the status quo. Education was introduced in these parts of the world as necessarily involving teaching and learning in colonial languages. Hence, it is widely believed, even today, that one is not really educated if one does not speak English, or French, or some other colonial language (Thwala, nd). Thwala is also of the opinion that it is generally believed, erroneously, that expressing oneself in English shows that one is "detribalised" and has become "civilised", what in IsiZulu is called "*ukuphucuka*". The term *'ukuphucuka'* has no other connotation except to denote 'civilisation'. This view can best be summarized by one of the respondents who stated that:

Educators and learners are used to the English terminology and any other person who is not for example a Swazi can teach even in Venda using English

5.4 WHAT ATTITUDES AND BELIEFS DO EDUCATORS OF MATHEMATICS HOLD TOWARDS USING MOTHER TONGUE IN THE CLASSROOM?

In order to investigate this question, this section will focus on the data which were collected using the educator questionnaire. As indicated earlier in the methodology section, the educator respondents in the study were asked a set of questions relating to their attitude and beliefs toward the use of mother tongue in the mathematics

classroom. The respondents were specifically requested to either – Strongly Agree, (SA), Agree (A), Neutral (N), Disagree (DA), and Strongly Disagree (SD) to a given statement. The educators were given a total of twenty statements measuring different aspects of their attitudes about the use of SiSwati in the teaching and learning of mathematics.

Factor analysis was applied to the data collected through the educator attitudes questionnaire. The following tables present the results of the analysis of the data which were collected using the educator questionnaires.

The data presented in table 8 below was collected from a total of 19 educators from four different schools located in four different districts of the Ehlanzeni Region of the Mpumalanga Province. The region is the area which is predominantly inhabited by SiSwati speakers.

Gender	*Frequency*	*Percentage*
Female	10	53
Male	9	47
Total	**19**	**100**

Table 8: Educators Gender distribution

The distribution of the educators in terms of gender was as follows: there were 10 females and 9 males from the four sampled schools in the different locations. As reflected in table 8, in terms of percentages, there was a total of females amounting to 53 percent whilst there was 47 percent males. This shows an almost equal number of male and female participants in the study. Despite this almost equal number of participants in terms of gender participation, it is worth mentioning that in some schools there were imbalances. That is to say, some of the schools where the data were collected had more male educators than females, or vice versa. The number of educators per school ranged from 3 to 6. This number was determined by the total number of educators teaching grade 7 from each participant school. It was also determined by the availability of educators. The next table shows the distribution of educators according to their age.

	Educators Age			
Gender	30 – 39	40 – 49	50 +	Total
Female	2	6	2	**10**
Male	1	8	0	**9**
Total	3	14	2	**19**
Percentage	**15.79**	**73.68**	**10.53**	**100**

Table 9: Distribution of Educators (Age)

According to table 9, the age of the educators ranged from 30 to 50. Specifically, there was a total of three (3) educators whose ages ranged from 30 to 39, representing about 16 percent of the population. Of these three educators, one was female and two were male. In addition, there was a total of 14 educators whose age ranged from 40 to 49. This age group represented 74 percent of the total population. Of these, six were female while eight were male. The last category of respondents which was above 50 years of age consisted of two male educators, representing 11 percent of the total population of educators in the study. Table 10 presents the results of the data about the educator's home / first language.

	Home / First Language			
Gender	**Sepedi**	**SiSwati**	**SiSwati/Pedi**	**Xitsonga**
Female	1	9	0	0
Male	1	6	1	1
Total	2	15	1	1
Percentage	**11**	**79**	**5**	**5**

Table 10: Educators Distribution (First languages)

Almost all (out of a total of 19), except for 3 educators were first language / mother tongue speakers of SiSwati, the language on which data for this study was collected. The population consisted of 10 males and 9 females. This shows an almost equal number of participants in terms of gender. However, in terms of language background, 15 educators were first language SiSwati speakers. The 16th respondent indicated that she was bilingual being both a SiSwati and Sepedi first language speaker. The other 3 participants indicated that they were either Sepedi (2) or

Xitsonga (1) speakers. Despite their different language backgrounds, the views of the Sepedi and Xitsonga speaking educators were included in this study mainly because of the fact that the researcher strongly holds the view that, (i) irrespective of their language backgrounds; the educators could still have similar views about the use of African languages in the teaching and learning of mathematics, (ii) also the fact that through their views, the researcher was be able to make general conclusions about the use of African languages in mathematics. The educator attitudinal data collected through the educator questionnaire were analysed according to the questionnaire items as follows:

First, as it was indicated in the section on 'educator questionnaire' of the research methodology, various statements were given to the educators to respond to by indicating their beliefs through marking one of the five options ranging from, Strongly Disagree (SD), Disagree (DA), Neutral (N), Agree (A), and Strongly Agree (SA). The options which indicated the educator's negative beliefs/ attitudes to a particular view about language in mathematics were negatively scored, whilst those that represented a positive attitude were positively scored. For example, in a statement like: "it is good to have SiSwati as a language of teaching mathematics", the educators will be scored -2 if they chose the option SD, -1 for option DA, 0 for option N, 1 for option A and 2 for option SA. The results of the analysis of the data are summarized in figure 5:

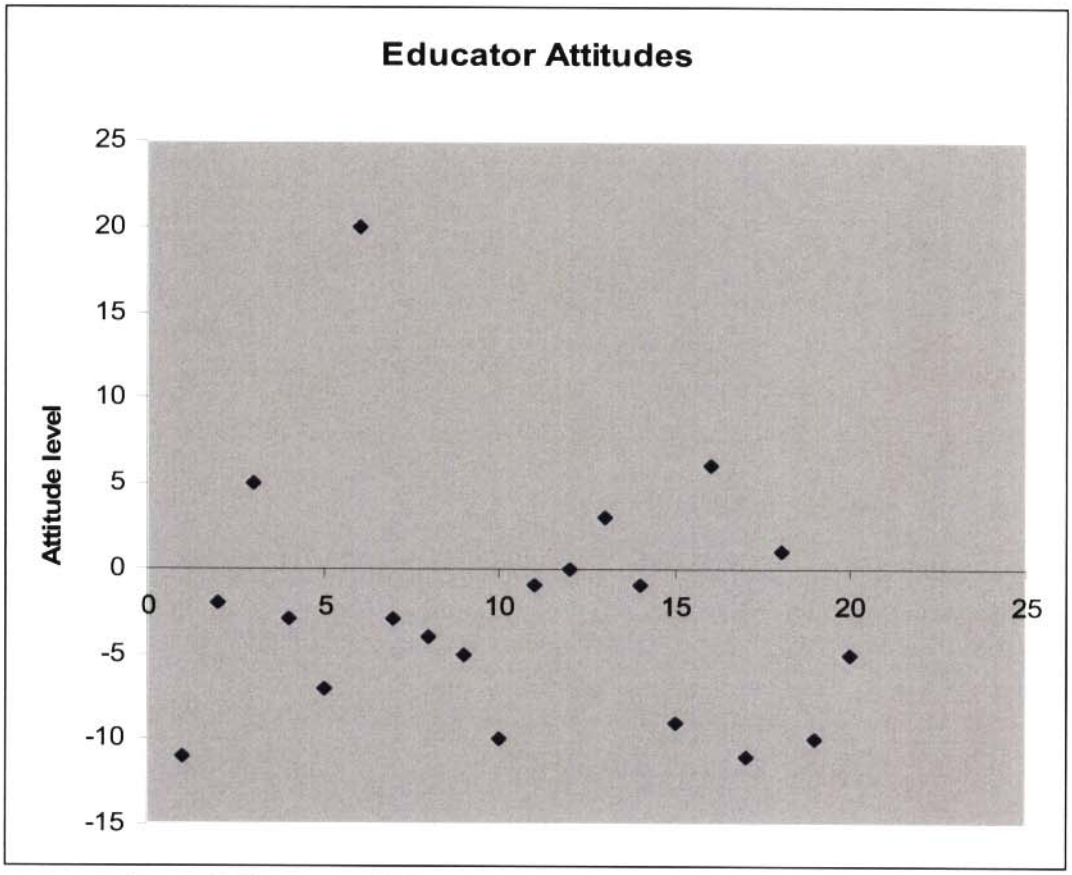


Figure 5: Summary of Educator Attitudes

From figure 5, it can be inferred that most of the educators had a generally negative attitude towards the use of African languages in the teaching of mathematics especially in grade 1 – 6 where the study sought to investigate educator attitudes. The graph shows that the study found educators to hold some positive attitudes about a few issues pertaining to the use of the mother tongue in the teaching and learning of mathematics. These, for example included some educators indicating that '*educators and learners should be forced to teach and learn mathematics in the MT*' and that it is not true that '*if English only is used in the mathematics classroom, the status of their learners is raised*'. The revelation of such beliefs was not only interesting to the researcher, but also surprising since it contradicted with most educators who seemed to overwhelmingly believe that:

- Using SiSwati will make children less competent in mathematics
- If English is used in teaching mathematics, the educator will be appraised and approved by the school and parents the learners, and
- The educator does not have any idea about how to teach mathematics in SiSwati.

However, there has been growing interest in the effect on achievement of educator and learner attitudes towards language. Previous studies in this area have reported that negative attitudes can adversely affect the classroom experience for both educators and learners. Similar to the observations of this study, only thirty years ago, Beatriz and Gray (1977) concluded that educators tend to give stereotypical evaluations when confronted with issues of language use in the classroom. Similarly, in this study conducted amongst educators in primary schools in the Ehlanzeni District of Mpumalanga, such stereotypes or beliefs seem to be pervasive. Although the issue of how the educator attitudes affect the performance of the learners was not the primary concern of this study, and might rightfully be the focus of further research projects, the researcher in this study predicts that such negative attitudes also negatively influence learners' performance. With regard to this issue, the researcher also concludes that negative attitudes and beliefs about the use of mother tongue invariably lead to lack of motivation from educators involved in the teaching of content subjects such as mathematics.

Whether or not the same sentiments prevail in the qualitative data collected from the educators will be answered in the next section, which presents data collected through the question 'What is your opinion about the dictionary contents? (The terms therein)' which was asked to the educators.

The purpose of this question was to establish whether or not the mathematics educators value the *Multilingual Mathematics Dictionary for Grades 1 to 6* (2003) as a resource tool for teaching and learning. Secondly, it was meant to find out if the educators thought the African languages terminology found in the dictionary was useful for the teaching and learning of mathematics.

Authors such as Van der Walt, Mabule, and de Beer (2001: 22) argue that "it is important for all educators to make the mind shift and see first languages as a resource in their teaching. This view is especially important in the case of the teaching of science and mathematics".

Even though such a belief was held by a few educators in the population (5 out of 19), the following responses agree with the view by Van der Walt *et al.* (2001) as pointed in the preceding paragraph:

Educator 3 – *I think it will be a useful tool or resource if terminology of maths are explained in our mother tongue.*

Educator 7 – *It is good to have a dictionary for mathematics so that we can refer to it when learners do not understand the meaning.*

Educator 11 – *The dictionary contents are so good for the learners because they will get clarity of words that they do not understand.*

From a superficial perception, it may seem that these educators' responses are a total endorsement of mother tongue teaching of mathematics. However, careful analysis of the above statements reveal that for all the quoted educators it seems that the mother tongue terminology will be a "useful tool or resource" – educator 3, "so we can refer to it" – educator 7, and "learners will get clarity of words that they do not understand" – educator 11. For the researcher, these statements seem to reveal a suppressed belief by the educators that the mother tongue terminology can serve not as a primary resource, but as a secondary material which can be used to a large extent for reference purposes only. This unfortunately, confirms that mathematics educators are essentially in favour of the use of English as a primary language for the classroom. This perception is best captured by Educator 18 whose response to this item was as follows:

The terms are of a limited scope and some are still formed from English words. It will be fine for reference only, not proper and enough for maths usage.

In the same vein, most educators (14 out of 19) generally held the belief that using mother tongue is bad for their classrooms. For example, it was interesting to note that some educators hold the view that 'through education, the ultimate goal is to ensure that African children are supposed to strive towards being closer to whites and in particular the white culture'. This view is best summed up by one educator

who when confronted by the same question about the multilingual mathematics dictionary mentioned:

Educator 15 - *Yes, the dictionary is needed…just to know the terms, but not for teaching in SiSwati because we live in South Africa – if we use SiSwati, the Bantu children will be different from their white counterparts.*

Mutasa (2006: 98) agrees that attitudes are very important as they, amongst other things, contribute to protect people's self-esteem and allow people to express their fundamental values. Failure to accommodate and interpret them correctly on any important decisions that affect people's lives has dire consequences or repercussions. Attitudes or perceptions play a crucial role when it comes to language policy implementation. Hence, in spite of the fact that materials are available in African languages, the use of African languages will not be implemented at present because of resistance from individuals with vested interests, hardened attitudes and fear of the unknown, arising from the question of uncertainty. Perhaps this uncertainty was best revealed by educator 4 who responded:

I am not sure, some of the terms are not relevant.

In addition, Madadzhe and Sepota (2006: 130), indicate that one of the reasons why African languages find themselves at the crossroads can be attributed to negative attitudes. They contend that African languages are mainly associated with attributes such as backwardness, poverty, and inferiority. Consider for example, the perception held by educator 12:

What is important, English or SiSwati? I think children must learn in English, so that they can become better tomorrow. I don't think using their mother tongue can gain them.

With regard to similar experiences as revealed in the above perceptions, Ngugi (2000: 60) writes:

> ...there is an obsession with monolingualism as seen as a neutral form of human intercourse. The Christian era has been far too long haunted by the image of the tower of Babel. People see many languages as a sin and say, "No, we must have one language." I think it is necessary for Africans to accept the reality of multilingual societies.

As Ngugi (2000) points out, a multilingual society is, for better or worse, an inescapable feature of Africa's linguistic landscape. Hence, in Ngugi's (2000:157) words, it should be "the goal of education to empower local populations to be able to interact directly with their government, rather than force them to forego interaction altogether or act through an interpreter". For this reason, Ngugi (2000:157) poses this hypothetical scenario:

> Imagine a peasant, a worker or any other person for that matter accused murder in a colonial court of law. His own life is at stake. The judge or magistrate, most likely a white person then, spoke English. The poor peasant accused of murder was entirely dependent upon an interpreter. Fighting for his own life, the poor peasant was denied the use of his language. He was like a foreigner in his own country and have to communicate through and interpreter. Here we are not talking about one or two visits by one or two people. We are talking about the majority of the people turned into foreigner in their own countries.

In the above scenario, Ngugi (2000: 157) describes that a colonial court of law, is just as applicable to any government situation where the language or languages of administration cannot or will not adapt to suit the needs of the citizens of the country. It is, as Ngugi (2000) believes, unreasonable to expect an entire population to be held in linguistic imprisonment in their own country.

In the same vein, Madadzhe and Sepota (2006: 131) lament a similar situation in the arena of education as they comment about a Western Cape secondary school which was reported in the media to have instructed its isiXhosa speaking students not to use isiXhosa in class.

There are also indications that besides school authorities, some parents (including those who are educators), especially from the elite group do not allow their children to learn indigenous languages or even use them at home (Madadzhe and Sepota,

2006: 131). The view shared by some of the educators in this study, such as educator 12 above is indicative of such elitist tendencies.

The analysis of the educator responses to this question has resulted in some interesting observations. First, the most important observation was the finding that despite a majority of the participant educators being mother tongue speakers of the African language from which the data were collected, most of them held negative beliefs and attitudes towards using the mother tongue in the mathematics classroom. Second, despite this generally high negative attitude level, the results of this investigation also revealed that a few educators had some positive attitudes about the use of SiSwati in the mathematics classroom. This was particularly evident from the results of the qualitative data analysis of the educator responses, such as the views held by educators 3, 7, and 11 in the population. However, as it would appear, these educators also have an underlying belief that the mother tongue can serve best as a secondary resource in the classroom.

The second question in this section sought to investigate the educators' perceptions with regard to the question: 'Do you think the learners in grades 1 to 6 will find the terminology in the dictionary easy to understand?' Some of the responses to this question were as follows:

Yes, they will find it easy to understand provided educators are supplied with more learning materials.

This view seems to be in agreement with the arguments purported by authors such as Kembo–Sure (2006: 27) who indicates that often the continual use of imported languages has been defended in various ways, but the most salient one amongst others is: "they are already standardized and since most teaching materials already exist in these languages it is more economical to continue using them.

Recently, Wildsmith-Cromaty (2007) suggested that there are several problems relating to the process of borrowing in order to compensate for lexical gaps, for example, shifts in word class leading to loss of core meaning. With regard to the issue investigated by the question in this section, educator number 5 indicated:

Not every term, because some terms are translated directly so they won't explain what the learners really should know.

Similarly, Wildsmith-Cromaty (2007) concludes, that the translation of learning material needs to be a consultative and participatory process with closer collaboration among curriculum specialists, translators and educators.

Kembo - Sure (2006: 94) adds that "the elite recoil from local content, language and culture which they conceptualise with the illiterate in mind which certainly is a condescending approach to life and is unfortunate that it affects people unconsciously". Further, Kembo – Sure (2006: 94) comments that "it is evident that the elite preach about the importance of African languages, but do not show much enthusiasm largely because they are not used to doing business in African languages." Hence, in response to the question on learner understanding of the SiSwati terminology, respondent number 9 wrote:

It was not easy for me, how about the Gr 1 – 6 learner?

In addition respondent number 16 stated:

No, the terminology is not easy and some are newly coined, not used daily. They are also not enough for usage as maths terminology.

The above comment seems to prove Kembo–Sure's (2006: 94) observation that the elite do not only converse among themselves in European languages but also with their children whom they send to schools where European languages are the languages of learning and teaching.

The results of the investigation of the question in this section also seem to point out that although African language development and use in the classroom may be desirable, there is a high level of reluctance from key role players such as the educators involved in this study. This is proven by the high number of educators who seem to strongly believe in a language shift that might see the reduction of African

languages such as SiSwati from languages of learning to the level of subjects, and escalate the dominance of particularly the use of English amongst learners whose mother tongue and home languages are African languages. Bearing in mind the fact that almost all the educators in the study were mother tongue speakers of SiSwati, such a mixed set of views towards the mother tongue indicates an ongoing conflict between the educators' linguistic identity and utility of their language as an enabling factor in the learning of the subject they teach. This finding is consistent with other studies. See for example, Gardner *et al's* (1985) study which examined the aptitude and attitudinal / motivational attributes on teaching and the rate of learning. Gardner *et al.* (1985) found that attitudes influence teaching as well as the rate of learning. In view of such a situation, the researcher in this study agrees with Roberts (1999: 48) lamentation that "the impending loss of the African language is likely to be more in the written and writing skills than the listening and speaking skills"

5.5 WILL THE TERMINOLOGY IN THE DICTIONARY BE PRACTICALLY APPLICABLE FOR TEACHING AND LEARNING MATHEMATICS?

The analysis of the dictionary, the educator's questionnaire, and the learners test provided the answers to this question. Further, as was indicated earlier in Chapter 4 the data collected through the learners test were meant to investigate whether or not the African language terminology would be able to handle the demands of teaching and learning mathematics.

Perhaps, the first and overarching question to answer in this section is: Were the research instruments (in particular the learners test) suitable to make valid conclusions in particular about learners' understanding of mathematical concepts as expressed in their mother tongue? Though this question was addressed in the methodology section (see Chapter 4), the researcher used section C of the educator questionnaire to further address this concern. In this section, the educators were given the learners test questions in English and asked to read them and thereafter to decide whether their learners will be able to find correct answers or not. This was done particularly to eliminate doubt in case some critics of this research may be concerned about the performance of learners. For example, if the learners did not perform well in the test, concern could be raised that the complexity of mathematics

questions could be the reason behind the poor performance. In addition, critics could also raise the question of familiarity with the mathematical concepts asked in the test.

However, with the aid of the educator beliefs shown through their predictions, the researcher was able to make firm conclusions about the fact that learners were familiar with the type of questions and concepts asked by the questions in the test. In other words, this has helped to confirm that the test was a proper instrument to investigate the understanding of mother tongue as used to express mathematical concepts in the test. The results of the analysis of the educator predictions are summarized in the next section.

5.5.1 Educators' Predictions about Learners' Mathematical Ability

After capturing by means of EPIINFO 6, the data were converted to Stata 8 using DBMSCopy 7 for analysis and presentation in tables. Excel was used to create graphical representations from which summaries were made.

This study was conducted in four major districts of the Mpumalanga Province where SiSwati is widely spoken and taught at school. As already indicated earlier in the study, four schools located in four different locations were selected for the study. The following table 11 presents a summary of the results for the analysis of the educator predictions.

	Overall		*Between*		*Within*
School	**Freq.**	**Percent**	**Freq.**	**Percent**	**Percent**
School A	100	26.32	5	26.32	100.00
School B	80	24.05	4	21.05	100.00
School C	100	26.32	5	26.32	100.00
School D	100	26.32	5	26.32	100.00
Total	**380**	**100.00**	**19**	**100.00**	**100.00**

Table 11: Educator Confidence (per location) (n = 19) [12]

[12] n = is the number of participant educators (respondents)

Table 11 indicates that from a total of four (4) schools (A, B, C, and D) in the different locations 19 educators responded to section 2 of the educator questionnaire. This part of the questionnaire was intended to investigate the educator confidence and / or prediction about their learners' ability to get correct answers to the questions asked in the learners' test instrument.

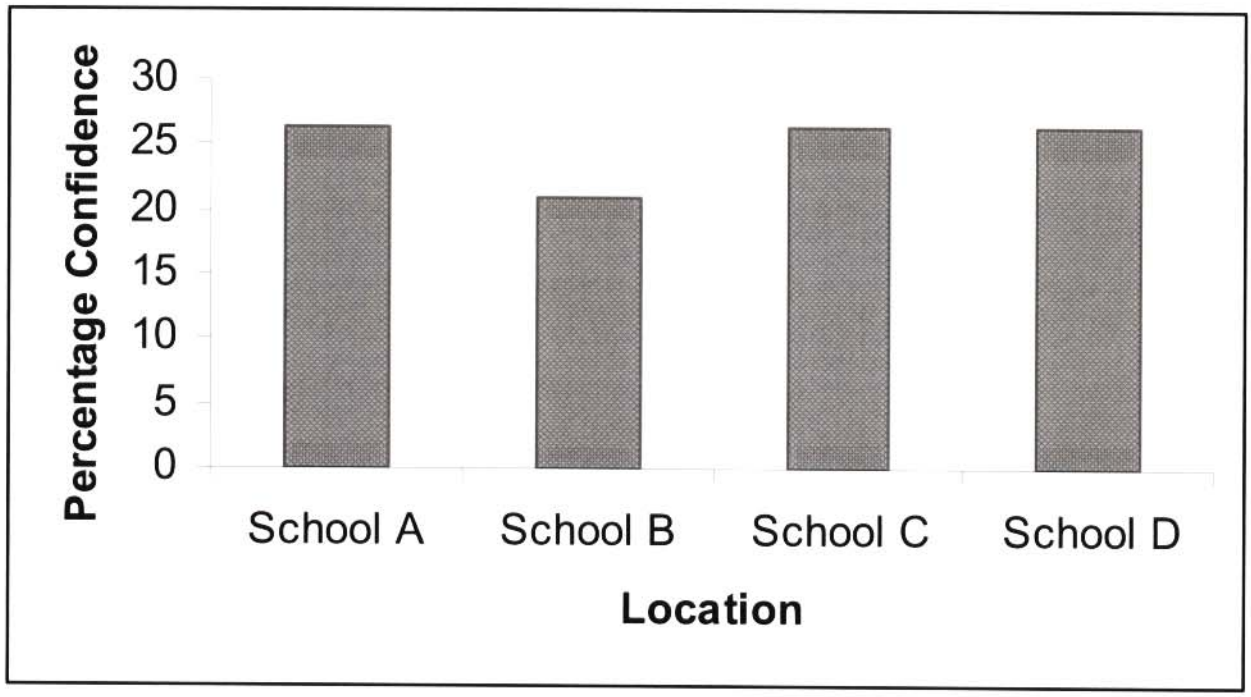


Figure 6: Summary of Educator Confidence

It has already been indicated that the main reason behind the educator confidence questionnaire was to establish and ensure that the items selected for the learners' test were suitable to investigate learners understanding of questions and instructions given in the mother tongue. This was mainly due to the researcher's view that critics of this research could argue that learners' performance in the test could be compounded by the fact that despite being in their mother tongue, the test could still require a great deal of mathematical skills and knowledge. An argument such as 'some of the questions could be unfamiliar if particular learners were not familiar with particular mathematical concepts' could seriously challenge and distort conclusions about learner understanding of the language used in the test instrument. To ensure that this argument is nullified, the researcher developed a test based on the four basic mathematical operations, which are: addition, subtraction, multiplication, and division. The use of these operations was informed by two reasons. First, the fact

that irrespective of background, learners would be able to understand questions that require the knowledge of such operations. Second, it was informed by the fact that two mathematics specialists[13] and material developers advised against the use of concepts that will require some form of advanced mathematical applications other than for basic mathematical operations. It is thus in this sense that the researcher required confirmation from the educators that the learners will not grapple with the mathematical skills as they completed the test instrument. So, if a poor performance in the test was experienced, the researcher would be able to conclude that the language (mother tongue) was responsible for the difficulties.

All educators had to make predictions about learner performance in each item of the test. This means that since there were 19 educators who had to predict twenty items each, the researcher expected a total of 380 responses / predictions. However, for some reason, not all educators responded to all items as some left one or two unpredicted. This resulted in a total of 369 predictions. From the total of 369 which was counted, only in 68 (18.43) cases did the educators believe the learners were not going to get correct answers. Table 12 below shows that all the 19 educators who inspected the test responded by confirming their confidence (i.e. for 81.57 percent of the questions) that the mathematics test would be simple enough for their learners and that they should do well. In other words, the educator's predictions showed that they were in 301 cases confident of their learners' performance:

	Overall		***Between***		***Within***
Num	**Freq.**	**Percent**	**Freq.**	**Percent**	**Percent**
No	68	18.43	14	17.68	25.00
Yes	301	81.57	19	100.00	81.57
Total	**369**	**100.00**	**33**	**173.68**	**57.57**

Table 12: Educator Confidence (n = 19)

It is interesting to learn from tables 11 and 12 that the educators were confident in their learners' ability in almost all the items (about 82 percent). Even though this study was in line with the research methodology outlined in the previous chapter, the

[13] The specialist's refered to above are both mathematics material developers, and leading members of the Association for Mathematics Educators of Southern Africa (AMESA) – refer to footnote on page 6.

researcher was interested in analyzing the educators' differences in their prediction / confidence. So, to answer this question, the researcher subjected the educators' responses to a statistical analysis to compare the differences in educator beliefs at 95 percent degree of confidence. The results of this analysis are summarized in table 13:

						Number of obs	**= 369**
						Number of groups	**= 19**
						Obs per group: min	**= 18**
						Avg	**= 19.4**
						Max	**= 20**
Num		Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
School	B	-1.008183	.6969294	-1.45	0.148	-2.37414	.3577731
School	C	-1.752449	.6629258	-2.64	0.008	-3.05176	-.4531384
School	D	-.5955152	.6872001	-0.87	0.386	-1.942403	.7513722

Table 13: Difference[14] in prediction (per location)

As seen in table 13, the total number of items (obs) responded to by the educators in the study were 369. The minimum responses per respondent were 18 whilst the maximum were 20. Out of the total of twenty questions the educators on average responded to 19. This shows a very good response by the educators.

Prior to discussing the predictions as summarrised by the data in table 13, perhaps it is important to mention the fact that, although it may appear as if the table does not include School A, the performance of learners in all other participant schools are compared to school A. That is to say, School A serves as a point of comparison or was used to benchmark the comparisons. Statistically, any of the other three schools could have been used to serve this purpose (see, also footnote 14).

The results from table 13 indicate that according to the educators' belief, learners in School B were predicted by educators to be able to score at a constant decrease of about – 1.008 with every increase in items or questions than learners in School A.

[14] On the surface, it might seem from table 13 above that School A is not part of the comparison. However, all the other schools (B, C, & D) are compared to School A.

The learners from school D were predicted to be -0.595 less likely to get the correct answers.

The prediction for School A learners was that they would more likely get the correct answers than the learners in the other schools. Even though the learners in School A were predicted to be more likely to get the correct answers, the differences between them and those of School B and D were statistically insignificant. This is attested by their estimated *p-values* of 0.148 and 0.386 in table 13 respectively. However, an interesting observation was the educator beliefs which revealed a statistically significant difference in their predictions about Schools A and C. The educator's prediction revealed that School C was – 1.752 less likely to get correct answers than School A. Table 13 shows that Educators in School A and C differed significantly (*z - score* = -2.64; *p-value* <0.05). This might probably have resulted from several reasons. On the one hand, the researcher believes that the difference could be the result of the effect of the location at which these educators are based. On the other hand, it could be a result of the fact that the educators at School C could have decided to impress the researcher and respond in this way. Whether these predictions about the educators at School C are true or false will be answered by the analysis of the learners test in the section that follows.

Despite such responses the aim of this investigation was to ensure that the test used to investigate the learners understanding of instructions in mathematics through their mother tongue was not compounded by lack of mathematical literacy. In addition, this vigourous investigation was intended to ensure that the study did not loose sight of its aims and objectives. In other words, when the educators overwhelmingly predicted that their learners were likely to get correct answers in more than 80 percent of the items, it meant that the only reason attached to poor performance could be the language in which the questions and instructions were given. This proved that according to the educators, the learners test instrument was reasonably satisfactory as an instrument from which the researcher could make conclusions about learner understanding of mother tongue mathematics terminology. So, instead of looking at the learner performance in the test as an indication of mathematics proficiency, the researcher looked at it (learner performance) as an indicator for establishing learner understanding of the mathematics terminology as expressed in

the learners' mother tongue. The actual learner performance will be discussed in the next section.

5.5.2 Learners' Performance

As already indicated in the preceding section, the learners' understanding of the mother tongue terminology was quantitatively measured through the use of the mother tongue mathematics test specifically designed for this purpose. The results of the analysis are presented in tables and graphs from which summaries are drawn and discussed in this section. It was earlier indicated, through the discussion of the research instruments, that the learners test had a total of twenty items. All twenty items are presented in this section: First, the results of the test are presented through discussing item by item of the test. Then, at the end of the section, a general overview of the performance in the test is offered to consolidate the discussion of the test items.

The data for this study were collected in four different locations in the Mpumalanga province of South Africa. In particular, there were four schools which participated in this research, namely Thembalethu primary school, Dindela primary school, Kamkhulu primary school and Matjulu Primary school. For research purposes these schools were coded School A, B, C and D. This was done in line with the ethical principle of ensuring that in reporting about the data collected, the researcher ensures the anonymity of the participants. School A had a total of 55 learners; School B had a total of 43, while School C and D had 45 and 41 respectively. All in all, the four schools provided the researcher with a total of 184 learners. The following table provides a summary of the gender distribution of the learner participants:

Gender	*Freq.*	*Percent*	*Cum*
Male	87	47.28	47.28
Female	97	52.72	100.00
Total	**184**	**100.00**	

Table 14: Gender Distribution – Learners' Sample

Table 14 thus reveals that the learner population in this study comprised of a total of 97 females and 87 males. In terms of percentages, the female and male populations were about 53 percent and 47 percent respectively. The statistical analysis applied to this research shows that there was no significant difference in the total number of female and male participants in the participation. Hence, the researcher can make conclusions from the population assuming that they were equal. The following table (Table 15) presents the data about the first languages of the learners.

1st Language	*Freq.*	*Percent*	*Cum*
SiSwati	175	95.11	95.11
Xitsonga	6	3.26	98.37
IsiZulu	1	0.54	98.91
Sepedi	2	1.09	100.00
Total	**184**	**100.00**	

Table 15: First Language- Learners' Sample

The learners' first language was mainly SiSwati. The analysis of the learners demographic details revealed that a massive total (175) of the learners had SiSwati as their first language. The table shows that only nine (9) learners from the population had a different first language from SiSwati. From these nine learners, 6 indicated that their first language was Xitsonga, and 1 indicated IsiZulu as his or her first language. The remaining 2 indicated that their first language was Sepedi. In percentages the findings indicated that the languages were spread as follows: SiSwati – 95.11 percent, Xitsonga – 3.26 percent, IsiZulu – 0.54 percent, and Sepedi – 1.09 percent. The next table (Table 16) indicates a summary of the average age of the learner population.

Variable |	Obs	Mean	Std. Dev.	Min	Max
Age |	184	13.92391	1.278094	11	18

Table 16: Average Age of the Learners

The age of the learners who participated in the study varied from the youngest learner at age 11 (Min) and the oldest at age 18 (Max). However, on average most of the learners were at age 13.

In line with the aim of the study to ensure that learners were familiar with all the concepts of mathematics taught from grade 1 to 6, all learners who participated in the study were at grade 7 during the period when the data for this study were collected. The learners responded to a test which had instructions and all questions in the medium of SiSwati. The following section presents summaries of data about the learners' test results.

The first item in the test required the learners to give even numbers from a given series of numbers less than 15. The question was phrased as follows:

'From the series of numbers 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, give those that are divisible by 2'

The results of the learners' responses are presented in the following table.

Item 1	***Freq.***	***Percent***	***Cum***
Incorrect	29	15.76	15.76
Correct	155	84.24	100.00
Total	**184**	**100.00**	

Table 17: Learners' test – item 1

To understand this question and to complete the task, the learners had to understand three key terms in this question. These are *luhlu* (series), *niketa* (give), and *hlukaniseka nga* (divisible by – even numbers). The researcher expected most of the learners to understand what the question in item 1 required since according to their educators' predictions the item was supposedly easy.

From Table 17, it is clear that most of the learners in all four different locations understood what the test item required, proving their educators' predictions as correct. This is attested by the low percentage, 15.76 percent of the learners who got the question wrong. Generally, a high number of learners (about 84 percent) across the four schools understood this question. In addition, the pattern of responses (that is, the proportion of learners that got it right to the proportion that did not) in the study

is significantly different (p=0.003). Graphical representation of these results follows below as figure 7:

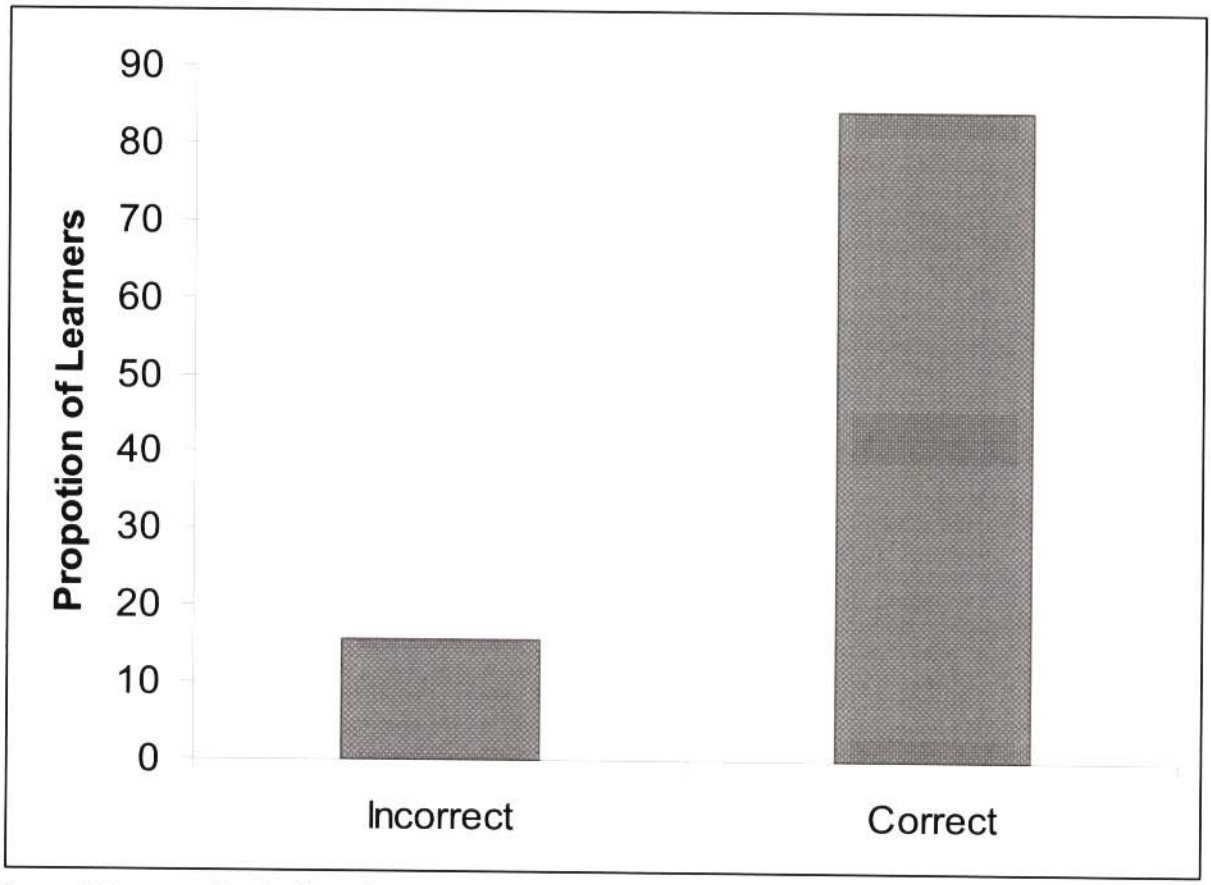


Figure 7: Learners' test – Item 1

The second item of the learners test required the learners to give odd numbers from a series of numbers less than 14. From the educators' prediction, it was found that this question would also be easy for the learners. Thus, a mismatch between the educators' prediction and the learners' actual performance would suggest a poor understanding of the key words in the question which are: *luhlu* (series), *niketa* (give), *letingahlukaniseki nga* (numbers not divisible by – odd numbers).

Table 18 and the following graph show the pattern of responses observed through analysis of item 2 of the learners' performance in the test:

Item 2	*Freq.*	*Percent*	*Cum*
Incorrect	94	51.09	51.09
Correct	90	48.91	100.00
Total	**184**	**100.00**	

Table 18: Learners' test – item 2

According to table 18, it is obvious that unlike item 1 (even numbers) which revealed a high number of learners understanding the item, the results for item 2 show that, with regard to odd numbers (numbers not divisible by 2), a noticeable number of learners (94 out of 184, which represents about 51 percent) did not understand what was required by this question. Thus the proportion of learners that got this question wrong against the one that got it correct was 51 percent. Despite this performance, however, one cannot generalize that most learners did not understand this question because even though 51 percent is a noticeable propotion, the percentage of those who got this question correct (about 49 percent) is still substantially high.

In other words, the conclusion about this item is that there is no significant difference between the learners who got the item correct and the ones who got it wrong. The data from table 18 can be illustrated graphically in figure 8 as follows:

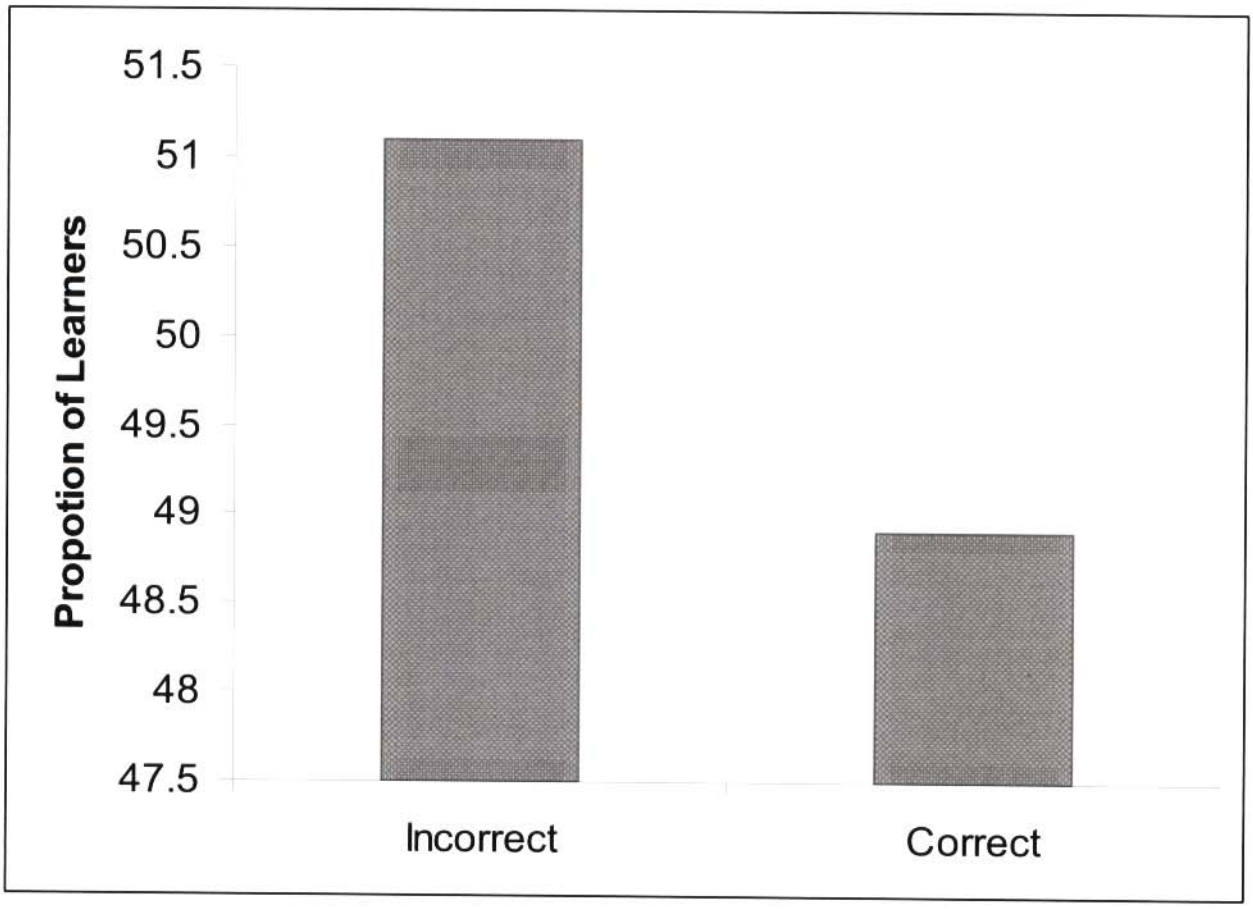


Figure 8: Learners' test – Item 2

Table 19 offers a summary of the question which required the learners to give a series of five even numbers that follow each other. The key words to understand in this question were *bhala* (write), *luhlu* (series), *letisihlanu* (five), and *letihlukaniseka ngakubili* (even numbers). As was seen in section 5.4.1, most educators believed that their learners will be able to understand this question. According to the subsumed thesis in this research, this entails that a poor performance in the item will not reflect poor mathematical literacy, but a lack of understanding of the instruction given through the mother tongue of the learners in the study. The results of the analysis of this item are presented in table 19 and figure 9:

Item 3	***Freq.***	***Percent***	***Cum***
Incorrect	89	48.37	48.09
Correct	95	51.63	100.00
Total	**184**	**100.00**	

Table 19: Learners' test – item 3

As shown in Table 19, the results of the study indicate that in direct contrast to the previous item (2) about 48 percent of the learners failed to understand this question. This represented a total of 89 learners out of the total of 184. Almost 52 percent of the learners in the study understood the instruction in this item as a total of 95 learners answered it correctly. Further, amongst those that failed to understand this question, further analysis showed that some of them did not understand the requirement of the question, namely 'a series of five numbers' as expressed by the instruction *Bhala luhlu lwetinombolo ... letilandzelanako*. This led to most of them giving either less or more than five numbers. For example, learner number 79 in school B gave a series of six numbers as follows: 2, 4, 6, 8, 10, 12. The results of this analysis are clarified in a summary presented as figure 9:

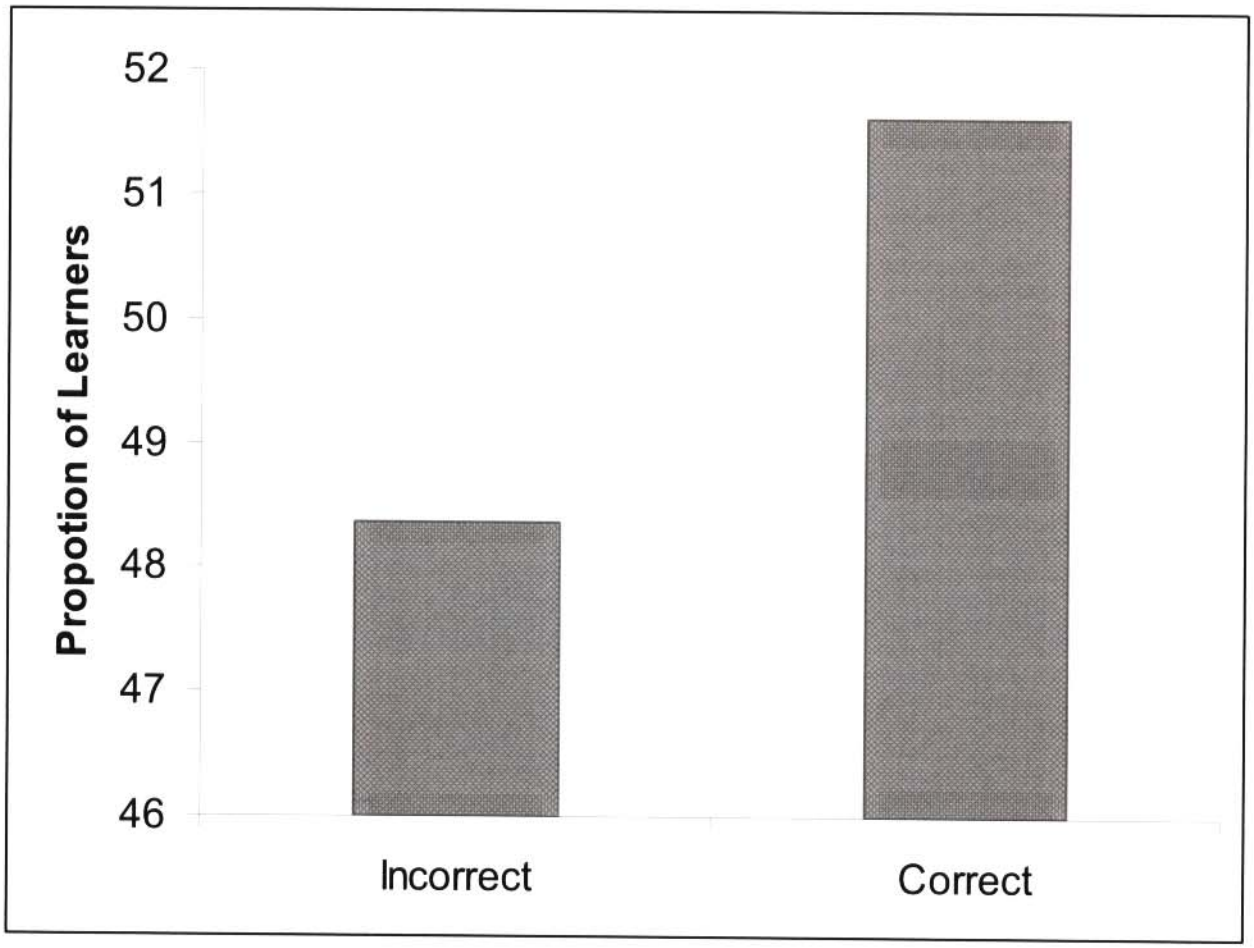


Figure 9: Learners' test – Item 3

The results to the question asking for similar responses with regard to odd numbers are presented in table 20.

Item 4	*Freq.*	*Percent*	*Cum*
Incorrect	99	53.80	53.80
Correct	85	46.20	100.00
Total	**184**	**100.00**	

Table 20: Learners' test – item 4

The above table (Table 20) shows that from a total of 184 learners 99 did not understand the question and thus answered it incorrectly. Only 85 learners understood the question, hence, their correct answers. This represents about 54 percent learners who did not understand the question and about 46 percent who understood the question. Similar to the previous item, amongst those who did not understand this question it appeared that the instruction *Bhala luhlu lwetinombolo … letilandzelanako* proves to be difficult to understand. It is worth mentioning that this lack of understanding was more evident at School B which had the highest percentage of learners who did not get a correct answer for the question. This is against their educators' prediction that their learners 'would find the question easy'. The researcher inferred that this could be the result of learners' lack of understanding of the terms used in the mother tongue instruction. It will be observed on the basis of the next items whether this trend (lack of understanding) will continue. Figure 10 graphically summarises these results:

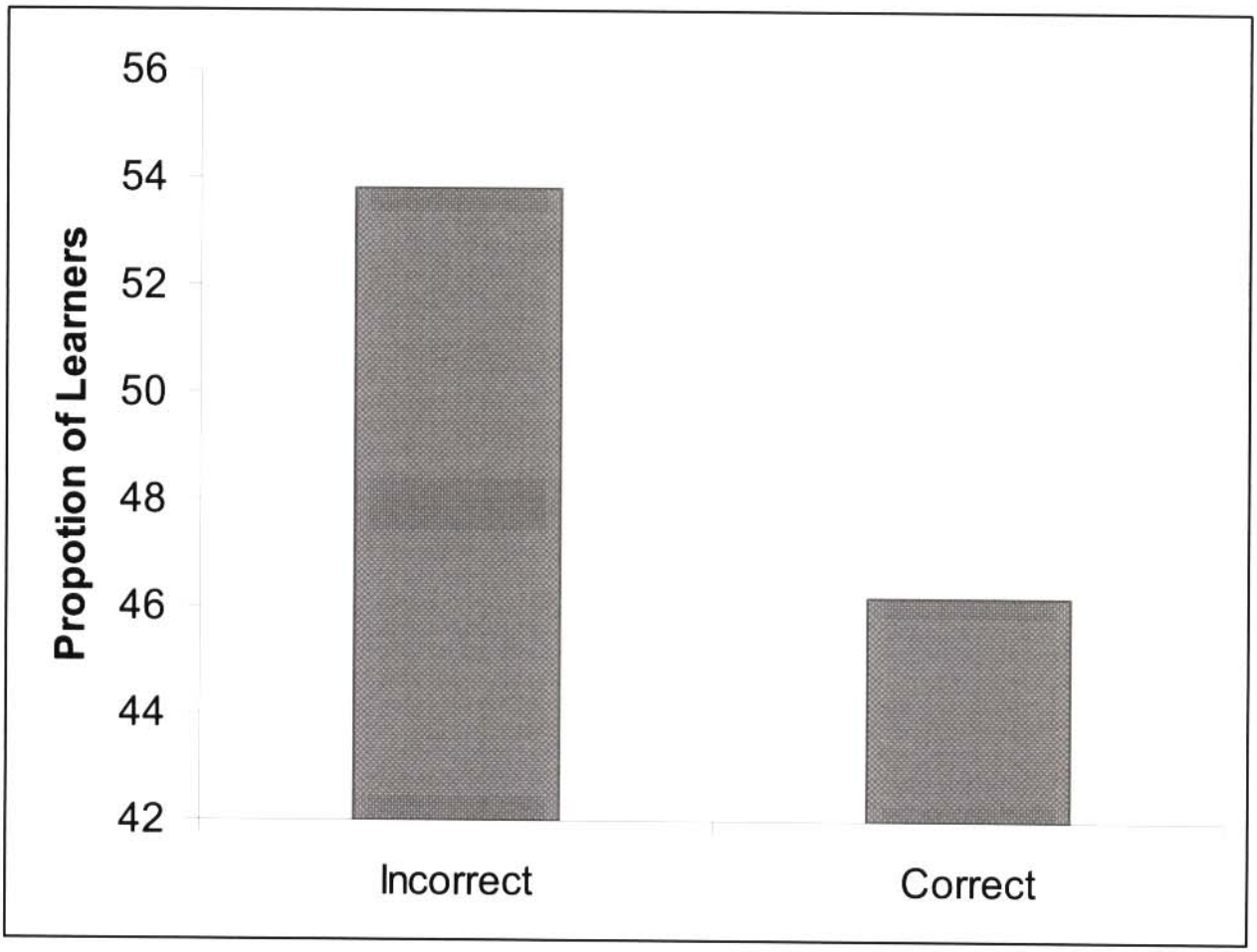


Figure 10: Learners' test – Item 4

According to figure 10 it is evident that the percentage of learners who did not understand this item is marginally higher (about 55 percent) than those who understood it. On the other hand, the percentage of learners who understood the question lies at about 45. Whether or not a similar trend will prevail in the next section will be answered by the next table and figure which presents results for the item that required learners to "write four numbers that come before 77".

Item 5	*Freq.*	*Percent*	*Cum*
Incorrect	184	100.00	100.00
Correct	0.0	0.0	100.00
Total	**184**	**100.00**	

Table 21: Learners' test – item 5

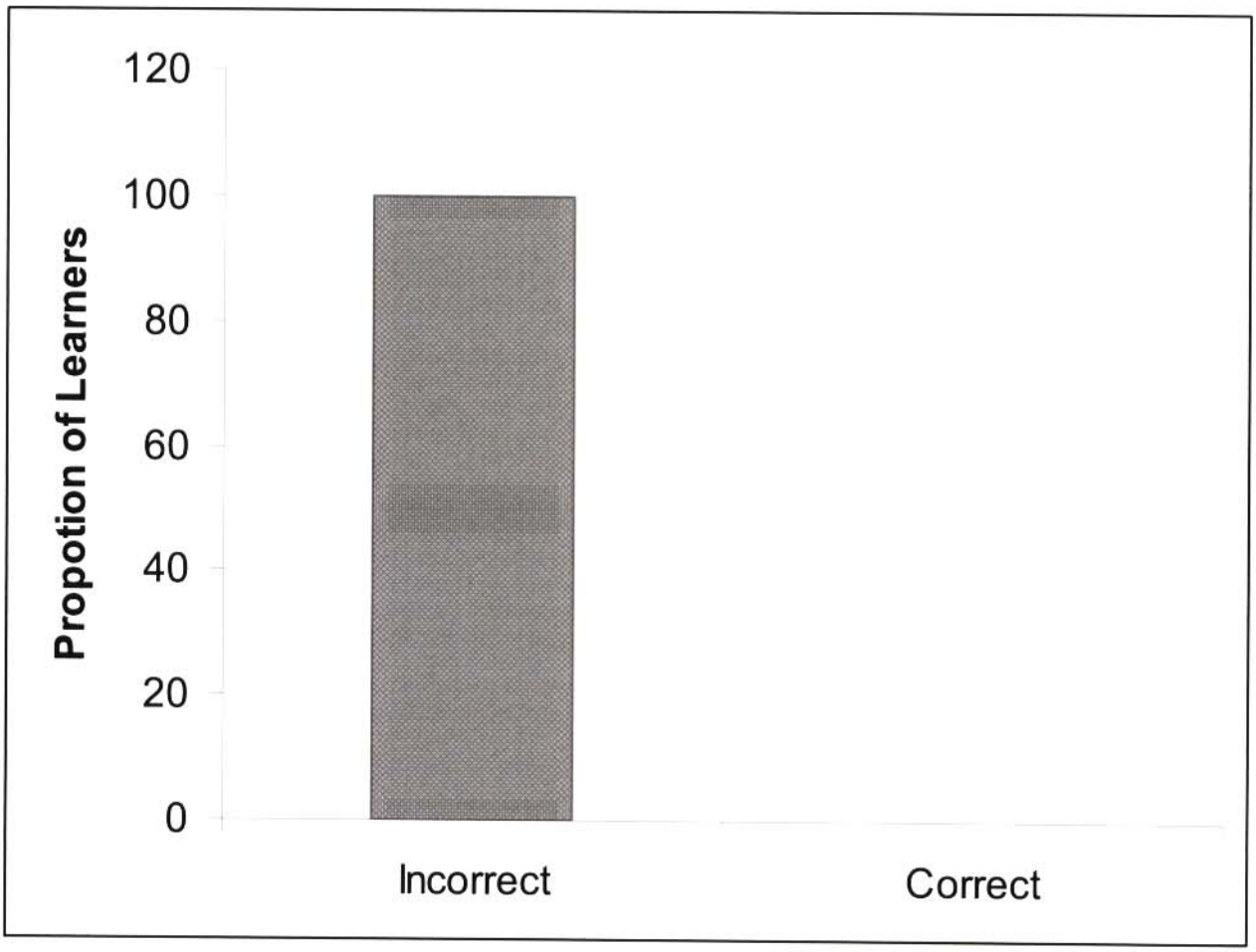


Figure 11: Learners' test – Item 5

The instruction for this item was "*Bhala tinombolo tibe tine letisembikwa 77*". The question in this item required the learners to 'write four numbers that come before 77'. The key word in the instruction for this item was *letisembikwa* meaning - before. The table above (table 21) shows that all learners in all four schools (i.e. 100 percent) failed to understand what the question required. It is surprising that not even a single learner understood the question and answered it correctly. From the learners' responses, the researcher can tell that most of the learners confused the term - *letisembikwa* – and assumed it to mean after. This is because most learners had written numbers which come after 77. It is worth mentioning that from the researcher's observation, while the learners were completing the instrument, it was clear that most learners were struggling to understand what the question required. This was evident when some would even ask for clarity about the concepts before and after. Perharps this should not be suprising, since, in a study which tested the comprehension of 'before' and 'after', Clark (1971) found that learners understanding

of temporal relationships in terms of their comprehension of sentences containing clauses linked by 'before' and 'after' where often confused. Hence, Clark (1971: 271) ascribed this comprehension difficulty to the "order of mention and main-subordinate relations strategies in children's interpretation of temporal order information." The researcher in this study is of the opinion that, the difficulty in conceptual understanding of the SiSwati equivalents for 'before' and 'after' may arise from the same reason mentioned in Clark (1971). In addition a study by Winskel (2003) reveals some evidence linking difficulties in comprehending clauses linked by 'before and 'after'. Hence, Winskel (2003: 81) indicates that "most students' difficulties have been linked to their cultural orientation". Whether or not any cultural reasons can explain the findings of this study remains unknown and might importantly be the focus of further studies.

It will also be interesting to observe the next table (Table 22) which presents' data about item 6 which required the learners to write four even numbers that come before 77.

Item 6	***Freq.***	***Percent***	***Cum***
Incorrect	182	98.91	98.91
Correct	2	1.09	100.00
Total	**184**	**100.00**	

Table 22: Learners' test – item 6

From the pattern of responses summarized in table 22 above, it can be seen that an overwhelming proportion of the learners did not understand the question in this item. About 99 percent of the learners did not understand it whilst only about 1 percent understood the question. If item five is to serve as a point of reference, it is not surprising to see such a similar trend. However, what leaves much to be desired is the question "why almost all the learners in all the schools did not understand the question?". The researcher's prediction is that the problem with this question and the one that precedes it is the use of the term *letisembikwa* – as it seems to be confused by the learners to mean after and not before. The graphical representation (figure 12

below) of the performance in this item clearly shows the lack of understanding which is predominant in this item.

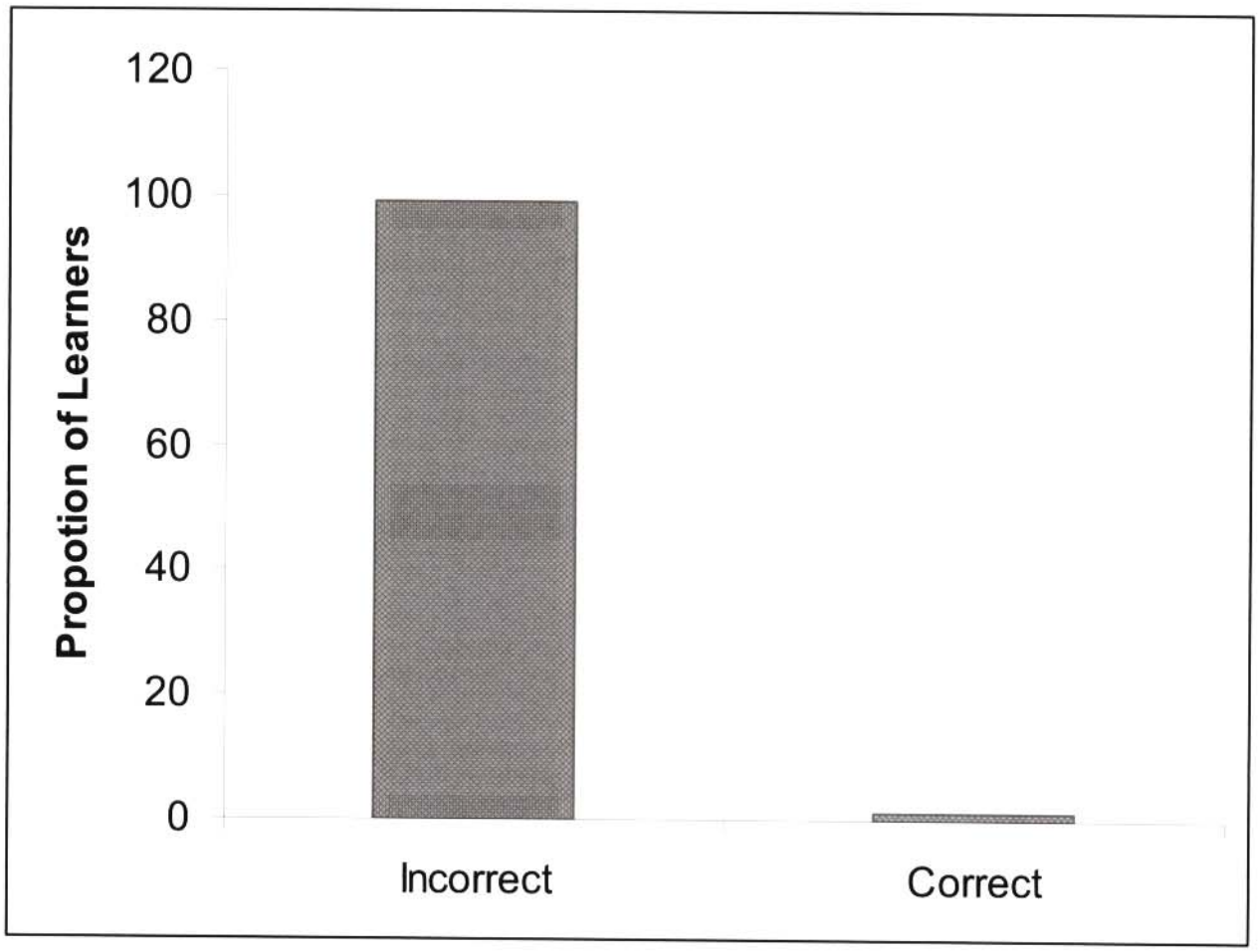


Figure 12: Learners' test – Item 6

The next table (Table 23) presents a summary of the results of the analysis for item 7 of the learners test.

Item 7	*Freq.*	*Percent*	*Cum*
Incorrect	180	97.83	97.83
Correct	4	2.17	100.00
Total	**184**	**100.00**	

Table 23: Learners' test – item 7

The pattern of responses reflected in 23 above shows that the trend in the previous item (cf.: table 16) seems to have been maintained because a high number of learners across all four locations did not understand what the question required. This

is reflected in the extremely high number of learners (180) who did not understand this question against the very low number of learners (4) who got the correct answers. Figure 13 below shows a summary of the performance of all learners in this item.

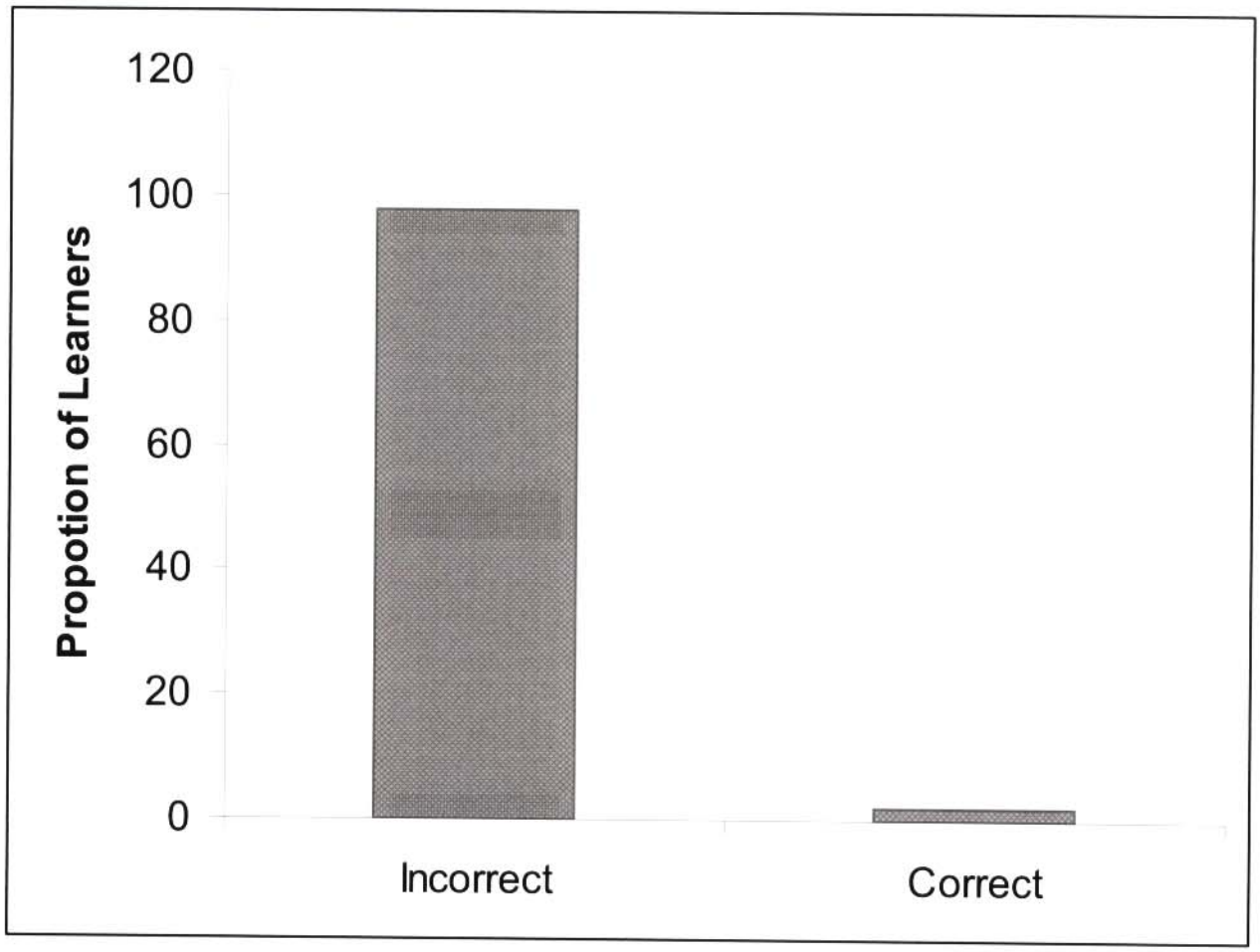


Figure 13: Learners' test – Item 7

This figure reveals that the trend has remained the same as in the previous items. There seems to be a high number of learners who did not understand the question as phrased in their mother tongue. The researcher in this study was prompted to further investigate the matter to find out which schools had only a few learners who got the questions correct. Figure 14 presents the results of this investigation.

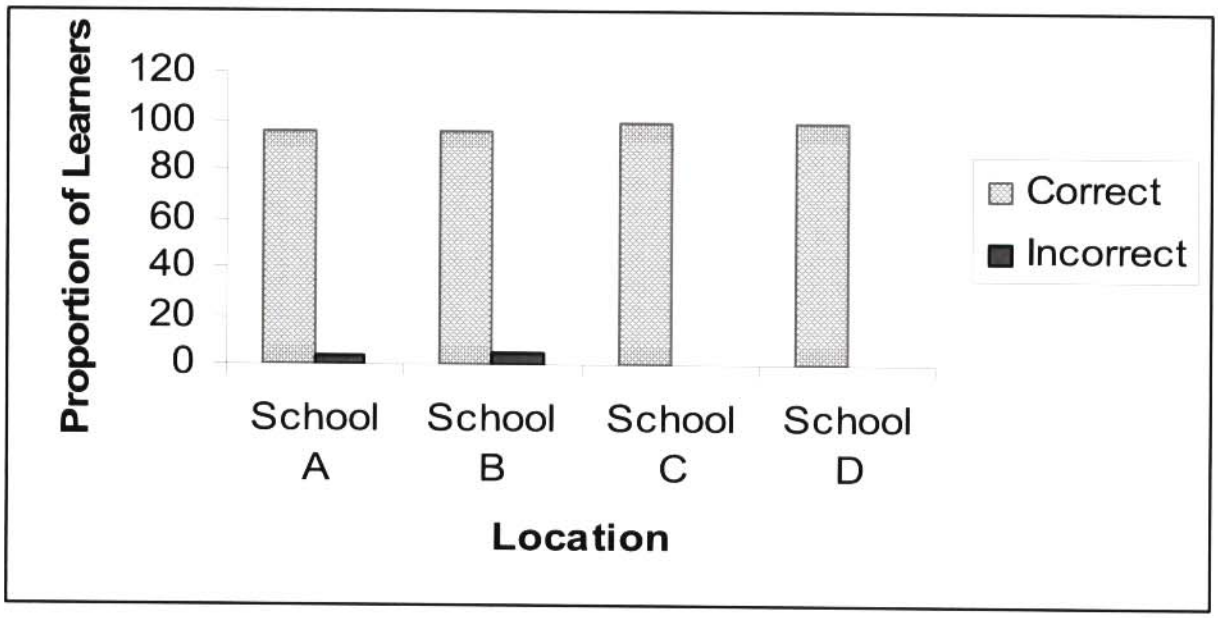


Figure 14: Learners' test – Item 7 (according to location)

According to figure 14, in line with the results presented by figure 13, there is a high level of misunderstanding of the instruction across the four schools. In particular, all learners from Schools C and D did not understand the question. Both these schools produced 100 percent incorrect answers for this particular item. From the other two schools 2 learners per school managed to get the correct answer for this item. From the pattern of responses summarized by table 23 and figures 13 and 14, it is obvious that almost all learners in the four locations had a problem understanding and interpreting what was meant by the concept 'before' as it is expressed in their mother tongue. While this issue is puzzling to the researcher, perhaps it calls for further reflections about the population of learners and educators who participated in the study. In the next table (Table 24) the results for the item which required learners to give all numbers between 77 and 107 are discussed.

Item 8	*Freq.*	*Percent*	*Cum*
Incorrect	2	1.09	1.09
Correct	184	98.91	100.00
Total	**184**	**100.00**	

Table 24: Learners' test – item 8

The item of which the results are presented in table 24 above was phrased as follows: *Bhala tonkhe tinombolo letitfolakala emkhatsini wa 77 na 107* meaning 'Write down all numbers that are found between 77 and 107'. The key word in the question presented in the above table was *emkhatsini* – meaning between. In contrast to the previous items, the learners showed a high level of understanding when it came to this question. Hence, the pattern of results shows that a large proportion of learners (approximately 99 percent), understood this question and gave the expected answers. This was also in line with their educators' prediction that projected that their learners will understand the question in this item.

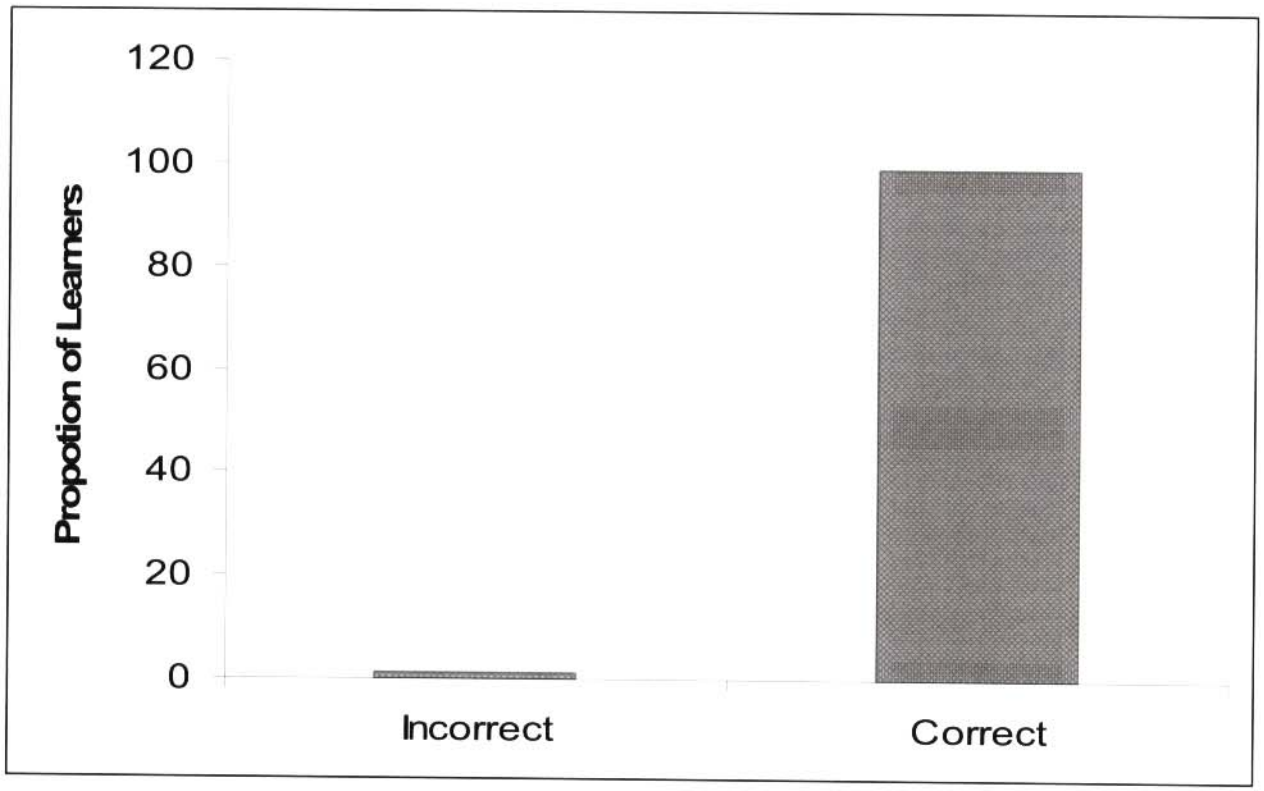


Figure 15: Learners' test – Item 8

Looking at figure 15 above, it is evident that only a negligible proportion of around 1 percent did not understand this item. The next item discussed in this section required the learners to 'give all numbers divisible by 5 from item 8'.

Item 9	*Freq.*	*Percent*	*Cum*
Incorrect	149	80.98	80.98
Correct	35	19.02	100.00
Total	**184**	**100.00**	

Table 25: Learners' test – item 9

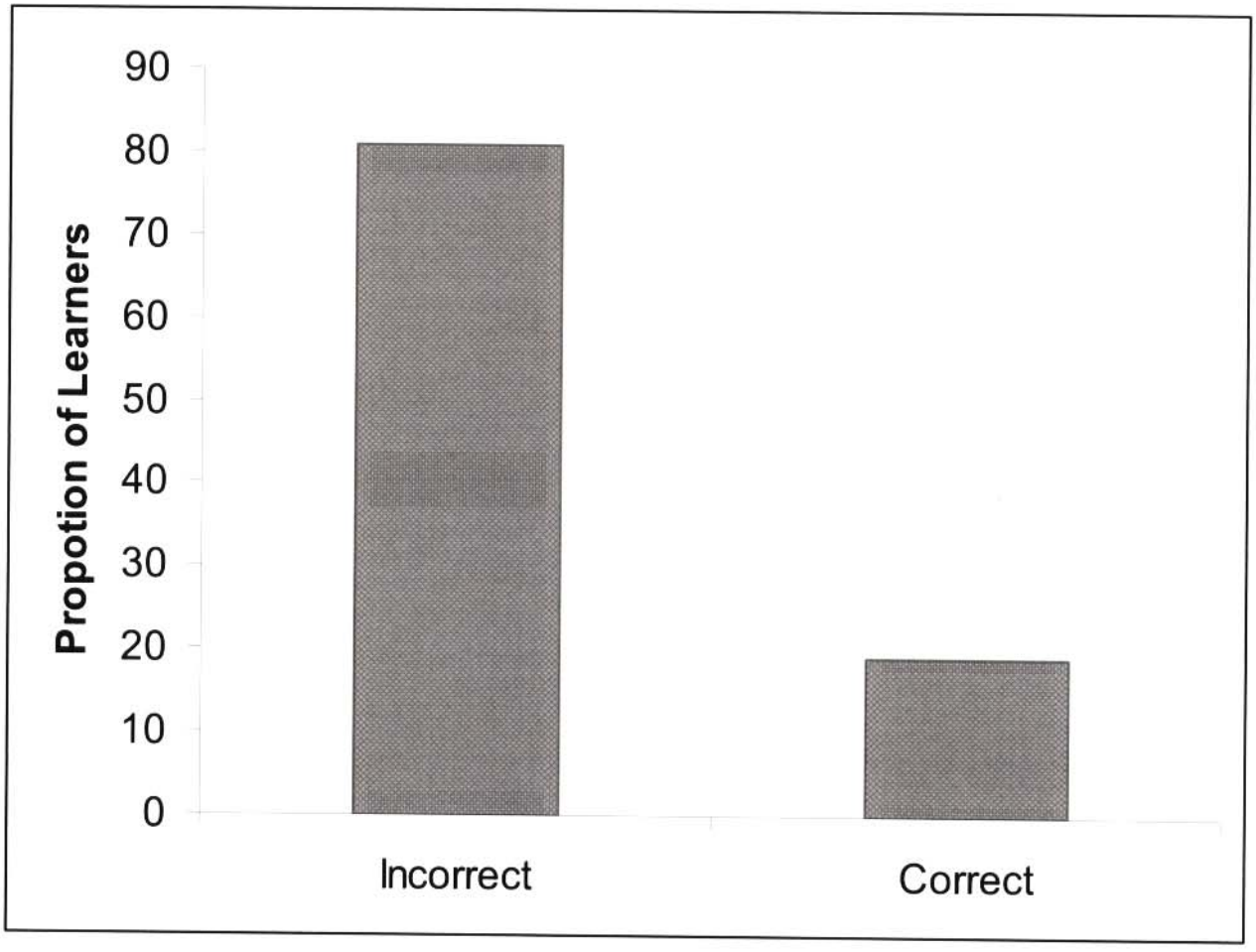


Figure 16: Learners' test – Item 9

The question was phrased as follows: *Ngutiphi taletinombolo ku 8 ngenhla letihlukaniseka nga 5?* This question means: 'Which of the above numbers in 8 are divisible by 5?' The key words to this item were *letihlukaniseka nga 5*. The pattern of

responses reflected in table 25 and figure 16 shows that there was an extremely high number of learners (149) who did not understand what the item required. This high number of learners represented about 81 percent of the population. Only about 19 percent of the total population understood the item. In the researcher's view, it appears that the expression 'divisible by 5' as phrased in the mother tongue of the learners '*letihlukaniseka nga 5*' seemed to be difficult to understand for the learners.

The following item required the learners to write two numbers from the previous one (item 9), that can add up to 180. The question to be answered in this item was constructed as follows:

Kuletinombolo lotibhale ku 9 ngetulu, ngutiphi letihlanganiswa tifike ku 180? Which means 'From the numbers in 9 above, which two numbers add up to a total of 180?'

The key words for this question were *ngutiphi* (which) *letihlanganiswa* (can be added) *tifike ku* (to total) *180?* In showing their understanding of the question / instruction in this item, the learners had to write the correct numbers as 100 and 80 as they were the only numbers that add up to 180. The results for the analysis of this item are presented in table 26 which is accompanied by figure 17.

Item 10	***Freq.***	***Percent***	***Cum***
Incorrect	111	60.33	60.33
Correct	73	39.37	100.00
Total	**184**	**100.00**	

Table 26: Learners' test – item 10

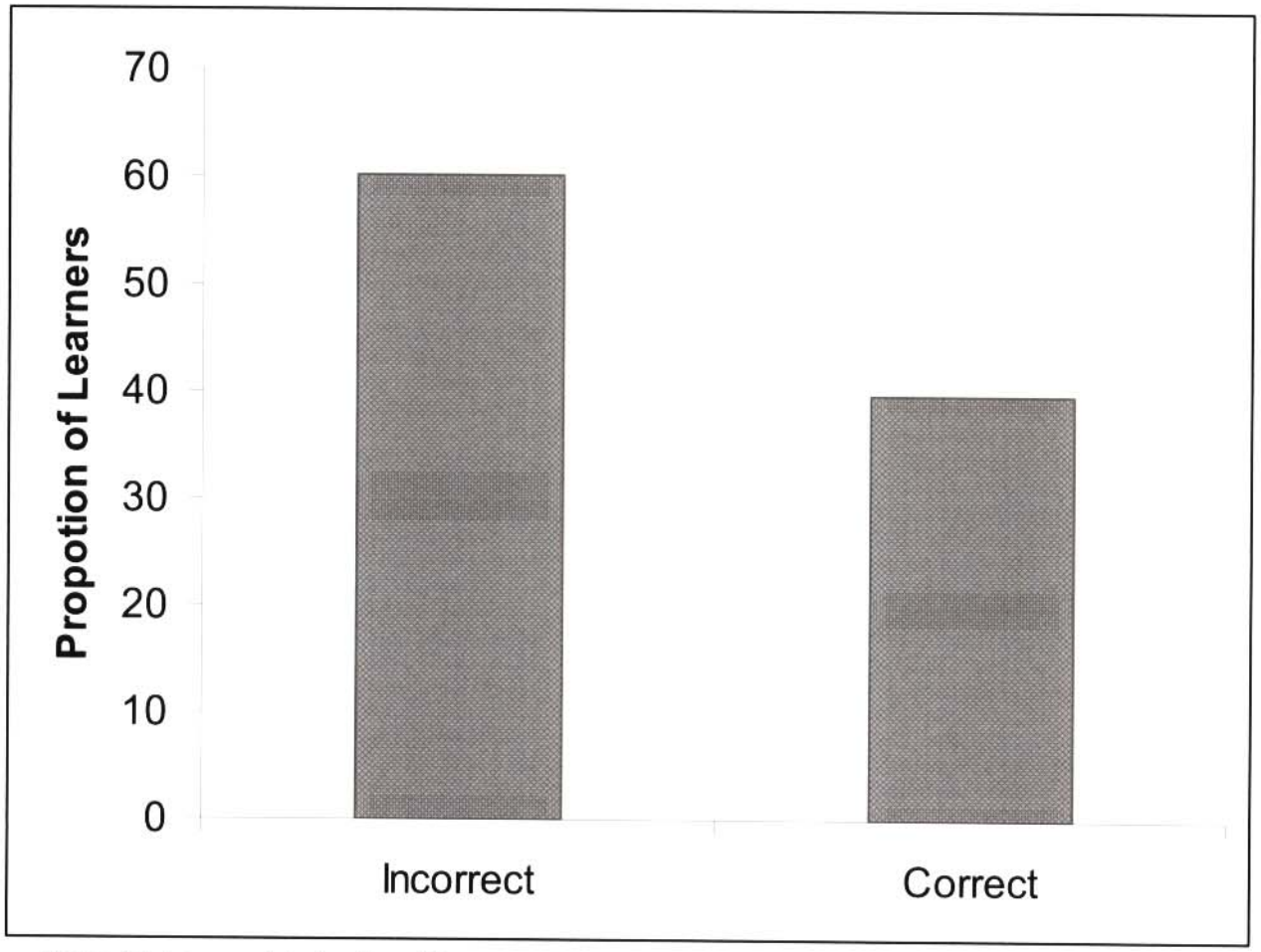


Figure 17: Learners' test – Item 10

The results presented in this instance reveal that a majority of the learners did not understand the question in this item. With regard to this item about 60 percent (the majority) of the learners did not understand the question in item 10. Almost 40 percent of the learners' population understood this question and answered it correctly. The researcher found that most of the learners who did not understand what the question required assumed that 90 + 90 was also a correct answer. However, as the question clearly reflected, the learners were required to write two numbers that add up to 180 from the ones given in the previous item. The numbers only included 100 and 80. Most learners did not understand this question. The researcher concluded that the reason for the high level of misunderstanding amongst learners was directly caused by an obvious misconception as learners presumed that the numbers to be given could be repeated, as long as they appeared once in the preceding item. This was evident as in their answers most learners gave 90 + 90, a 'correct' answer on the surface, but wrong if one understood the question correctly. Table 27 thus presents

data about an item that investigated learners understanding of the question that required them to show equalities.

Item 11a	*Freq.*	*Percent*	*Cum*
Incorrect	7	3.81	3.81
Correct	177	96.19	100.00
Total	**184**	**100.00**	

Table 27: Learners' test – item 11a

The question which elicited responses presented above was phrased as follows:

Cedzela nati tibalo ukhombise kulingana which means 'Complete the following equalities'.

The key words to be understood by learners in this item are, *cedzela* meaning 'complete', and *kulingana* meaning 'equalities'. The results of the analysis of this item as summarized in table 27 show that learners understood the instruction which was in their mother tongue. This is shown by the large number of learners (177) who got the item correct. This large number represented about 96 percent level of understanding. Only seven learners did not understand the item, representing about 4 percent of the population. The graph in figure 18 accompanies table 28 and further clarifies the results of the analysis of this item.

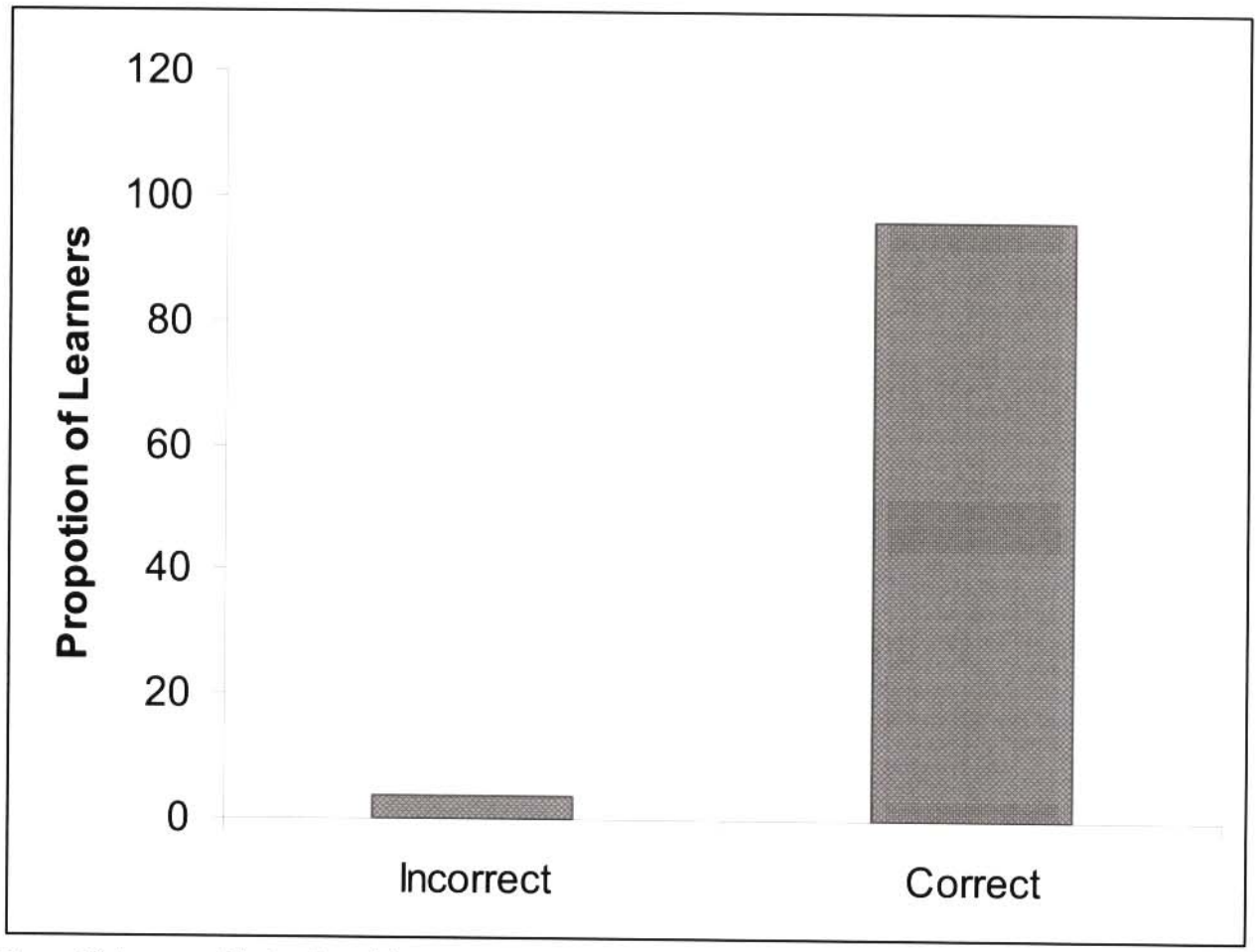


Figure 18: Learners' test – Item 11a

The next item (11b) was also about a similar concept of equalities. The key words to this item remained the same as in item 11a. The results of the analysis of this item are presented in table 28 and figure 19:

Item 11b	*Freq.*	*Percent*	*Cum*
Incorrect	14	7.61	7.61
Correct	170	92.39	100.00
Total	**184**	**100.00**	

Table 28: Learners' test – item 11b

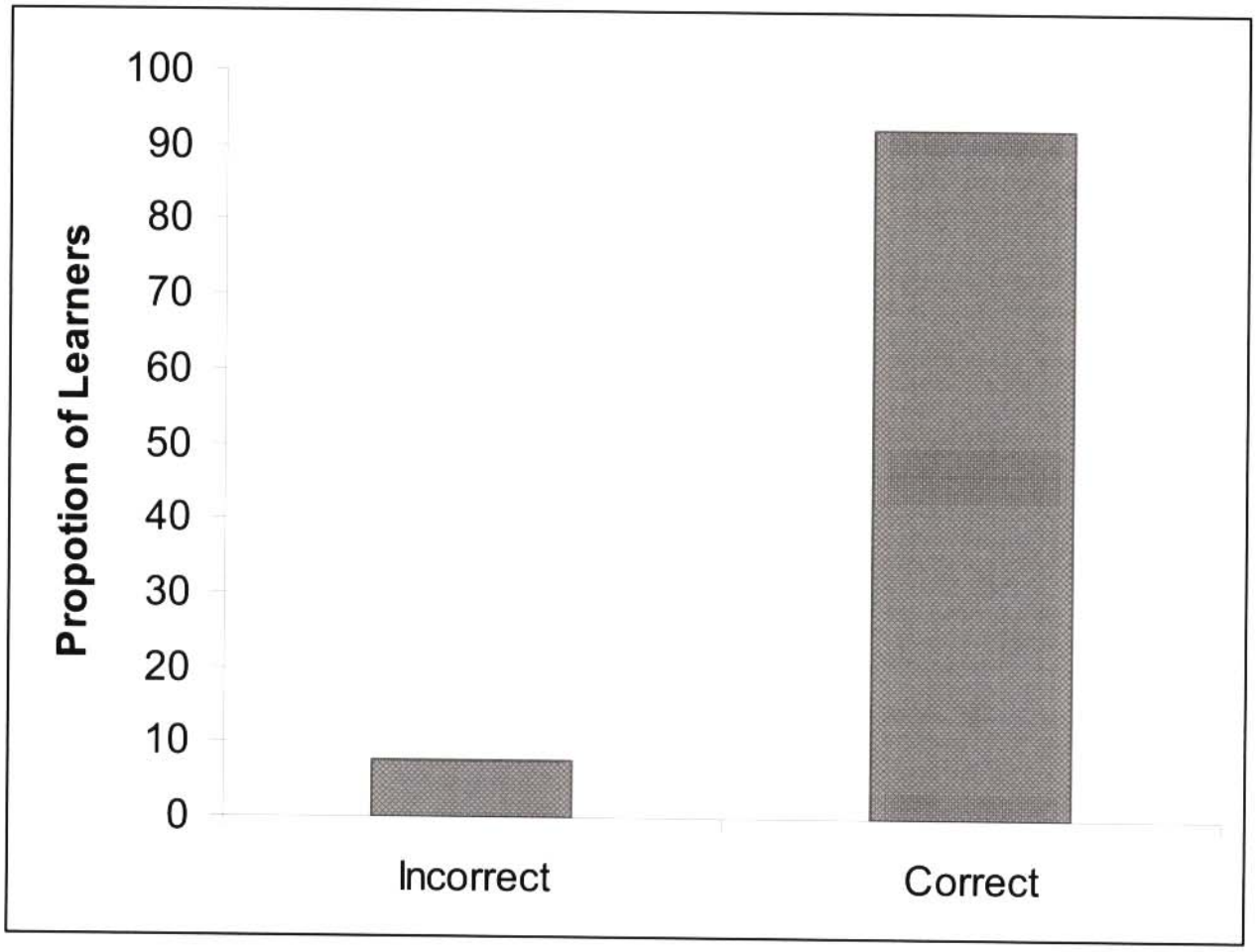


Figure 19: Learners' test – Item 11b

The results of the analysis of item 11b show a trend similar to that observed in item 11a in that, there was a high level of understanding of the question in the item. In item 11b, about 92 percent of the total population of learners understood the item, while about 8 percent did not understand the item and thus gave wrong answers.

The next tables (Table 29 & 30) present the results of the data about an item where the learners were supposed to - 'according to the instruction' – judge whether the equalities were 'true' or 'false'. In the researcher's view of this item, it was necessary for the learners to understand the statement:

Kuphindzaphinza lenombolo 18 nga 3, kuyefana ne kutsatsa inombolo 18 uhlanganise katsatfu. Ngabe letibalo letilandzelako tiliciniso nobe cha?

This statement simply means – 'To multiply the number 18 by 3 is to take the number 18 as an added three times: 18 x 3 = 18 + 18 + 18. Are the following equalities true or false?'

The results of the leaner responses can be summarized as follows:

Item 12a	*Freq.*	*Percent*	*Cum*
Incorrect	62	35.03	35.03
Correct	115	64.97	100.00
Total	**177**	**100.00**	

Table 29: Learners' test – item 12a

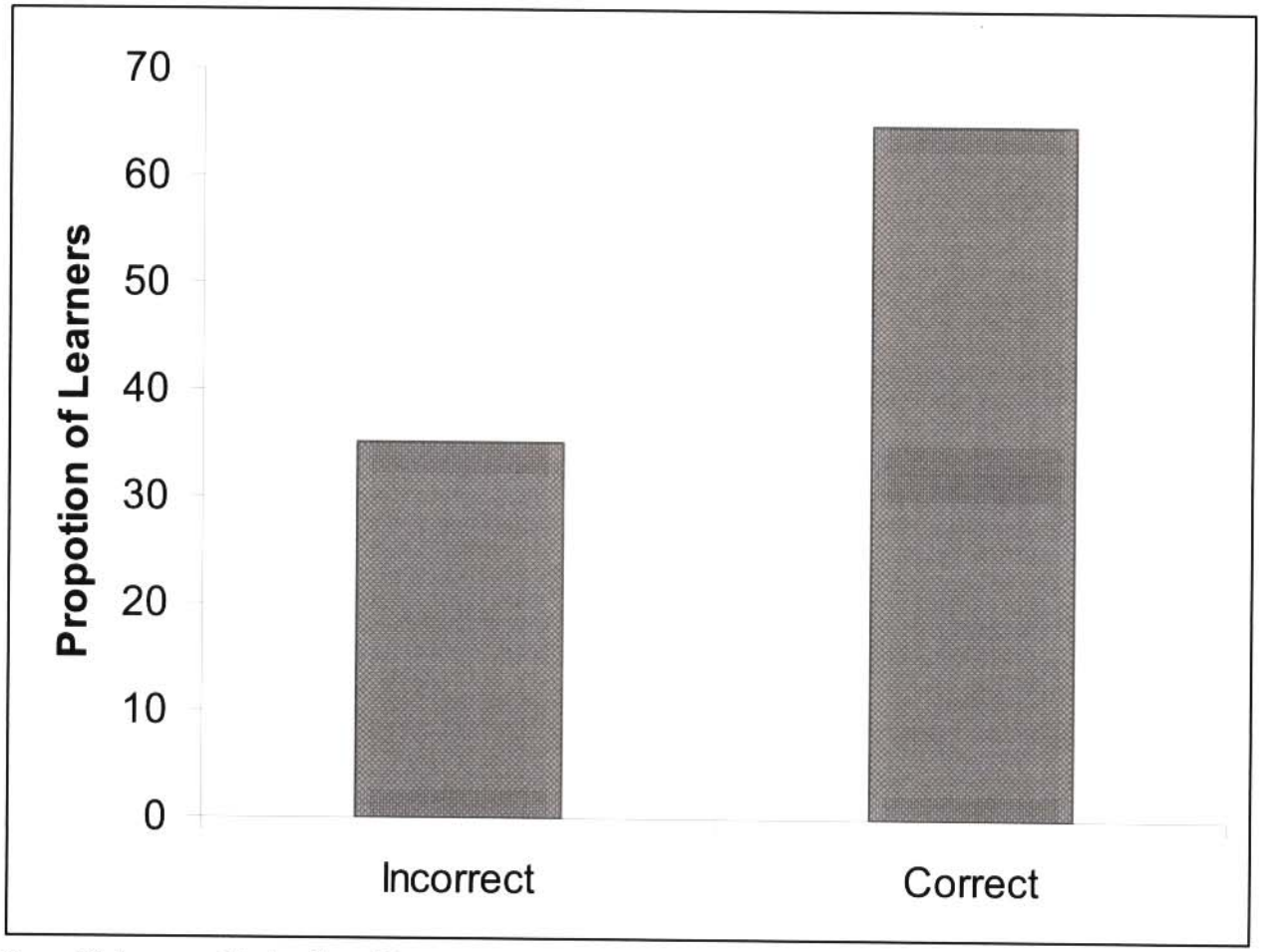


Figure 20: Learners' test – Item 12a

In table 29 a summary is presented of the learners' responses to the question which asked them to indicate whether 18 x 3 = 18+18+18 is correct or not. This table shows that 62 (about 35 percent) of the learners' population indicated that the item was

wrong, whilst 115 (about 65 percent) indicated that it was true. This is better clarified by figure 20 which graphically shows the difference between the learners who understood the item and those who did not understand it. The results of the second question in this item were as follows:

Item 12b	*Freq.*	*Percent*	*Cum*
Incorrect	61	34.08	34.08
Correct	118	65.92	100.00
Total	**184**	**100.00**	

Table 30: Learners' test – item 12b

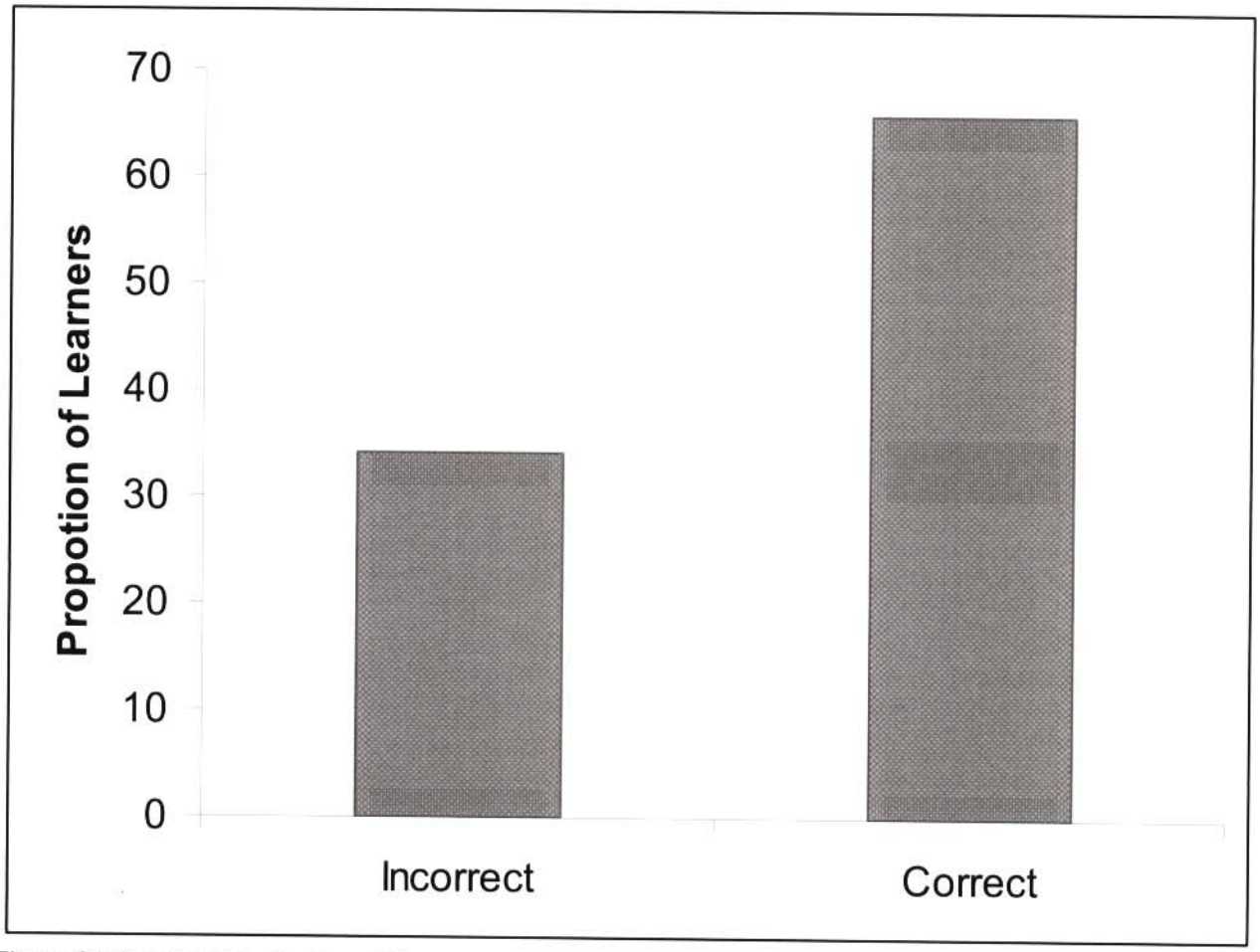


Figure 21: Learners' test – Item 12b

Like table 29, table 30 reveals that 61 learners did not understand that the item was correct. This amounts to about 34 percent of the population. About 66 percent of the learners correctly indicated that the item was true. Figure 21 gives a graphic representation of the results.

The next item (13) asked learners the following question:

Division is related to multiplication. To divide 8 by 2 means to find a number that is multiplied by 2 to give 8. What is that number?

In the mother tongue this question was phrased as follows:

Kukhipha lokuphindziwe kuyahambelana nekuphindzaphindza. Kususa 8 nga 2 ngekuphindzelela kuyafana nekutfola inombolo lengaphindvwaphindvwa nga 2 ikunikete 8. Nguyiphi lenombolo?

The summary of the results of the item is presented in table 31 and figure 22 respectively.

Item 13	***Freq.***	***Percent***	***Cum***
Incorrect	67	36.41	36.41
Correct	117	63.59	100.00
Total	**184**	**100.00**	

Table 31: Learners' test – item 13

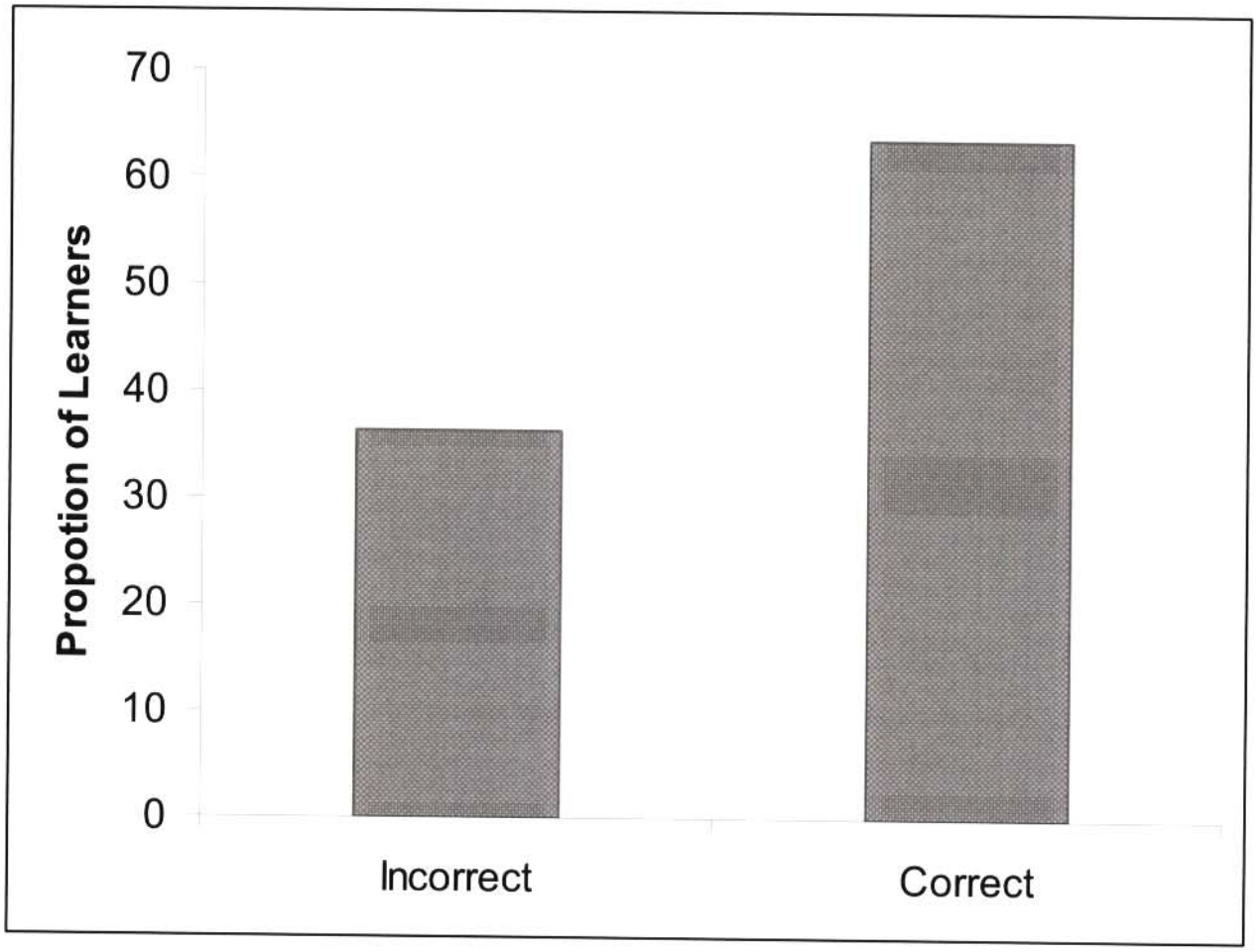


Figure 22: Learners' test – Item 13

The results in table 31 graphically represented in figure 22 above show that about 36 percent of the population did not understand the question, whilst about 64 percent understood it.

The next tables (Table 32 & 33) and figures (23 & 24) present results about an almost similar item (14). The only difference is that in this case learners had to deal with division. This means that learners had to understand the key word – *kukhipha lokuphindziwe* – division, in order to perform the correct task. The two questions in this item were asked as follows:

Hlola ngekuphindzaphidza kutsi kukhipha lokuphindziwe kwentiwe kahle kuletibalo letilandzelako:

a) *18 ukhiphe ngekuphindzelela nga 6 ulingana na 3 (Liciniso nobe Cha)*
b) *45 ukhiphe ngekuphindzelela nga 3 ulingana na 15 (Liciniso nobe Cha)*

In English this question would read as follows:

Check by multiplying whether the following divisions have been done correctly.

a. 18 divided by 6 equals 3 (True or False)
b. 45 divided by 3 equals 15 (True or False)

The learners who understood the task as instructed to them in their mother tongue gave their answers as True. Tables 32 and 33 present the results of the analysis of items 14a and 14b. For question (a), 100 learners (54 percent) understood this question, while 84 learners (56 percent) did not.

Item 14a	*Freq.*	*Percent*	*Cum*
False	84	45.65	45.65
True	100	54.35	100.00
Total	**184**	**100.00**	

Table 32: Learners' test – item 14a

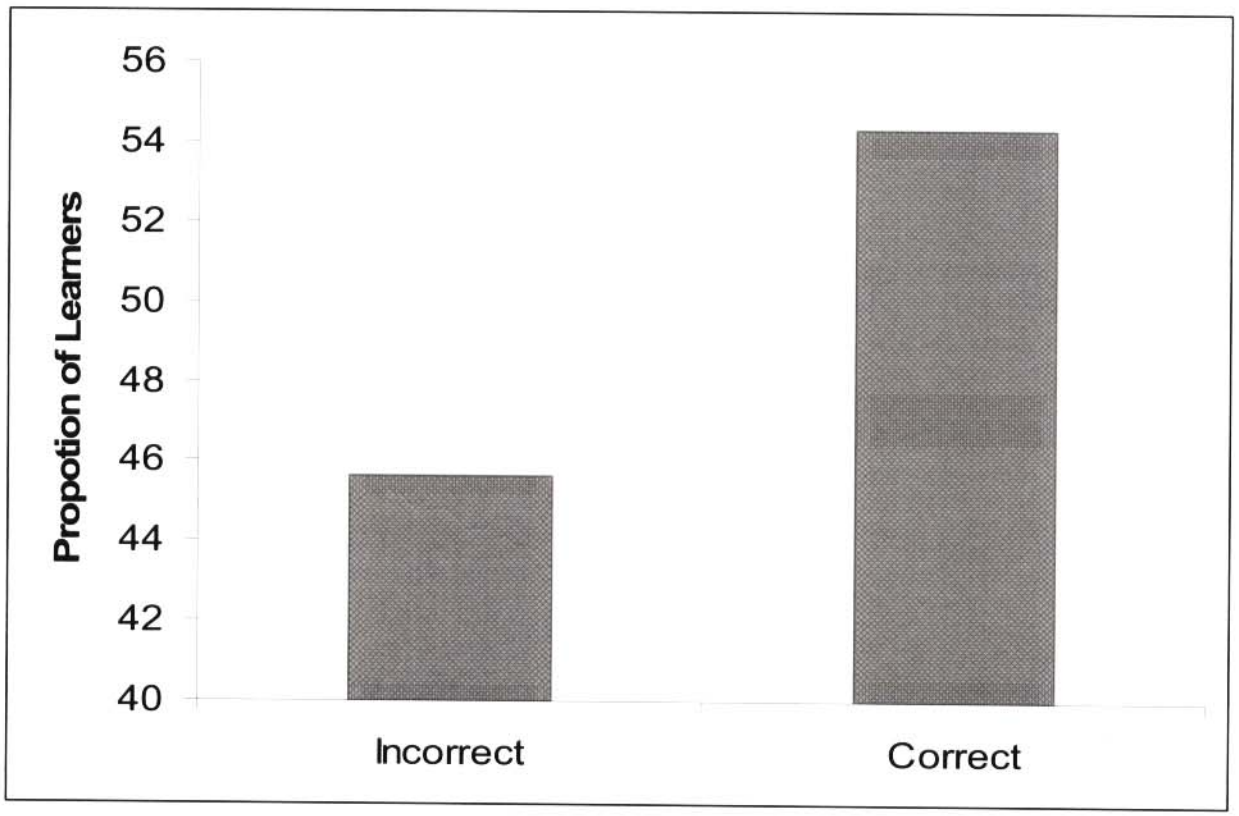


Figure 23: Learners' test – Item 14a

Table 33 shows a similar finding about question (b) in this item. A total of 82 learners (45 percent) did not understand the question, while a total of 102 (54) learners understood it.

Item 14b	*Freq.*	*Percent*	*Cum*
False	82	44.57	44.57
True	102	55.43	100.00
Total	**184**	**100.00**	

Table 33: Learners' test – item 14b

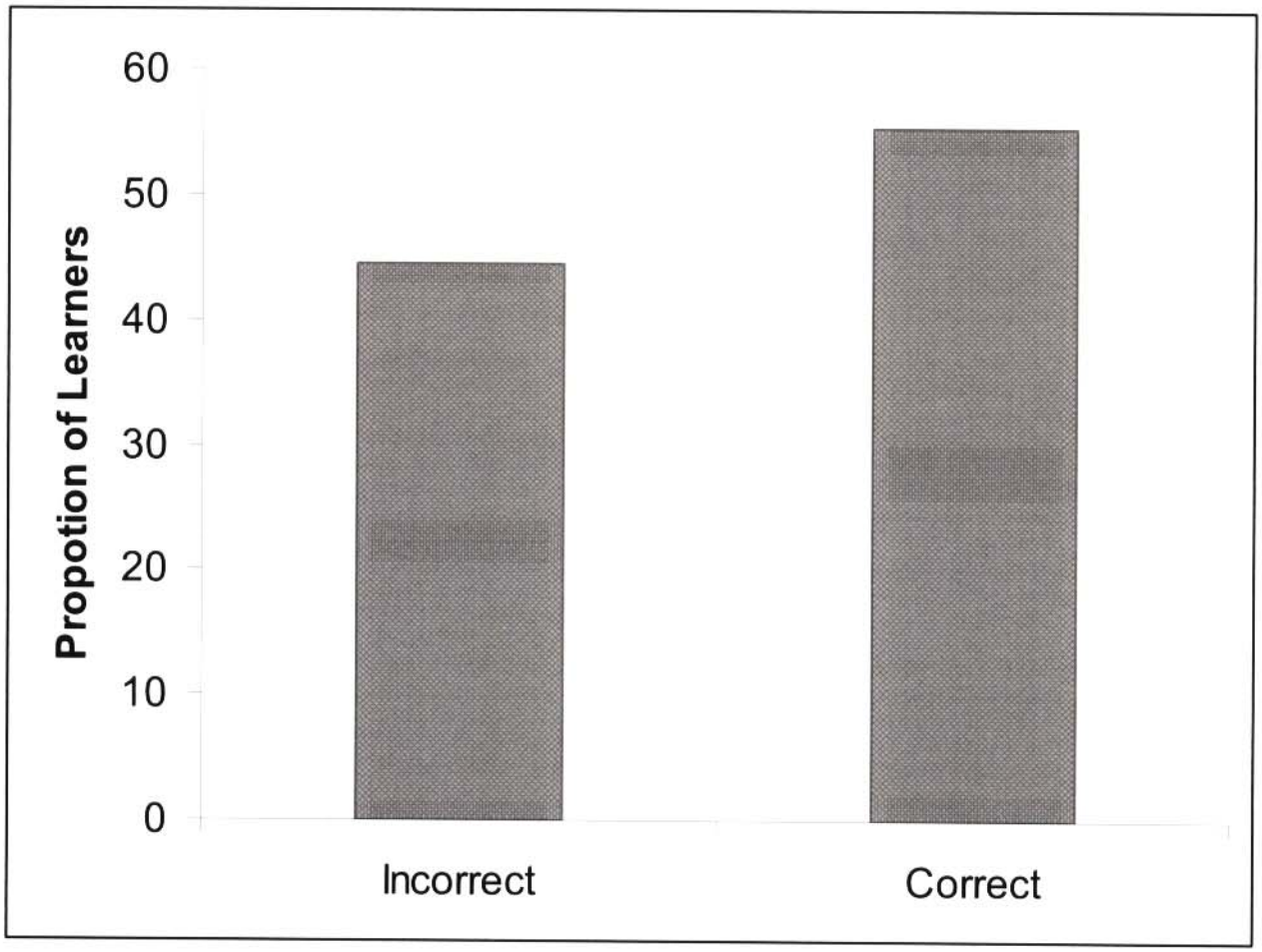


Figure 24: Learners' test – Item 14b

According to the results observed in this item that more learners could not tell whether the expression *ukhiphe ngekuphindzelela* is associated with subtraction, multiplication or division.

In the next item (15) in this section, the learners where expected to understand a question in which the instruction was accompanied by a table of given centimeters. The learners' task was to complete the table by converting the centimeters into millimeters in a manner that would follow a particular pattern. The instruction for this item was as follows:

'Complete the number pattern on the following table. The table says that there are 10 millimeters in one centimeter.'

Centimeters	1	2	3	4
Millimeters	10	20		

The mother tongue instruction for learners was:

Cedzela lephethini yetinombolo kulelithebula lelilndzelako. Lithebula likhombisa kutsi kunemamilimitha lalishumi kulinye lisentimitha.

Lisentimitha	1	2	3	4
Emamilimitha	10	20		

Since Item 15 required the learners to provide two answers to complete the number pattern, during the analysis, for analysis purposes the item was split and presented as 15a and 15b. That is to say, each answer was independently analysed. The main reason for this is the fact that in mathematics, it is often possible that a learner can complete the table and have the first number correct whilst the last one is wrong and *vice versa.* Even when marking, one would credit the correct answer. The results for the analysis of the learners' responses for this item are summarized through table 34 (15a) and 35 (15b) as well as figures (25 & 26) below:

Item 15a	***Freq.***	***Percent***	***Cum***
Incorrect	5	2.72	2.72
Correct	179	97.28	97.28
Total	**184**	**100.00**	

Table 34: Learners' test – item 15a

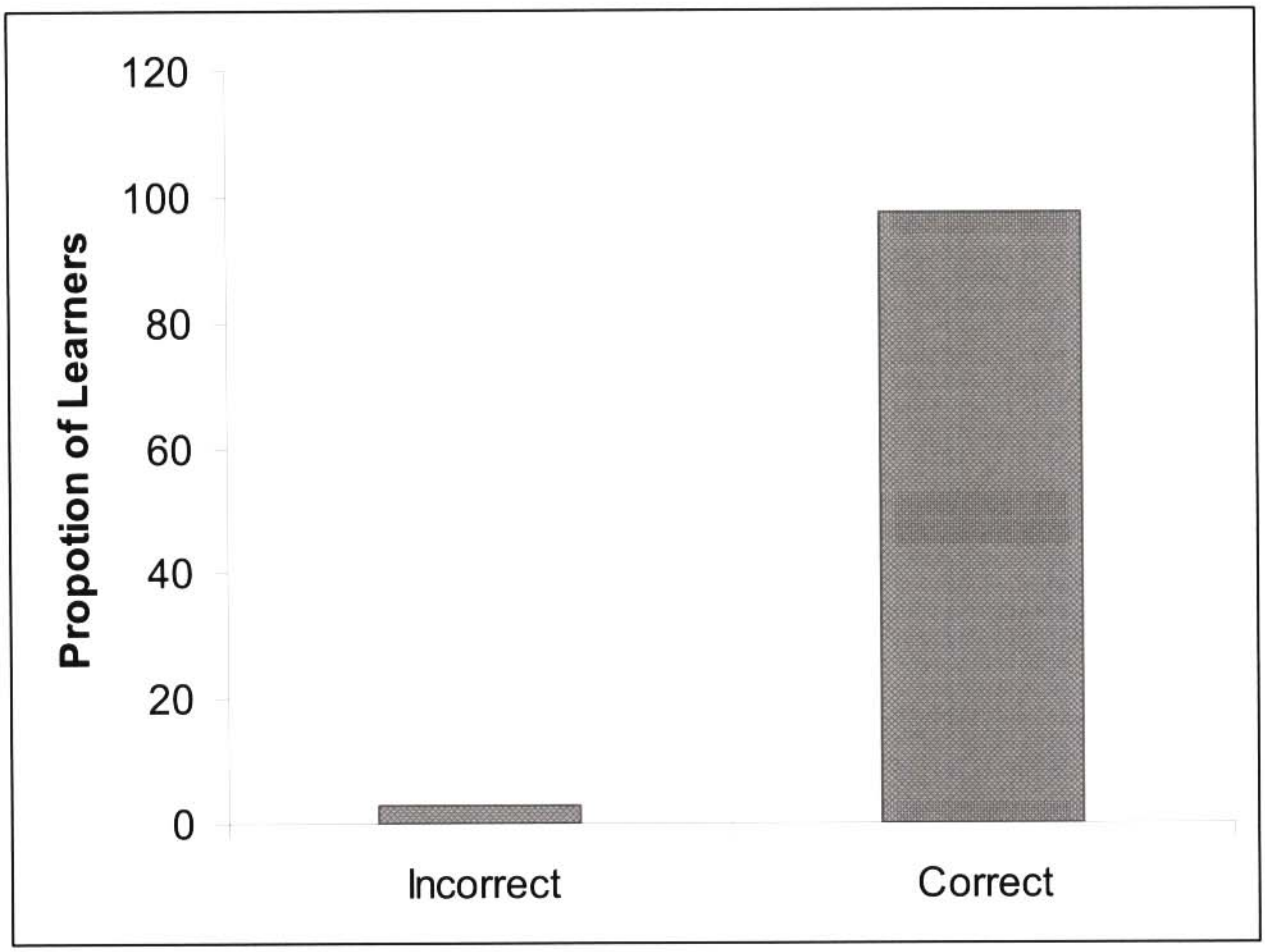


Figure 25: Learners' test – Item 15a

From table 34 as well as figure 25, it is observed that a total of 179 learners understood the task in this item. This represented an impressive 97 percent of the total population of learners. Only about 3 percent (5) of the learners did not understand the question in this item. As such the researcher observed that there was a high level of understanding by almost all learners across the various schools which participated in this study.

In the same way, item 15b presented in table 35 below, shows that the same level of understanding prevailed throughout. Evidence for this finding is also presented as figure 26:

Item 15b	*Freq.*	*Percent*	*Cum*
Incorrect	5	2.72	2.72
Correct	179	97.28	100.00
Total	**184**	**100.00**	

Table 35: Learners' test – item 15b

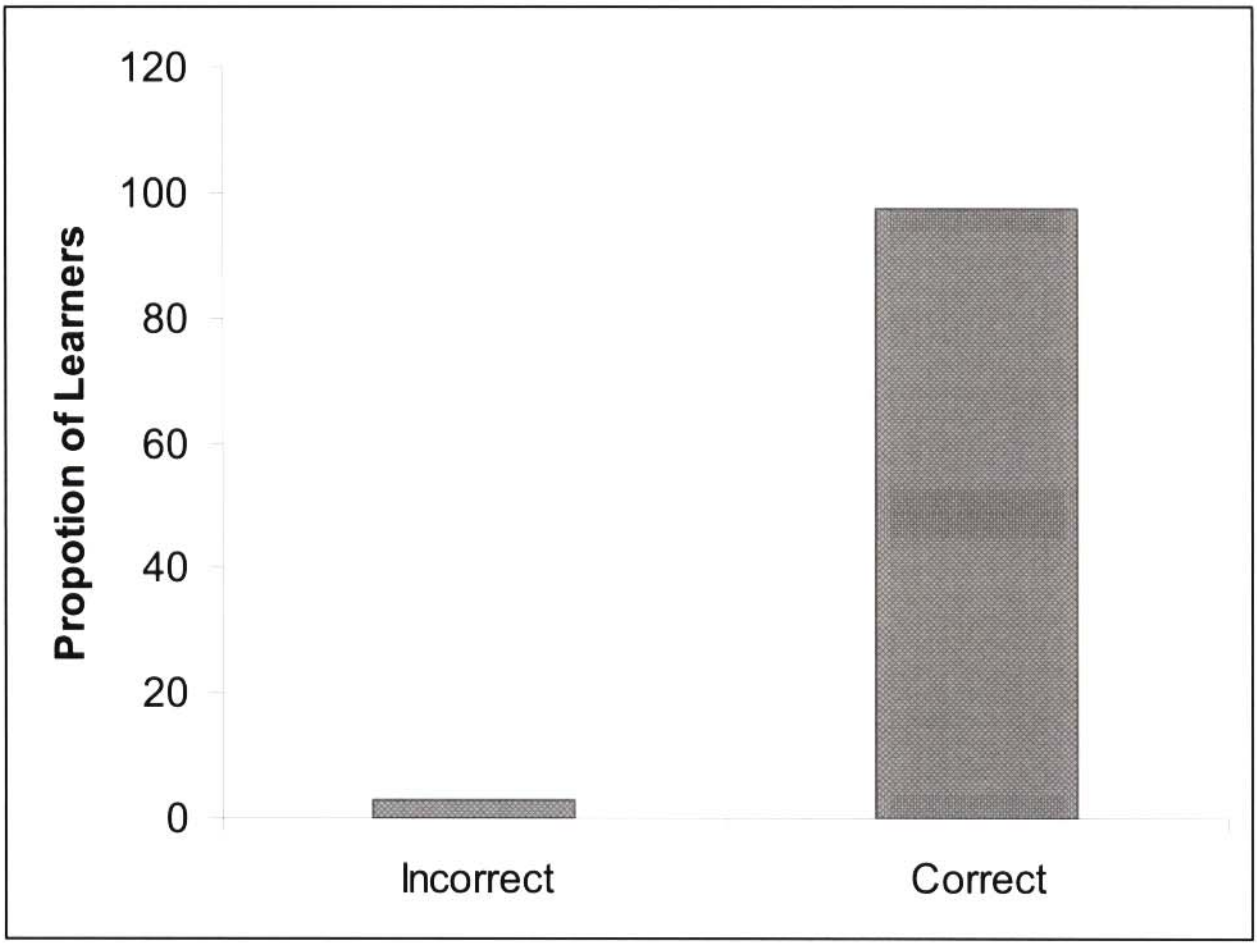


Figure 26: Learners' test – Item 15b

Similar to the previous item, from the total population (184), 97 percent of the learners understood this item. Again, only about 3 percent (5) of the learners did not understand the question in this item.

The results for item 16 which required learners to refer to the table in item 15 are summarized through table 36 and figure 27:

Item 16	*Freq.*	*Percent*	*Cum*
False	73	39.67	39.67
True	111	60.33	100.00
Total	**184**	**100.00**	

Table 36: Learners' test – item 16

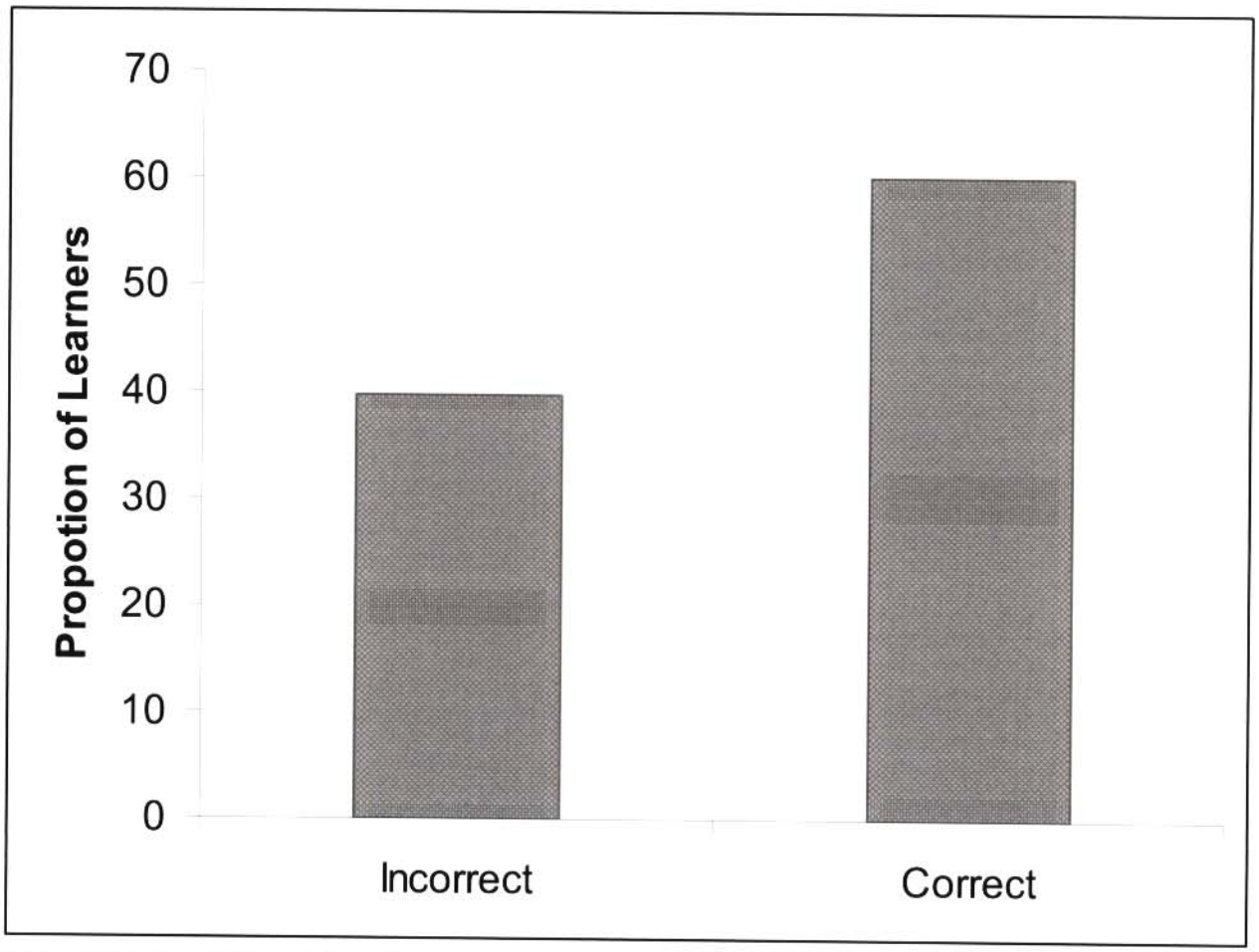


Figure 27: Learners' test – Item 16

The question for this item was phrased as follows:

Mangaki emamilimitha latfolakala kumasentimitha lamane? which means 'How many millimeters are there in four centimeters?'

For the learner to show understanding of this question, he or she needed to refer to the preceding item (15) to observe then learn that 4 centimeters is the same as 40 millimeters. From the results presented in tables 36 as well as figure 25, it is clear that that a majority of the learners' population 111 (about 60 percent) understood this

question, and hence perform the task correctly. In contrast 73 learners (about 40 percent) did not understand the question, and thus did the task incorrectly.

In the same way as in item 15, item 17 required the learners to complete a table that accompanied a question which was as follows:

Complete the number pattern on the following table. Each row has 3 chairs.

Rows[15]	1	2	3	4
Chairs	3	6		

In the learners' mother tongue, the question was phrased as follows:

Cedzela lephethini yetinombolo kulelithebula lelilandzelako. Umugca ngamunye unetitulo letintsatfu.

Umugca	1	2	3	4
Titulo	3	6		

The results of the analysis for the learners' responses to this question item presented as 17a and 17b are summarized in tables 37 and 38 as well as figures 28 and 29:

Item 17a	***Freq.***	***Percent***	***Cum***
Incorrect	8	4.35	4.35
Correct	176	95.65	95.65
Total	**184**	**100.00**	

Table 37: Learners' test – item 17a

[15] The designation 'rows' above has nothing to do with rows and columns as it would be in a table, but refers to the sitting arrangement in 'rows' as it would be in a common classroom.

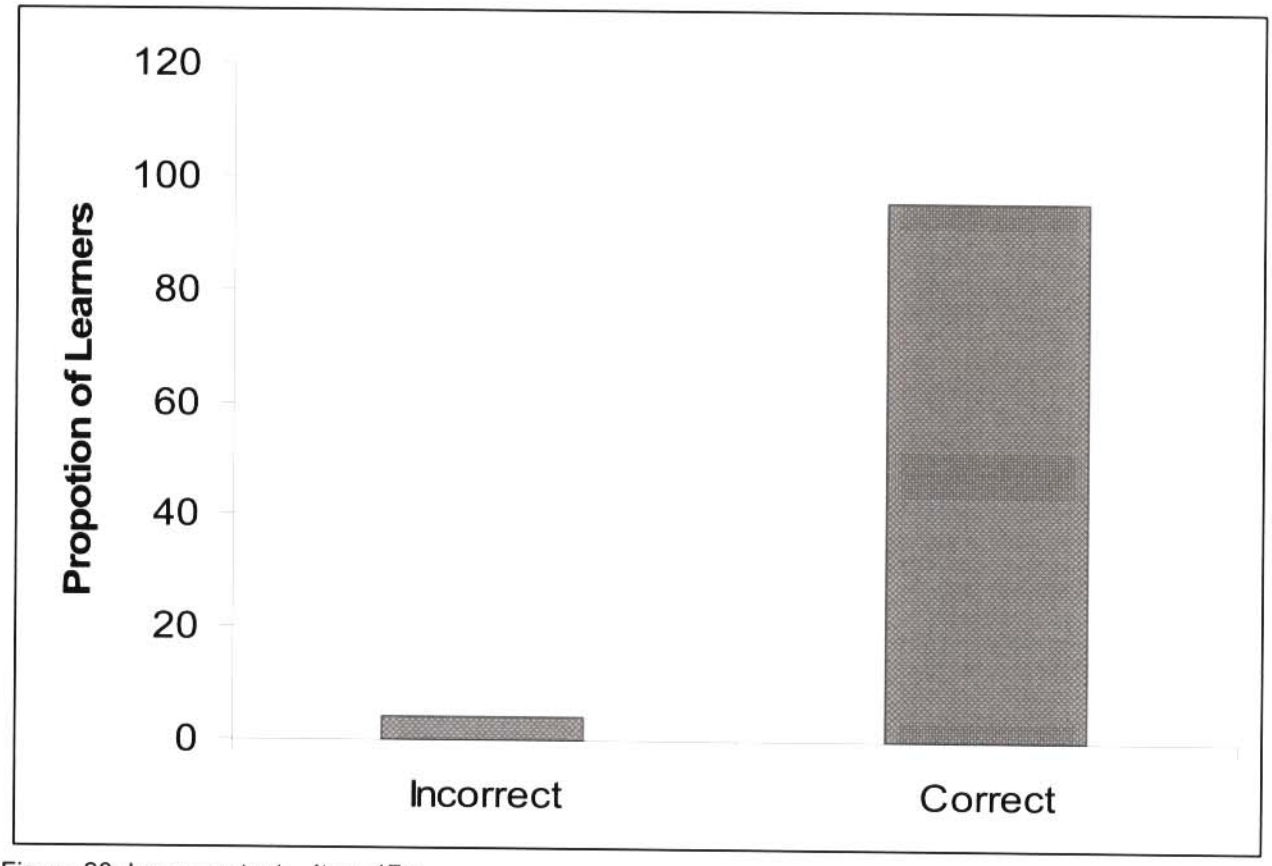


Figure 28: Learners test – Item 17a

Table 37 and figure 28 show the maintenance of a trend which was established in item 15. It seems therefore that learners' understanding across all schools was the same for all the items (i.e. items 15, 17 and maybe 19). As observed in table 37 above, an insignificant number of 8 learners (like in item 15) did not understand the question in the item, whilst a significant number (176) of the learners understood the question. In terms of percentages, this represented a 4 percent lack of understanding and 96 percent of understanding. Whether, a similar finding will be observed in item 17b as it was the case with item 15 will be answered through the data presented in table 38 and figure 29.

Item 17b	*Freq.*	*Percent*	*Cum*
Incorrect	15	8.15	8.15
Correct	169	91.85	100.00
Total	**184**	**100.00**	

Table 38: Learners' test – item 17b

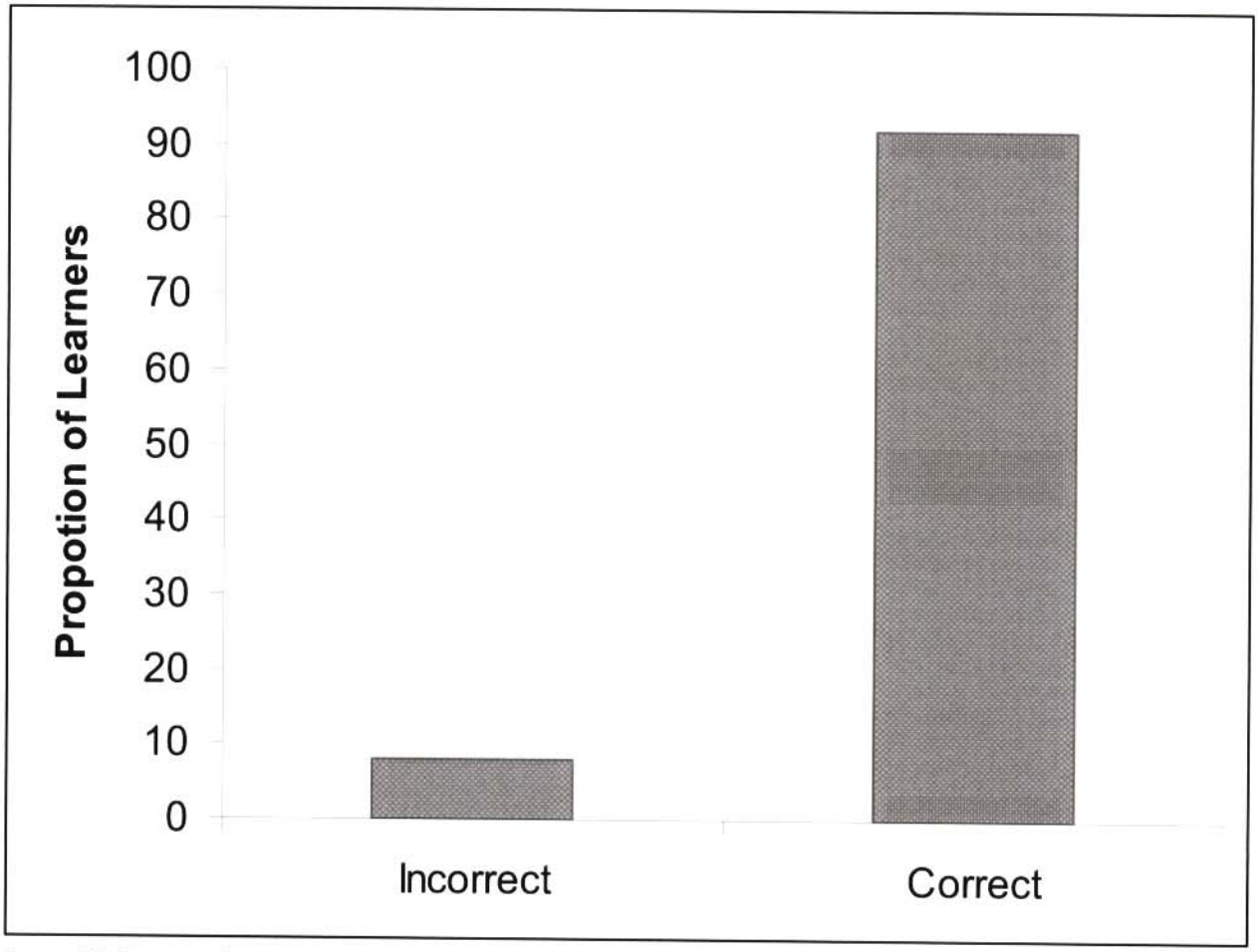


Figure 29: Learners' test – Item 17b

Table 38 and figure 29 also confirm the trend observed earlier, specifically with regard to item 17b, where there were 169 learners who understood the task (about 92 percent), while there were 15 learners (about 8 percent) who did not understand it. The researcher in this study was interested in establishing what would be the case with item 19 which was more or less similar in design to the two items. However, according to the researchers' prediction, it seemed that this trend was not going to change. The next table (Table 39) and figure 30 below present data about item 18 which required the learners to infer from the table in item 17.

Item 18	*Freq.*	*Percent*	*Cum*
Incorrect	106	57.61	57.61
Correct	78	42.39	100.00
Total	**184**	**100.00**	

Table 39: Learners' test – item 18

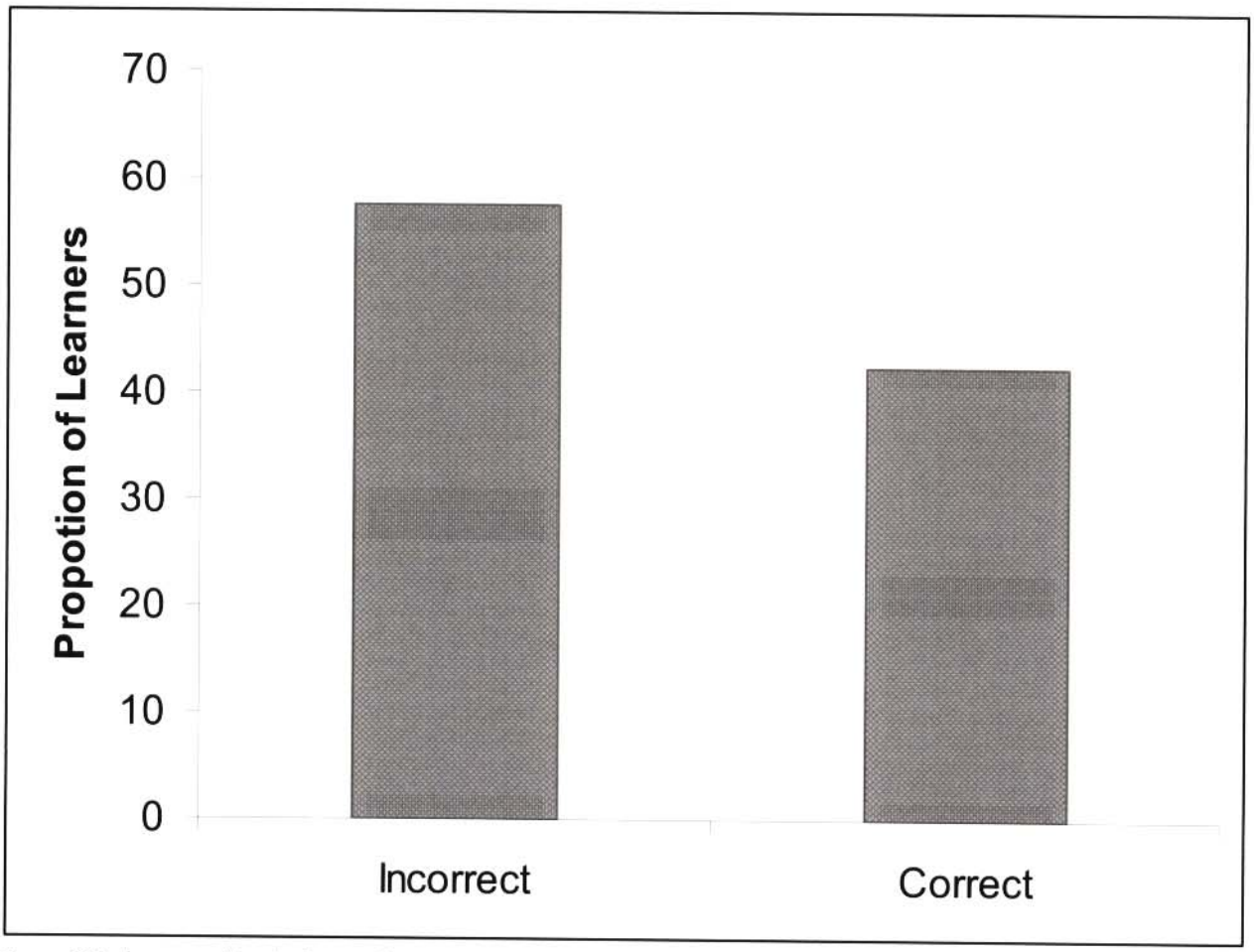


Figure 30: Learners' test – Item 18

The question which the learners had to understand in item 18 was as follows:

How many chairs are in three rows? In SiSwati the question was phrased as follows: *Tingaki titulo letisemigceni lemitsatfu?*

Table 38 and figure 30 show, that a majority of the learners in the study did not understand the question in this item. In specific terms, the table shows that 106 learners (about 58 percent) did not understand this item while 78 (about 42 percent) understood the item. An interesting observation seems to appear from the type of questions such as that in this item (cf.: item 16), namely, that the understanding of this item seems to be independent of the level of understanding that prevailed in items 15 and 17. It should be noted that these questions have to do with inference. The researcher is of the opinion that there perhaps is another problem linked to this poor understanding. One such problem might be the fact that some learners might have failed to understand that the questions relate to the previous items they already

completed. The next tables and figures below will present data about item 19. For the same explanation given earlier the results for item 19 are presented similarly to the way in which items 15 and 17 were presented.

The question for this item was phrased as follows:

> 'Complete the number pattern on the following table. One South African rand has the same value as five 20 cents.'

Rand	1	2	3	4
20 cents	5	10		

In SiSwati this item was phrased as follows:

> *Cedzela lephethini yetinombolo kulelithebula lelilandzelako. Lirandi lilingana nemasenti langemashumi lamabili lasihlanu.*

Lirandi	1	2	3	4
20 emasenti	5	10		

The results of the analysis for item 19a where if the learners understood the instruction they were supposed to write their answer as 15 and 20 are summarized in table 40 and figure 31 below. The analysis of this item was split into two sets of data for the same reason as in item 15 a & b.

Item 19a	***Freq.***	***Percent***	***Cum***
Incorrect	17	9.24	9.24
Correct	167	90.76	100.00
Total	**184**	**100.00**	

Table 40: Learners' test – item 19a

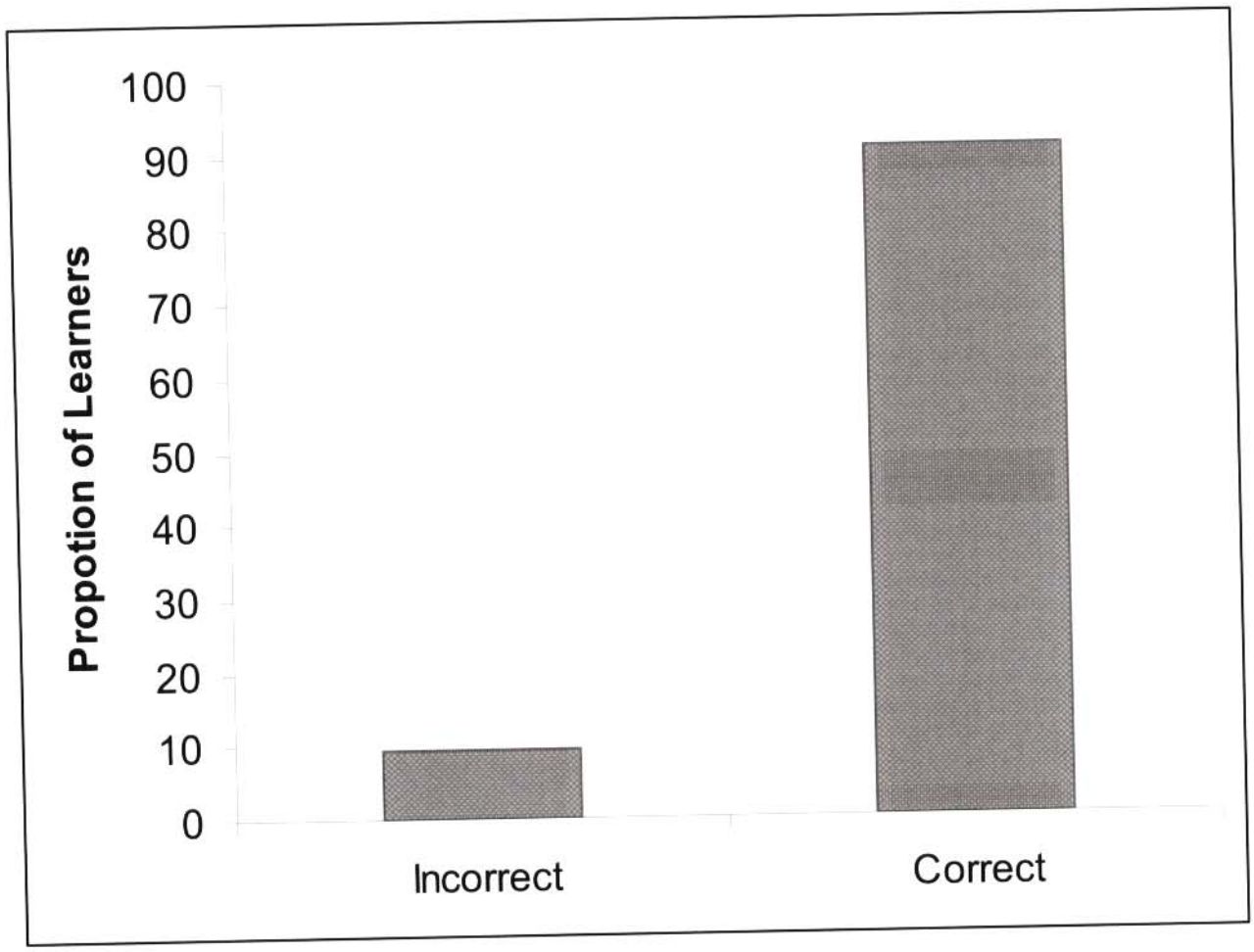


Figure 31: Learners' test – Item 19a

In table 40 and figure 31, it is evident that a majority of learners understood the item. Almost a similar number of learners to that of item 17 did not understand item 19a. This is interesting as it seems to prove the researcher's prediction which was made in item 17. The next table and figure below will present data for item 19b.

Item 19b	*Freq.*	*Percent*	*Cum*
Incorrect	12	6.52	6.52
Correct	172	93.48	100.00
Total	**184**	**100.00**	

Table 41: Learners' test – item 19b

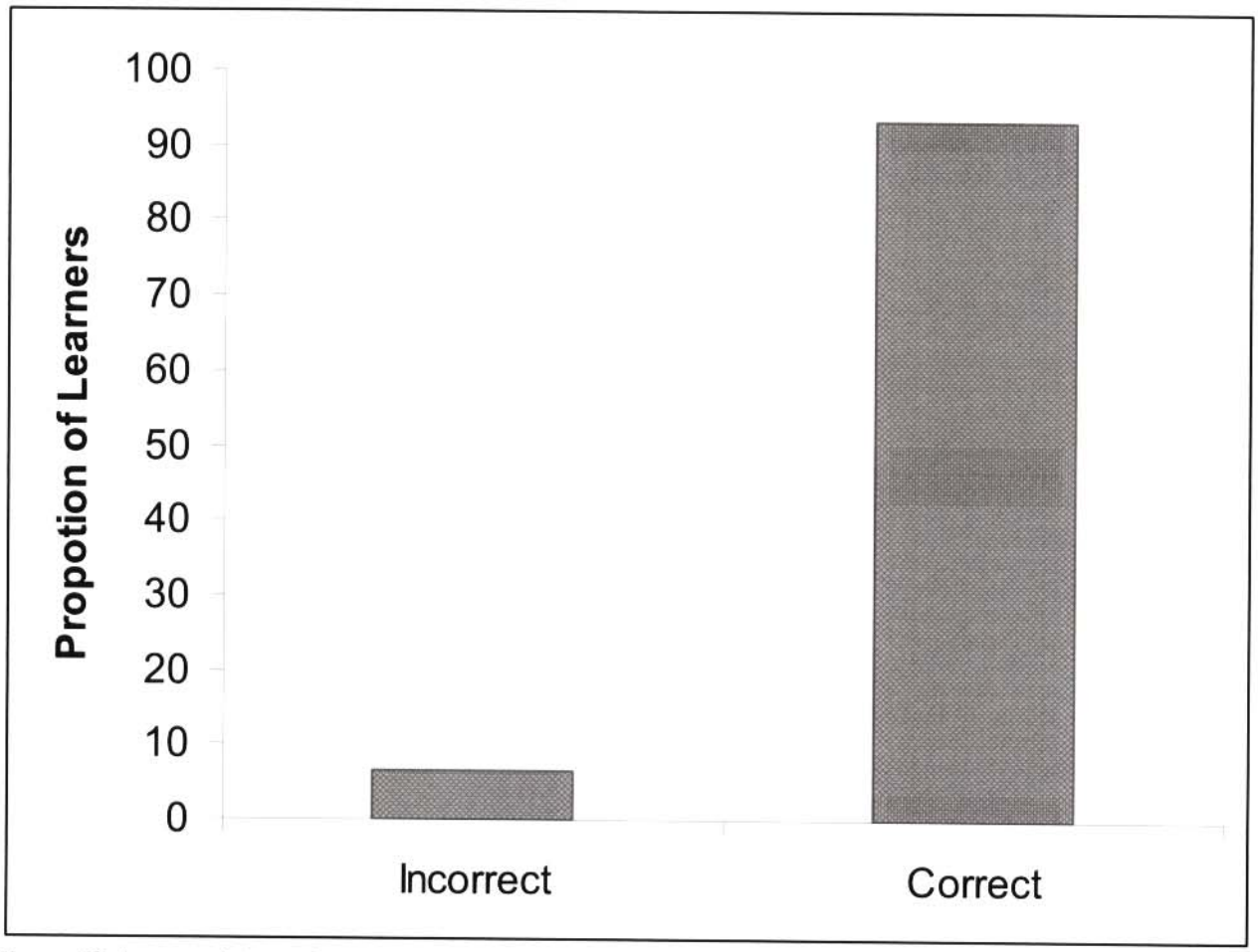


Figure 32: Learners' test – Item 19b

Table 41 and figure 32 above show that the trend was maintained. That is to say, a majority of learners understood the item whilst a negligible number of learners did not understand it. This is represented by about 93 percent understanding and about 7 percent lack of understanding. The results of the analysis for this item are better clarified through figure 30 above. In addition, it appeared to the researcher that almost the same number of learners seem to have lack understanding of questions of this kind. This prompted the researcher to investigate and identify the specific learners who did not understand item 15, 17, and 19. Prior to this investigation, the researcher predicted that more or less the same learners who did not understand item 15 will be those who did not understand items 17 and 19. The further examination of the learners' responses yielded the following results presented in tables 42, 43, and 44.

Learner #	Location
67	School B
83	School B
128	School A
145	School D
171	School D

Table 42: Learners who did not understand 15

The analysis revealed that learners who did not understand item 15 (# 67 and # 83) were from School B, and # 128 was from School A. In addition, the other two learners (learner 145 & 171) who did not understand this item were from School D. Table 43 shows the results of a similar analysis about item 16.

Learner #	Location
83	School B
145	School D
171	School D

Table 43: Learners who did not understand items 17

As expected, the same learners in Schools B and D who did not understand item 15 also did not understand item 17. Whether or not a similar trend will be maintained in the next item will be answered by the analysis of the learners individual responses to item (19) presented in table 44 below.

Learner #	Location
83	School B
128	School A
145	School D
171	School D

Table 44: Learners who did not understand items 19

Table 44 shows that learners # 83, # 128, # 145 and # 171 failed to understand the item 19. In particular, learners # 83, # 145 and # 171 who did not understand items

15 and 17 also did not understand item 19. It is worth noting that throughout the analysis of the learners' responses, it appeared that no learner from School C failed to understand any of these items. Perhaps this has to do with the location of the school and, or the dialect which is widely spoken in that area. Learners might have misconstrued the instructions in the items or may be familiar with a different vocabulary to the one used in these items.

The next table (Table 45) and figure 33 will present the results of the data analysis for item 20 in the learners' questionnaire.

Item 20	*Freq.*	*Percent*	*Cum*
Incorrect	147	79.89	79.89
Correct	37	20.11	100.00
Total	**184**	**100.00**	

Table 45: Leaners' test – item 20

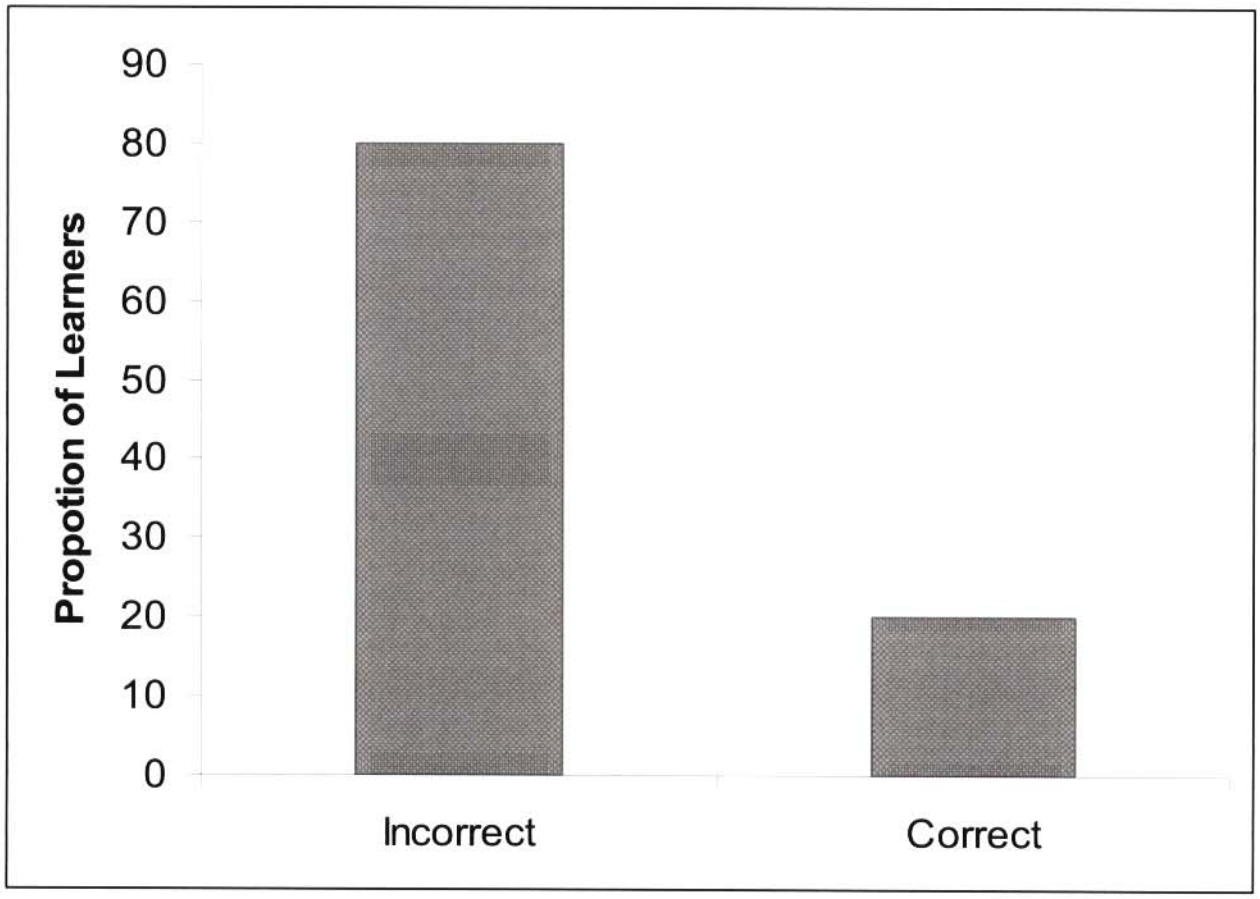


Figure 33: Learners' test – Item 20

The question in this item required learners to infer from the table which was completed in item 19. The question which made item 20 was phrased as follows:

Mangaki emarandi lalingana nemasenti langemashumi lamabili lalishumi?

In English this question is as follows:

'How many South African rands have the same value as ten twenty cents?'

Initially, the researcher predicted that since the learners results showed poor understanding in questions similar to this one (cf, items 16 and 18), the results of this item will show a poor understanding as well.

Table 45 and figure 31 above seemed to bear out this prediction. Table 45 shows that a majority (147) of the learners in the population did not understand the question. Only a negligible (37) number of learners understood the item. In terms of percentages, this represented an almost 80 percent level of misunderstanding against a mere 20 percent level of understanding.

5.6 CONCLUSION

The findings in this study suggest that in the case of SiSwati, the development of terminology for the *Multilingual Mathematics Dictionary for grades 1 to 6* (2003) was mainly through coining. This was complemented by paraphrasing which took second place. Collaborators in the language development project tended to also favour borrowing. These were followed by compounding and synonym richness of vocabulary. The dire lack of SiSwati mathematics terminological equivalents seems to be the main reason why the collaborators tended to make use of coinage. In addition, an earlier study by Mabasa (2005) rightly remarks that when developers of terms are confronted with a concept that can not be readily / easily expressed in Xitsonga, they often resort to paraphrasing and in most of the cases this is in the form of a definition of the original concept. This study also observed a similar finding for SiSwati as it was revealed that paraphrasing came second best to coinage.

With regard to the experiences of the Curriculum Implementers, the findings of the study indicate that there is generally positive belief in that African Languages can serve the best medium through which learning mathematics can be achieved. This was a general finding even though Curriculum Implementers' prior knowledge of the *Multilingual Mathematics Dictionary* was negative, since the respondents indicated that they were coming into contact with the document for the first time.

After scrutinizing the document most of the Curriculum Implementers were generally satisfied with most of the terminology in the dictionary. The researcher speculates that this general satisfaction was perhaps because as first language speakers the Curriculum Implementers are familiar with most of the terminology.

In addition, there is a strong belief amongst Curriculum Implementers that South Africa cannot achieve its language development objectives in isolation, hence the Curriculum Implementers strong recommendation that, in an endeavour to develop indigenous South African languages, the country should also draw on other countries which were successful in their implementation of similar aims. It seems from the data collected amongst Curriculum Implementers that a country such as Japan seems to be most preferred as model for successful implementation of mother tongue education.

On the other hand, Curriculum Implementers contend that the use of indigenous languages is not new to South Africa. This is true since a review of LiEP developments in the country revealed several areas where use of mother tongue was preferred.

Curriculum implementers were also found to be aware of the fact that training is a crucial factor in the implementation of LiEP goals. In addition, the findings also reveal that some of the respondents believed in and supported code-switching. When investigating what the Curriculum Implementers believe could hinder the implementation of the LiEP, the findings indicated that they believed the legacy of apartheid was crucial. Hence, there was a popular belief amongst the Curriculum Implementers that the use of mother tongue in mathematics can help curb stereotypes about African languages that which often lead to *'loss of African values'.*

As for the educators who participated in the study, the findings indicate that they generally hold negative attitudes and beliefs about using SiSwati in the mathematics classroom. This finding was evident despite the fact that most of the educators in the sample for the study indicated that their first language was SiSwati. On the other hand, the educators were found to believe that the use of African languages in the teaching of mathematics can be a useful resource. These attitudes and beliefs are equally a revelation of an ongoing conflict between the educators' linguistic identities and the fuctional value of their language.

In defense of the negative perceptions about the use of mother tongue in mathematics, some of the educators raise issues such as lack of material for teaching and learning. They also ascribed the use of English to the fact that English offers the learners a chance for better opportunities. Hence, the researcher is of the opinion that the responses of the educators in this study are indicative of the conclusion drawn by Kembo-Sure (2006: 43) after drawing evidence from Kenya, that through "English Language Teaching learners in Africa are frustrated by identity crisis".

Even though it was found in this study that educators generally hold negative attitudes against the use of mother tongue in the teaching of mathematics, their confidence in their learners was overwhelming. In response to questions which sought to establish whether or not learners will understand test items, a majority of educators indicated that learners will understand a majority of the items. This overwhelming confidence ensured that the learners test was a reliable instrument to investigate the utility of the SiSwati mathematics terminology developed for the *Multilingual Mathematics Dictionary for grades 1 to 6* (2003).

It should be noted that the researcher's intention with regard to the test items was not to investigate mathematics literacy. Hence the learners test instrument was designed in a manner that eliminated doubt about learners' ability to understand the mathematics concepts. In other words, a wrong answer in the test was not supposed to be indicative of learners' lack of mathematics literacy, but a sign of lack of understanding the language in which the question was posed.

With regard to this, the results of the learners' investigation in the study seem to indicate that most learners who participated in the research understood the MT mathematics questions. This was attested by the fact that most learners correctly followed the instructions. It was also attested by the fact that most of the learners understood (got correct) a majority of the items in the test.

However, there is evidence that learners grappled with some of the items in the test. This suggests that several issues about understanding mother tongue terminology are at interplay. Learner understanding also varied according to their different locations in some items, suggesting that different dialects spoken within the community might influence learner understanding. For example, in the four different locations, there were obvious differences in learner understanding of item number 7. Another reason may be the fact that learners might have had little or no contact with a particular term.

This chapter has achieved its objective to present the result and their discussions. The results of the collected data were clearly presented through summaries in a form of tables and figures as well as through the actual narratives provided by the open ended questions. This was in line with the quantitative and qualitative design of the study.

The next chapter will make a conclusion through summarising the findings of this chapter and making several pertinent reccommedations.

CHAPTER 6

SUMMARY OF THE FINDINGS OF THE STUDY, CONCLUSIONS AND RECOMMENDATIONS

6.1 INTRODUCTION

This chapter presents a summary of the findings and conclusions drawn from the study. It proposes recommendations for action and indicates areas for further study, to (i) improve upon the development of African languages as languages of teaching and learning, in particular for subjects such as mathematics and science; (ii) enhance the value of African languages; and (iii) promote positive attitudes towards African languages amongst educators and other stakeholders in the society. The chapter also recommends possible strategies for the advocacy of African languages as languages of learning and teaching. The findings and conclusions are generalized to South Africa's population of learners and educators.

The purpose of this study was to review the process through which the National Language Service developed the terminology for the *Multilingual Mathematics Dictionary for grades 1 – 6*, in particular with regard to the new concepts that appear in the teaching materials for grades 1-6. Secondly, the study sought to compare this process with the established linguistic theories / frameworks for terminology development. The study also set out to determine through empirical investigations of educator experiences, whether or not the terminology in the dictionary will cope with the teaching and learning requirements of mathematics, especially in the light of discussions provided in the available literature on the role of language in learning. This entailed establishing the appropriateness and acceptability of the terminology presented by the multilingual dictionary. In addition, this study sought to provide contributions and recommendations towards effective development of African languages to the status of languages of learning and teaching.

The following research questions guided the study:

- How did the South African authorities responsible for terminology development in the National Language Service develop terminology for the teaching and learning of mathematics as it is contained in the *Multilingual Mathematics Dictionary*?
- Which theoretical considerations of language development were taken into consideration during the development of the *Multilingual Mathematics Dictionary*?
- What are the experiences of the educators teaching mathematics with regard to the *Multilingual Mathematics Dictionary*?
- Will the terminology provided in the dictionary be able to handle the demands of teaching and learning mathematics in the concerned grades?

6.2 SUMMARY OF FINDINGS

This section presents a summary of findings established by this study from the previous five chapters, with respect to the purpose, objectives and the main research questions that guided the study. Contributions from the literature are also presented.

6.2.1 LITERATURE REVIEWED

6.2.1.1 The Use of African Languages in Education

A survey of the literature which was reviewed prior to this study supports the view that "There is a false, but pervasive belief that children learn better in English, as a result they should get into English as soon as possible or they will be retarded in learning" (Saville-Troike, 1991: 5–6).

However, the reviewed literature also showed that the use of indigenous languages in teaching was practised quite early on in South Africa, for example…

- during latter part of the eighteenth century, under British administration, when the education of African children was mainly conducted by missionaries - initial education was in the mother tongue, while 'advanced' instruction was in English;
- during the Anglicisation period, indigenous languages were used in both

religious and non- religious instruction;

- African languages were used by missionaries as an aid in proselytising the indigenous peoples;
- education being under the control of the church till 1953, the teaching materials were prepared to teach natives in their 'own languages' for at least four years;
- under the Bantu Education Act, mother tongue was compulsory for African language speakers in the early grades;
- since 1997, central to the language-in-education policy is the commitment to the promotion of multilingualism that will see the elevation of previously marginalised African languages to a position of full equality with Afrikaans and English.

The study also revealed that despite the fact that South Africa's language policy is very clear with regard to the promotion, respect for and use of all official languages, the use and consequent status of English continues to spread.

Further, the review of the relevant literature revealed that there are very strong scientific reasons for the use of African languages in education. For example, the findings of the Third International Mathematics and Science Survey (TIMMS) shows that language is a major factor in the performance of learners in subjects such as mathematics. Hence, a majority of studies also support the proposition that bilingual education affords children numerous cognitive advantages over monolingual children.

The literature revealed that MT education einforces childrens self worth and identity. In addition, the research provides evidence that literacy transfers across languages, thus, learning to read in the mother tongue makes learning to read and write in additional languages easier. In line with other studies, (for example, Cummins and Swain, 1986; Saville-Troike, 1991; Anstrom, 1997) this study refers to a correlation between cognitive academic abilities and first language proficiency. The study found that authors in the field argue, "if a learners' first language remains underdeveloped, then so does that learners cognitive academic ability" (Bell, 2003, no page).

On the basis of a detailed and elaborate investigation of available literature on mother tongue education in South Africa, a number of issues surrounding the use of mother tongue in education were identified. These issues are summarised in the next sections that follow.

6.2.1.2 Negative Attitudes towards Mother Tongue Education – A trend toward "unilingualism"

The study pointed out that learners in South Africa have been consistently shunning their mother tongues in favour of English. In addition, some black parents "want English only for their children" and are vocally opposed to the introduction of African languages in education. As a result certain areas in the country (for example, the Eastern Cape) have even seen some Afrikaans speaking parents moving their children to English medium schools.

6.2.1.3 Mismatch between Policy and Practice

Despite the fact that the current LiEP clearly advocates the use of mother tongue in teaching and learning

1. there has been a decline in the choice of an African language as a first language of learning and teaching;
2. there has been an accompanying increase in the choice of English;
3. there has also been an ambivalence concerning the notion of multilingualism evident in the shifting use of the terms multilingualism and bilingualism. This ambivalence creates the impression that the Department of Education is not sure whether or not a multilingual approach is feasible.

The literature revealed that such a mismatch impacts negatively on the philosophy of multilingualism.

6.2.1.4 Language Prejudice

The study suggests that because of prejudice, the current LiEP that was proclaimed in 1997 remains largely unknown, and with few exceptions, has not been implemented. Furthermore, the study also revealed that as a result of language prejudice, some school officials are capable of 'deliberately misinterpreting the language policy and conveying the wrong message' to influence parents and learners' choice of language of instruction.

6.2.1.5 Second Language Education and Mathematics

The literature (Baker, 1993; Saville-Troike, 1991; Cummins and Swain, 1986) highlights the fact that African learners in L2 education lag behind their peers in areas such as mathematics and science. Not only does the second language itself hinder the learners; the system as a whole tends to expect lower achievement of learners studying through a second language.

Consequently, progressive teaching approaches such as constructivism cannot be achieved if learners have poorly developed language skills such as L2 learners tend to have.

On the other hand, certain linguistic structures, such as logical connectors and specialised vocabulary are problematic for L2 learners. The importance of language, in mathematics instruction it is often overlooked in the mistaken belief that mathematics is somehow independent of language proficiency.

The literature in the study also revealed that immersion programmes resulted in stunted development of learners' mother tongues, impeded development of their cognitive academic abilities, created negative attitudes towards the first language and resulted in poor performance in second language tests. As such, the study found that learners have the best chance of success in mathematics and science if they study them through their mother tongue.

6.2.1.6 On SiSwati

Contrary to popular belief, studies indicate that SiSwati is not an offshoot of IsiZulu, and could even be older than IsiZulu.

In addition, the findings of the study revealed that SiSwati is widely used in the media, especially on radio and television. Though a SiSwati literary tradition exists, the volume of materials is small, especially because of the restricted market and the lack of a tradition of reading among SiSwati speakers.

6.2.1.7 Language Development

Looking at the issue of language development, despite having a progressive policy, South Africa has been painstakingly grappling with the challenge of developing and empowering its nine African languages. The study also found, through the literature survey that the single biggest problem with language development has been the lack of terminology in the African languages in many specialist fields such as for example, mathematics, chemistry, and computer science.

In particular, the problem of a lack of technical terms in African languages results from the failure of African language terminology to adhere to what authors refer to as monosemy – which suggests that a term should have one meaning only.

In view of the above scenario, some authors have already developed appropriate and relevant approaches for African language development. For example, Gauton (2002), suggests a step-by-step guide to solve the problem of lack of terminology in African languages (see Chapter 3, section 3.5).

The study also revealed that while the use of more advanced technology, such as corpora, is more common in Europe and the rest of the western world, it is not the case on the African continent. Particularly in South Africa, published literature does not attest to the availability and use of corpora in African languages. What could

make the situation worse is that in South Africa too, despite the obvious need for using corpora in term creation, higher education and other training institutions have generally not yet incorporated the use of electronic text corpora in their training curricula, especially as far as the African languages (including Afrikaans) is concerned.

6.2.2 FINDINGS FROM EMPIRICAL DATA

6.2.2.1 How the terminology for the Multilingual Mathematics Dictionary was developed

The analysis of the mathematics terminology which was conducted in this study revealed that the SiSwati terminology developers had not carried out the most basic and important step towards terminology development, namely that of looking for terms in available dictionaries, hence there was no reference to any available SiSwati dictionary.

The classification of all the terms in the *Multilingual Mathematics Dictionary for grades 1 to 6* (2003) revealed that most of the terms in the dictionary were developed through coinage which amounted to about 500 terms. This was followed by paraphrasing, about 200 terms. The next approach was borrowing which yielded about 180 terms, followed by compounding with about 110 terms and semantic transfer as well as synonyms both of which yielded about 50 terms each.

Specifically, in line with the aims of this study the terminology was classified according to established translation approaches which are also of relevance to the development of African languages. The findings of this classification were as follows:

- 4.3 percent of the terms in the dictionary were found to have been developed through **semantic transfer**. Examples of these are terms such as *Licandza* – meaning 'Nought', but which in ordinary speech means 'an egg' and also *Enhloko* – meaning 'O'clock', which in ordinary speech means "on the head'.
- 4.6 percent of the terms was developed through the approach known as

synonym richness of vocabulary according to Gauton (2002). Some examples of terms developed through this approach include 'Afternoon' meaning any of the following synonyms: *Selimatfunti, emvakwedina, ntsambama*, and 'Circle' – meaning: *Indingilizi, kakela, siyingi, indilinga.* However, whilst this approach has been successful in providing various terms for the multilingual mathematics dictionary project, the findings of this study also indicate that it my equally yield potentially damaging results. The use of terminology from an unfamiliar variety can also have the potential to confuse learners and hence make it difficult to grasp mathematical concepts.

- 11.1 percent of the terms was developed using the method called **compounding**. These include terms such as *Umnyakashumi* [*umnyaka (n) + shumi (n)*] meaning 'decade' and *Likhonokubhala* [*likhono (n) + kubhala (v)*] meaning 'numeracy'. As this study found, the translation of certain concepts caused the loss of the correct meaning for the terms. For example, in the case of words like 'decade' and 'temperature' the given equivalents may also create learner misconceptions about important mathematical and scientific concepts. The misconceptions refered to here were earlier discussed in Chapter 5, section 5.2.
- 15.4 percent of the terms in the multilingual mathematics dictionary was developed using the well known translation method called **borrowing**. Examples of these terms included *i-avareji* which means 'average' and *i-bhayinari* which means 'binary' in English. The findings of this study show that borrowing seems to be a successful method for African language development, especially in the case of SiSwati where analysis revealed no shortcomings. However, language purists would argue that borrowing does not amount to language development and may even lead to the same difficulties as in second language learning.
- 19.1 percent of the terminology represented the translation approach known as **paraphrasing**. As the name suggests, this method takes a particular term and provides an equivalent through paraphrasing it. The result is usually a term made up of two or three words. Some examples of this method include *susa ngekuphindzelela (susa* = minus + *ngekuphindzelela* = repeatedly*)* which means 'divide' as well as *lokutsite ekhulwini (lokutsite* = something + *ekhulwini* = in a hundred) which means 'percent'.

- 45.5 percent of the terminology was developed through **coinage**. Examples included terms such as *embikwa* which means 'before' as well as *calantsatfu* which means 'triangle'
- According to the findings of this study, the only approach through which terminology was not developed in the dictionary was **deidephonisation**.

If one were to fleetingly look at the terminology in the document understudy (that is, the *Multilingual Mathematics Dictionary*), it would appear that the translation of the mathematics terminologies was successful. This is especially so because, since a vast majority of the dictionary was developed through coinage. However, it should be noted that the fact that most of the terminology was developed through coinage enhanced the value of this study which sought to evaluate the utility of SiSwati mathematics teminology. In other words, the study became most significant to answer the underlying question of whether or not the development of the mathematics terminology was successful.

6.2.2.2 Beliefs of Curriculum Implementers

In brief, the findings based on the empirical data indicated that Curriculum Implementers are generally positive towards South African indigenous languages and hold positive beliefs about their prospects as future languages of teaching and learning mathematics. The researcher viewed this finding as crucial to the implementation of LiEP. This is especially in view of the the fact that Wildsmith-Cromaty (2007) who contends that curriculum specialists are important if the translation of academic discourse is to be applied effectively in education.

Another, important issue with regard to the beliefs of the Curriculum Implementers is that they view language development as a task to be left to the country's terminologists and language planners. Hence, they believe strongly that the experiences of other countries can be of crucial help in this endeavour. For example, evidence from the Curriculum Implementers indicates that Japan is one particular country most preferred to act as a role model. Thus, Madadzhe and Sepota (2006:

144) provide evidence that countries such as Japan, China, France, Greece, Spain, Sweden, and the Netherlands, which are exemplary because of their positive development.

In line with de Klerk (2002), the Curriculum Implementers also revealed their awareness in the fact that the use of indigenous languages is not new to contemporary South Africa. Hence, the successes of past endeavors can also assist in the successful implementation of effective mother tongue instruction in the mathematics classrooms.

6.2.2.3 Educators' attitudes and beliefs towards mother tongue in the mathematics classroom

The results of the educator questionnaire analysis have shown that there were more female than male participating educators in the study (10 out of 19). Although this was the case, the study also found that this difference was not significant to negatively or otherwise influence the results of the study. The age of the educators ranged between 30 and above 50. Out of the total sample, 16 educators were SiSwati first language speakers.

The analysis indicated that generally, educators hold negative attitudes towards the use of mother tongue in the teaching of mathematics. In addition, analysis of the qualitative data revealed mixed results the educators' views on the use of African languages as a medium of teaching and learning. For example, on the one hand some educators were found to hold a strong belief in the fact that the African language can be seen as a resource in their teaching while some educators felt that using the African language is bad for their teaching. To put it more appropriately, the educators' qualitative data revealed that most educators hold the view that through education, African children should strive towards coming closer to the whites and their culture.

The conflicting views observed from the educators strongly indicate an ongoing struggle between educators' linguistic identity and use of their language as an enabling factor in the learning of mathematics.

6.2.2.4 Applicability of the MT mathematics terminology

The applicability of the terminology was investigated through an educator predictions / confidence questionnaire and the learners' test which sought information on learners' understanding of mathematics terminology.

The results of the study points to the fact the educators were generally confident that learners would understand the mathematics questions as contained in the learners test. This finding was particularly important as it helped dispel any claim that might have been made by critics about the learners test as a test for mathematics and not a test for evaluating the usability of MT mathematics terminology. In specific terms, the study found that educators were confident about most (82 percent) of the items which made up the test. This overwhelming educator confidence was later complemented by the learners' good understanding of various items in the test. The following table presents a summary of all the items; it provides the percentages of learners who understood the items (see Chapter 5) and those who did not understand them.

Item Number	*Proportion of Learners who Understood*	*Proportion of Learners who did not Understand*
1	15.76	84.24
2	48.91	51.09
3	51.63	48.37
4	46.20	53.80
5	0	100
6	1.09	98.91
7	2.17	97.83
8	98.91	1.09
9	19.02	80.98
10	39.67	60.33

Item Number	*Proportion of Learners who Understood*	*Proportion of Learners who did not Understand*
11a	96.19	3.81
11b	92.39	7.61
12a	64.97	35.03
12b	65.95	34.08
13	63.59	36.41
14a	54.35	45.65
14b	55.43	44.57
15a	97.28	2.72
15b	97.28	2.72
16	60.33	39.67
17a	95.65	4.35
17b	91.85	8.15
18	42.39	57.61
19a	90.76	9.24
19b	93.48	6.52
20	20.11	79.89

Table 45: Summary of Learner understanding

Table 46 presents a summary of the data analysis provided in section 5.4.2, and shows that a majority of learners did not understand items 2, 4, 5, 6, 7, 9, 10, 18 and 20. All other items were understood by a majority of the learners. This presents a positive picture about the learners' understanding of mathematics instructions as expressed in their mother tongue. Figure 32 graphically shows the general difference between those items which learners understood against those they did not understand.

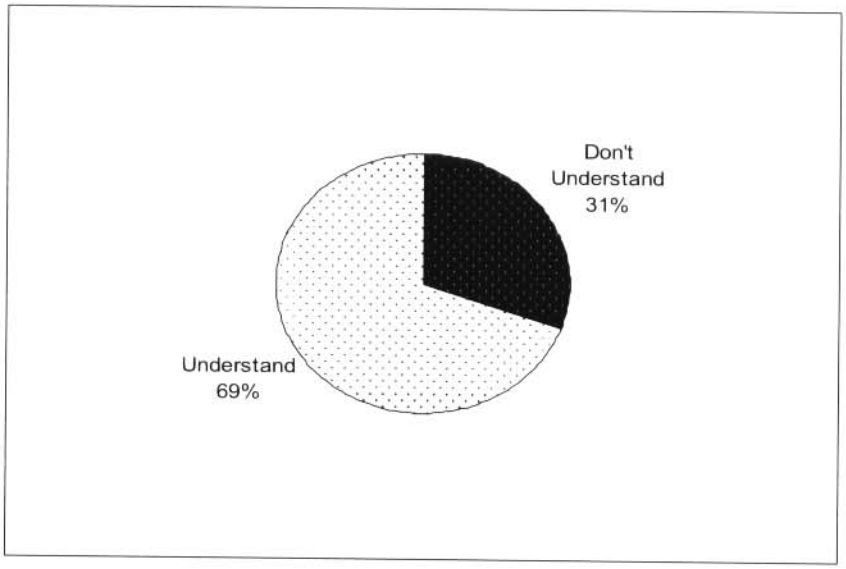


Figure 34: Proportion of Learners', understanding

From the graphical (figure 34) summary, it is apparent that generally, learners understood 69 percent of the test items, while they did not understand 31 percent of the items. The researcher is of the view that the results of the study indicate that in general the mother tongue terminology seems to be well understood and hence applicable for the teaching and learning of mathematics.

6.3 CONCLUSIONS

The conclusions of this study are based on the findings about the processes through which terminology in the *Multilingual Mathematics Dictionary for grades 1 to 6* (2003) was developed, the educator attitudes towards the use of MT in mathematics teaching, the Curriculum Implementers' beliefs about MT in mathematics and the outcomes of the learners' mathematics test in their mother tongue.

Chapter One focused on setting the background for the study, and locating the aims and objectives of the study, namely (1) to review the process through which the Department of Arts and Culture's National Language Service developed the terminology for the *Multilingual Mathematics Dictionary for grades 1 to 6* (2003); (2) to compare the process through which the terminology was developed with established strategies / frameworks for terminology development; (3) to determine through empirical evidence educator beliefs and attitudes, as well as learners' understanding whether or not the terminology in the dictionary will be applicable for teaching and learning mathematics. The following sections summarise the conclusions of the study:

6.3.1 Predominant Language Development Strategies

For the most part of their task language development practitioners and the collaborators in the dictionary project preferred coinage as a method/ strategy for the development of the SiSwati terminology. As the results indicated, this was closely followed by paraphrasing.

6.3.2 Curriculum Implementers' Beliefs

The findings of this study evinced that specialists such as Curriculum Implementers play a crucial role in the implementation of education policies. Hence, the findings of this study about the beliefs of the Curriculum Implementers are considered to be important.

With regard to the Curriculum Implementers who participated in this study, the researcher concludes that their generally positive perceptions suggest a good chance of success in promoting the use of mother tongue in the mathematics classroom.

6.3.3 Educators' Attitudes

Scholars (for example, Kamwamangalu, 2000b; Malherbe, 1977) often point to the importance that attitudes play in the successful implementation of language in education policies. This study contends that, in South Africa as well, the attitudes of educators are significant for the implementation of the LiEP, and particularly the use of African languages in the teaching and learning of mathematics. In this study, an analysis of the educator attitudes exposed that that a majority of respondents showed a clear tendency to actively choose the English language as a medium of instruction in the mathematics classroom. Educator participants (respondents) indicated negative attitudes towards SiSwati in the mathematics classroom. English was considered as a marker of status and an important component of access to a higher culture by most of the educators who participated in the study. The function of English as a *lingua franca* or language of international communication was the main argument in favour of the use of English as a medium of instruction in the mathematics classroom.

It may be concluded from this study that mathematics educators could delay implementation of the objectives of the LiEP because of the general negative

attitudes they hold towards using mother tongue in the teaching and learning of mathematics. It may also be concluded that educators generally lack a self belief that, they can use their mother tongue effectively to enhance learner understanding in the classroom. This conclusion is supported by the overwhelming number of educators who strongly maintained that they have no idea how to teach mathematics through the medium of the MT.

It is, therefore, concluded that the educators strongly believe that it would be very difficult to teach mathematics in SiSwati. In the researcher's view, such negative attitudes towards the use of mother tongue could be a consequence of the continued domination of English in the South African education system.

6.3.4 Educators' Confidence

Though the educators had a high level of negative attitudes towards the use of MT in the mathematics classroom, they were confident that their learners will understand the mathematics items which were used to investigate learner understanding. This study therefore concludes that the learners' test was a valid and reliable instrument to measure the applicability of MT mathematics terminology because the educator confidence eliminated any doubt about lack of mathematics literacy amongst the learners.

6.3.5 Learners' understanding

The study showed that learners were generally able to understand most of the questions in the learner test. Specifically the learners understood 62 percent of the items in the test. However, despite the generally high level of understanding, most of the learners did not understand items 2, 4, 5, 6, 7, 9, 10, 18, and 20. Hence, this study makes the following conclusions about these items:

With regard to item 1 it was indicated in Chapter 5 (Results and Findings) that the key words in this question were *luhlu (*series), *niketa (*give), and *letingahlukaniseki*

*nga (*not divisible by). This study concludes that for most of the learners the terms which were difficult to understand were *luhlu* and *letingahlukaniseki nga.* This was evident as a majority of the learners either did not respond to the question or gave a similar answer to the one in item one which required learners to write a series of even numbers.

With regard to item 4, the researcher concludes that the learners failed to understand the instruction *bhala luhlu lwetinombolo ... letilandzelanako,* because they had a difficulty understanding the term *luhlu.* The study also concludes that this lack of understanding resulted from learners' lack of understanding the fact that the question in this item referred them to the one which preceded it.

One item which proved to be difficult for learners to understand was item 5, in which all of them failed to understand the instruction *Bhala tinombolo tibe tine letisembikwa 77.* The researcher believes that the problematic term in this item was *letisembikwa* which in the context meant before. The conclusion is that learners did not know whether the term meant before or after. As a result most of them wrote numbers that come after 77. The conclusion about this finding was also borne out during the data collection process where the participant learners repeatedly requested clarification on the meaning of the question. Similar conclusions are arrived at with regard to items 6 & 7 in which almost all the learners (about 99 percent and 98 percent respectively) did not understand an instruction to give four even numbers and odd numbers respectively.

With regard to item 9 of the learners test, it is evident that the learners did not understand the expression *letihlukaniseka nga 5* meaning 'divisible by 5'. The researcher concludes that learners struggled to understand whether *letihlukaniseka* - meant to divide or minus. Hence, the analysis of the learners' responses shows that there was a high level of guess work in responding to the item.

With regard to item 10 it was established that although the learners responded to the question in this item, most of them failed to understand that the item required them to select two numbers from the previous item (cross reference / inference) which could add up to 180. Whilst the correct answer was 100 + 80, many learners wrongfully

assumed that 90 + 90 was also correct. It would appear then that learners did not understand the question as a whole. That is, the learners seem to have misinterpreted the question related to this item.

The conclusion arrived at with regard to items 18 and 20 are similar in that both questions involved inference. To give the correct answers, the learners had to understand that the questions required them to deduct answers from items 18 and 20. Rather than seeing the wrong answers as a lack of understanding of a particular term, the researcher concludes that learners' lack of understanding in both these items was as a result of their lack of understanding the tasks that these questions required of them.

Earlier studies revealed that tasks that have to do with the acquisition of certain linguistic structures (see, section 2.10.1) such as inference seem to be a challenge for learners. Such studies revealed that learners usually find it difficult to perform tasks which require inference. This is evident even amongst advanced learners in higher education. Hence, Bloom *et al* (1956) classified inferencing as a thinking skill which falls at the higher level in their hierarchy.

6.4 RECOMMENDATIONS

6.4.1 Terminology Development

The *Multilingual Mathematics Dictionary for grades 1 to 6* (2003) provides a solid basis from which African language terminology could be evaluated for use in the teaching of mathematics. It also provides a basis through which translation strategies relevant for African language development can be evaluated. The lack of references (for example, dictionaries) in African languages such as SiSwati clearly indicates the damage that African languages have suffered at the hands of apartheid policies. It also shows the need to properly train language developers in the relevant steps and strategies to be taken when engaging in a language development project such as the one that produced the dictionary which was under study. The dominance of coined terms in the SiSwati dictionary of mathematics terms indicate the challenges that terminology developers face. This study seeks to highlight Cabre (1999) as well as

Mabasa's (2005: 42) work which suggest the following ways that can be applied to address the problems involved in the lack of terminology:

- A selection of the most suitable strategy for intervention
- Preparation of terminology research
- Preparation of terminology with the relevant domain specialist
- Standardisation of the prepared terminology
- Choice of the most suitable format and presentation for the prepared terminology
- Constant updating of terminology

In agreement with Cabre (1999) and Mabasa (2005), this study also contends that engaging in a process of "selection of the most suitable strategy for intervention" will ensure that the government through the Department of Arts and Culture's NLS will be able to design methods to effectively oversee successful language development. Secondly, if "preparation of terminology research" is achieved, the researcher believes that collaborators can receive proper support and training in effective methods of terminology development. At the same time, it is recommended that future collaborations on projects such as the one which gave birth to the *Multilingual Mathematics Dictionary for grades 1 to 6* (2003) should ensure that terminologists work in close collaboration with subject specialists. This will help provide well – informed results when new terminology is developed. It may also help to avoid potentially damaging results such as those observed in the study with regard to equivalents for the terms 'exponent and power'.

In addition, standardisation of the prepared terminology will ensure that terminology does not have several equivalents such as what Gauton (2002) called "synonym richness of vocabulary", resulting in different locations using a different term for the same concept. The researcher also recommends the constant evaluation and updating of terminology to ensure that African languages are always on a par with new developments.

The study also concurs with Mabasa's (2005: 44) study which recommends that:

> After all the processes of term creation have been completed by all relevant stakeholders, term corpuses are to be consolidated and turned into terminology databases; dictionaries and vocabularies. They must also be tailored towards the needs of different user groups and different application requirements. Both the terminology standardisation methods and terminology planning efforts have to focus on acceptability of terms that are newly introduced and are expected to be used by the target communities.

The study found that the reasoning skill of inferencing proved to be difficult to understand for learners. This study concurs with Johnson and von Hoff Johnson (1986: 56) who recommends that "learners can be assisted in making the appropriate inferential connections through:

- Filling in background information, - this means that before you ask learners a question that requires recall or reference to a previous item, scaffolding needs to take place. Through scaffolding educators can be able to provide remedial teaching about a concept in the previous item, and then ask a question about it;
- Provide learners with opportunities to discuss prior experiences that pertain to that information;
- Examine vocabulary in text for terms that may be abstract or may have subtle shades of meaning;
- Review test for figurative language that may be unknown to the learner;
- Teach the learner to restate the meaning of the text using the inferred information."

6.4.2 Training Curriculum Implementers and Educators in LiEP

In line with Eastman (1983), Abdulaziz (1989: 33) indicates that the modernisation of languages should be sensitive to national planning and development activities in other areas such as agriculture, industry, appropriate technology, education, health and other fields. It is the contention of this study that terminology planning may successfully be operationalised and implemented by reviewing language policies,

and in particular the LiEP with the Curriculum Implementers who in turn can take it to the level of mathematics educators in the schools and cluster meetings.

In suggesting recommendations for training Curriculum Implementers and educators, this study wishes to borrow from Kamwangamalu (2000b: 130) the idea of "a market-oriented approach to mother tongue education". Kamwangamalu's main argument is that, as an aspect of status planning, mother – tongue education is a marketing problem. This argument is informed by previous studies into the economics of language planning (for example, Cooper 1996; Bourdieu 1991; Coulmas 1992). Viewing language planning as a marketing problem entails, as Cooper (1996: 72) puts it, "developing the right *product* backed by the right *promotion* and put in the right *place* at the right *price*." Concerning the product, Cooper (1996: 72) states that

> Language planners must recognise, identify, or design products that the potential consumer will find attractive. These products are to be defined and audiences targeted on the basis of empirically determined consumer needs. *Promotion* of a communicative innovation such as language refers to efforts to induce potential users to adopt it, whether adoption is viewed as awareness, positive evaluation, proficiency, or usage. *Place* refers to the provision of adequate channels of distribution and response. That is, a person motivated to buy a product must know where to find it. The *price* of a consumer product is viewed as the key to determining the product's appeals to the consumers.

Bourdieu (1991) also views language planning or language management as he calls it a marketing problem. This is clear from his definition of status planning as an exercise in regulating the power relationship between languages (that is, the product in Cooper's sense) and their respective users in the linguistic market.

Applying the ideas of Cooper (1996) and Bourdieu (1991) to the South African context, Kamwangamalu (2000b: 131) argues that it is clear that the products, in this case the nine official African languages, have been identified; and the places where these products can be found are common knowledge to most South Africans. However, this study suggests as Kamwangamalu (2000b: 130) puts it, "What is missing in the current multilingual language policy, and which policy makers need to consider in efforts to implement policy, is the promotion and price of the above and the other official languages".

6.4.3 Overcoming negative attitudes held by Educators

This study recommends that, for the successful adoption of mother tongue as a language of teaching and learning, dealing with the prevailing negative attitudes held by educators is urgently required. The literature stresses that learners learning content subjects such as mathematics should not have to contend with learning an alien language along with difficult subject specific concepts. It appears from this study that the development of South African indigenous languages has to be accompanied by the promotion of positive attitudes.

Though this study assumes that African languages can be ideal languages of learning, it is also the contention of this study that there is a need for mathematics and other content subject educators to be provided with information through workshops about the benefits of using mother tongue. If the views of the Curriculum Implementers are something to go by, it is possible to overcome the negative attitudes held by educators. Thus, this study recommends that Curriculum Implementers should be equipped with necessary information on the benefits of mother tongue in order to enable them to promote its use and eradicate some stereotypes that cause negative attitudes.

With reference to such negative attitudes this study recommends in agreement with a suggestion by Kamwamangalu (2000b: 131) that authorities need to ensure that "language consumers need to know what an African language, if adopted as a medium of learning, would do for them in terms of upward social mobility. What payoff or reward, would it generate? Would it, for instance, open up job opportunities and give the consumers access to employment?" In view of the negative attitudes revealed in this study, it is clear that neither a constitutional principle nor a multilingualism awareness campaign will determine whether status planning for African languages in South Africa will fail or succeed.

Authors such as (Malherbe, 1977; and Kamwangamalu, 2000b) have made suggestions to market mother tongue education in African languages. For example, Kamwangamalu (2000b) is of the opinion that Afrikaans, labeled a kitchen language fifty years ago, today competes with English in most high domains of language use

including education. Kamwangamalu (2000b:132) poses the important question: "How did the Afrikaners, who were in power at the time, manage to promote Afrikaans to its present status in South Africa?" Apart from the sad chapter of the Bantu Education Act, Afrikaans was promoted through incentives and rewards for top achievers in the language. For example in order to encourage pupils to become bilingual in English and Afrikaans, the governments of Transvaal and Natal awarded monetary grants as inducements, these were known as Bilingual Merit Grants in the Transvaal and Bilingual Bonuses in Natal. Malherbe (1977) reports that "these grants went to pupils who attained a certain percentage of marks in each of the official languages". Attached to these grants was the condition that such pupils had, on completion of high school, to go to a training college in order to become educators. The teachers who displayed exceptional proficiency in the use of both official languages as media of instruction were each given a monetary grant.

Although the current South African government has begun to implement similar incentives for studying indigenous languages, through efforts such as the *Fundza Lushaka Bursaries* awarded to education students studying science and technology as well as an African language, and the Education Minister's grant in Limpopo which targets high achievers in African languages to supports them towards studying these languages at university, it seems that the marketing of these incentives has not yet gained momentum. The strategy is also defeated by the overwhelming lack of desire amongst students to study towards the teaching profession. Thus, this study also recommends that the provision of such incentives as was the case in Afrikaans should also be imperative for educators who can successfully use an African language as a medium of instruction. This could also be coupled with efforts to change the prevalent negative perceptions about the teaching profession.

In addition, the study also suggests that incentives for promoting mother tongue education in African languages do not have to be limited to the teaching profession. Since these languages have been systematically marginalised in the past, it is imperative that they be promoted aggressively both in education and in other sectors. One perfect example for the support of this is the suggestion that certified knowledge of African languages should become one of the criteria for access to employment. This is similar to the way Dutch, English and Afrikaans in the Dutchification, the

Anglicisation, and the Afrikanerization eras were promoted respectively. Otherwise, Eastman (1990:63), correctly points out that "people would not want to be educated in their indigenous language if that language has not cachet in the broader social, political, and economic context".

Lastly, the study recommends that mother tongue education requires more deliberate promotion. To support the work done by organisations such as PanSALB, regional agencies must be established to encourage the use of African languages. In addition, more curriculum materials must be developed and educators trained as recommended by participant number 1 amongst the Curriculum Implementers. Researchers must be encouraged to study issues about African languages. Moreover this study endorses the view by Kamwangamalu (2000b: 131) that suggest the fact that "a political support must be given to the use of these languages as media of learning".

6.5 RECOMMENDATIONS FOR FURTHER STUDIES

The focus of this study has been the development of African languages in the multilingual context of South Africa, with special reference to SiSwati, one of South Africa's nine indigenous languages. Studies similar to the current one should be commissioned to prove the efficacy of newly developed terminologies.

Studies similar to Mabasa's (2005), which investigated the translatability of academic discourse in other areas of science and technology, also need to be conducted. There is also an obvious need to document the experiences, challenges as well as successes of collaborators who are involved in similar terminology development projects commissioned by the NLS.

There is a need to undertake pilot studies that will provide evidence about the use of mother tongue in the teaching of subjects such as mathematics. Evidence from such studies will help to demonstrate the benefits that proponents of mother tongue education argue there are.

It is also recommended that, with the advancement of technology and the emergence of burgeoning ICT products that could foster more affordable and sustainable terminology development projects, research be conducted into the possible use of new technologies such as terminology databases.

It was indicated in the literature review for this study that one of the most formidable challenges to terminology development is the fact that an African language such as SiSwati, has several varieties spoken in the different locations of the area where the language is predominant. This study recommends that research be conducted into the possible use of media such as radio to establish a forum through which a majority of stakeholders of a particular language can contribute to the development of their language. In addition, it is recommended that projects for the standardisation of languages be promoted to ensure that standard terminologies are circulated. Perhaps the pertinent question to be researched is: Which strategies can be employed to promote the use of African languages as languages of learning and teaching in South Africa?

6.6 CONCLUSION

In summing up the review of the literature on 'Multilingualism and the Development of African Languages", the researcher would like to endorse the following views which appeared in the Article 'Mother Tongue Speak to Us All", *Sunday Times, 05 August 2007:*

- *Language is important as a way of understanding oneself. It goes beyond economic value* (Nomboniso Gasa)
- *The state needs to make it preferable that in order to get a job, you need to be able to speak an African language* (Neville Alexander)
- *Research indicates that the majority of parents would like their children to learn African languages* (Ntombenhle Nkosi)
- *Our black students are running away, not even shying away, from the language. Running away!!* (Peter Mtuze)

- *Is the government giving us enough money ... to promote African languages?* (Mantoa Rose Smouse)
- *We somehow felt that we needed to replicate what had been done with Afrikaans, 11 times over.* (Kathleen Heugh)
- *The missionaries made people believe that African languages were languages of barbarians.* (Sizwe Satyo)
- *In the rise of Afrikaans, for every political or economic gain there was a language gain.* (Theo du Plessis)

(Sunday Times, 05 August 2007: 13)

In the researcher's opinion all the above experts who concur that "uplifting the status of African languages would benefit the entire country" are correct in making proposals which are in line with the recommendations of this study, with regard to the fact that in order to improve the status of African languages, South Africa should:

- Allow children to learn languages in a form they understand;
- Use existing resources more efficiently;
- Improve the quality of African-language teaching;
- Offer bursaries and policies to encourage students to study African languages;
- Make African languages more visible, for example on street signs, and encourage prominent people to speak the vernacular on TV;
- Include the speaking of an African language among the criteria for employment; and forming a pressure group to hasten the legislative process so that the South African Languages Bill is presented to parliament.

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APPENDICES

Appendix 1[16]: References – *Multilingual Dictionary of Mathematics Grades 1 to 6*

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Appendix 2: Educator Questionnaire

Teacher/ Educator Questionnaire

Fill out the following questionnaire, putting a cross in the box which best describes whether you agree or disagree with each statement. This is about yourself and not for anyone else, so answer as honestly as you can.

Remember, this is an anonymous questionnaire, your name is not important. In addition your views will not be used for anything other than the research it was intended for.

Section A: Demographic Data

Please cross the relevant box				
Gender			Male	Female
Age	20 - 29	30 - 39	40 – 49	50 and above
Mother Tongue				
Learning area/ subject				
Number of years employed				
Number of years teaching the learning area/ subject				
Highest Qualification				

Section B:
Put a cross next to the statement that best reflect your opinion

Key: SA= **Strongly Agree,** A= **Agree,** N= **Neither agree nor disagree,** D= **Disagree,** SD = **Strongly Disagree**

Statement	SA	A	N	D	SD
It is a good thing to have SiSwati as the main official language in teaching mathematics					
Using SiSwati will make our children less competent in mathematics					
When using SiSwati, I do not feel that I am teaching mathematics any more.					
If I use English in teaching mathematics, I will be praised and approved of by the school and parents of my learners.					
At times I fear that by using English I will become like an expatriate.					
Teachers and Learners should not be forced to learn mathematics in SiSwati.					
I think that the learners in my school will not like it if I use the mother tongue when teaching mathematics.					
I don't like the idea of relying on speaking English in a classroom full of SiSwati speakers.					
A good command of the language of the community where I teach will let me help people more than I could otherwise.					
In the mathematics classroom, SiSwati is superior to English.					
It would be a mark of respect for mother tongue if we were to teach learners in their language					
If I use English in the mathematics classroom, it means that I am not patriotic.					
If English is used in the classroom, the status of my learners is raised.					
Teaching mathematics in SiSwati is important, but I don't expect it to be much fun.					
My mathematics textbooks should be written in, or translated into, SiSwati.					
I don't have any idea about how to go about teaching mathematics in SiSwati.					
I feel uneasy and lack confidence when speaking SiSwati in the mathematics classroom.					
Knowledge of SiSwati is important to be successful in mathematics					

I worry a lot about using mother tongue in the classroom.					
English should not be a medium of instruction in the schools of South Africa.					

Section C:

Having looked at the *Multilingual Dictionary of Mathematics for Grades 1 to 6*, please answer the following questions. Use the space provided. If you want to write more, please use the back of this questionnaire

1. What is your opinion about the dictionary contents? (The terms therein)

2. Do you think the learners in grades 1 to 6 will find the terminology in the dictionary easy to understand? Motivate

Appendix 3: Educator Attitudes Questionnaire

Educator Questionnaire

The questions given in this questionnaire are the items/questions written by your learners. Please study the items and respond to the given statement for each and every question.

My learners will get the correct answer for this item ***(Choose Yes or No)***			
	ITEM	**Educator's Choice**	
1.	From the series of numbers 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, give those that are divisible by 2	**YES**	**NO**
2.	From the series of numbers: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, give those that are not divisible by 2	**YES**	**NO**
3.	The numbers identified in 1 above are even. Give a series of five numbers that follow each other and are odd.	**YES**	**NO**
4.	The numbers that you identified in 2 are odd. Give a series of five numbers that follow each other and are odd.	**YES**	**NO**
5.	Write four numbers that come before 77.	**YES**	**NO**
6.	What four numbers that are divisible by two come before 77?	**YES**	**NO**
7.	What four numbers that are not divisible by two come before 77?	**YES**	**NO**
8.	Write all the numbers found between 77 and 107?	**YES**	**NO**
9.	Which of these numbers in 8 above can be divided by 5?	**YES**	**NO**
10.	Which of these numbers in 9 above add up to 180?	**YES**	**NO**
11.	Complete the following equalities a) $5 + 5 + 5 =$ b) $5 \times 5 =$	**YES**	**NO**
12.	To multiply the number 18 by 3 is to take the number 18 as an added three times: $18 \times 3 = 18 + 18 + 18$. Are the following equalities true? a) $12 \times 5 = 12 + 12 + 12 + 12 + 12$ b) $8 + 8 + 8 + 8 + 8 + 8 + 8 + 8 = 8 \times 8$	**YES**	**NO**
13.	Division is related to multiplication. To divide 8 by 2 means to find a number that multiplied by 2 gives 8. What is that number?	**YES**	**NO**
14.	Check by multiplying whether the following divisions have been done correctly. a) 18 divided by 6 equals 3 b) 45 divided by 3 equals 15	**YES**	**NO**

15. Complete the number pattern on the following table. The table says that there are 10 millimeters in one centimeter. Centimeters | 1 | 2 | 3 | 4 Millimeters | 10 | 20 | |	**YES**	**NO**
16. How many millimeters are there in 4 centimeters?	**YES**	**NO**
17. Complete the number pattern on the following table. Each row has 3 chairs. Rows | 1 | 2 | 3 | 4 Chairs | 3 | 6 | |	**YES**	**NO**
18. How many chairs are in three rows?	**YES**	**NO**
19. Complete the number pattern on the following table. One South African rand has the same value as five 20 cents. Rand | 1 | 2 | 3 | 4 20 cents | 5 | 10 | |	**YES**	**NO**
20. How many South African rands have the same value as ten 20 cents?	**YES**	**NO**

Appendix 4: Learners Test

Gcwalisa lemininiKamkhulu ngaphambi kwekutsi ucale kuphendvula imiboto

Ligama Lesikole: _____

I - Grade: _____

Iminyaka Yakho: _____

Bulili: _____

Lulwimi lwasekhaya: _____

Lusuku: _____

1. **Kuloluhlu lwetinombolo 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, niketa leto litihlukaniseka nga 2.**

---

2. **Kuloluhlu lwetinombolo 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, niketa leto letingahlukaniseki nga 2**

---

3. **Letikunombolo lotibhale ku 1 ngenhla tiyahlukaniseka ngakubili.**
   Bhala luhlu lwetinombolo letisihlanu letilandzelanako letihlukaniseka ngakubili.

---

4. **Letinombolo lotikhetsile kunombolo 2 ngenhla atihlukaniseki ngakubili.**
   Bhala luhlu lwetinombolo letisihlanu letilandzelanako letingahlukaniseki nga 2.

---

5. **Bhala tinombolo tibe tine letisembikwa 77.**

---

6. **Ngutiphi tinombolo letine letihlukaniseka ngakubili 2 letisembili kwa 77?**

---

7. **Ngutiphi tinombolo letine letingahlukaniseki ngakubili 2 letisembili kwa 77?**

---

8. **Bhala tonkhe tinombolo letitfolakala emkhatsini wa 77 na 107**

---

9. **Ngutiphi taletinombolo ku 8 ngenhla letingahlukaniseka nga 5?.**

---

10. **Kuletinombolo lotibhale ku 9 ngetulu, ngutiphi letingahlanganiswa tifike ku 180?**

---

11. **Cedzela nati tibalo ukhombise ulingana**

    (a.) $5+5+5=$

    (b.) $5\times5=$

12. **Kuphindzaphindza lenombolo 18 nga 3, kuyefana ne kutsatsa inombolo 18 uhlanganise katsatfu. Ngabe letibalo letilandzelako tiliciniso nobe cha?**

    (a) $12\times5=12+12+12+12+12$ _____

    (b) $8+8+8+8+8+8+8+8=8\times8$ _____

13. **Kukhipha lokuphindziwe kuyahambelana nekuphindzaphindza. Kususa 8 nga 2 ngekuphidzelela kuyefana nekutfola inombolo lengaphindvwaphindvwa nga 2 ikunikete 8. Nguyiphi lenombolo?**

---

14. **Hlola ngekuphindzaphindza kutsi kukhipha lokuphindziwe kwentiwe kahle kuletibalo letilandzelako:** Liciniso nobe Cha

(a) **18 ukhiphe ngekuphinzelela nga 6 ulingana na 3** _____

(b) **45 ukhiphe ngekuphindzelela nga 3 ulingana na 15** _____

15. **Cedzela lephethini yetinombolo kulelithebula lelilandzelako. Lelithebula likhombisa kutsi kunemamilimitha lalishumi kulinye lisentimitha.**

Sentimitha	**1**	**2**	**3**	**4**
Milimitha	**10**	**20**		

16. **Mangakhi emamilimitha latfolakala kumasentimitha lamane.**

---

17. **Cedzela lephethini yetinombolo kulelithebula lelilandzelako. Umugca ngamunye unetitulo letintsatfu.**

Umugca	**1**	**2**	**3**	**4**
Titulo	**3**	**6**		

18. **Tingaki titulo letisemgceni lemitsatfu?**

---

19. **Cedzela lephethini yetinombolo kulelithebula lelilandzelako. Lirandi lilingana nemasenti lengemashumi lamabili lasihlanu.**

Lerandi	**1**	**2**	**3**	**4**
20 emasenti	**5**	**10**		

20. **Mangaki emarandi lalingana nemasenti langemashumi lamabili lalishumi?**

Appendix 5: Curriculum Implementers Questionnaire

Curriculum Implementers Questionnaire

In 2004 the National Language Service published a *Multilingual Mathematics Dictionary for grades 1 to 6*. The main aim of the dictionary was to serve as resource material for the implementation of the Language in Education Policy 1997 which advocates the use of mother tongue in education and the promotion of multilingualism. By implication this meant that African languages (e.g. SiSwati) could be used as languages of instruction in the lower classes. However, the use and effectiveness of the said dictionary is not known. This study seeks, with your help, to establish the usefulness of material such as the dictionary mentioned here.

Please respond to the questionnaire items honestly and frankly. The information obtained will be used strictly for purposes of this research project. You do not have to mention your name on the questionnaire.

SECTION A

Please use the space provided on the questionnaire, you may use extra paper if your responses do not fit on this questionnaire.

Please cross the relevant box				
Gender			Male	Female
Age	20 - 29	30 - 39	40 – 49	50 and above
Mother Tongue				
Learning area/ Specialisation				
Highest Qualification				
Number of years teaching the learning area/ subject				
Number of years employed in current designation				

SECTION B

1. Prior to this day, were you aware of the Multilingual Mathematics Dictionary? If So, since when?

2. What is your opinion about the SiSwati terminology in the *Multilingual Mathematics Dictionary* for grades 1 to 6.

3. In your opinion do you think it is possible to teach mathematics in African languages like SiSwati? Please motivate.

4. Do you favour the use of African languages (SiSwati) or English in the teaching of mathematics? Why?

5. Looking at the dictionary, do you think the African language terminology (SiSwati), in it will help enhance learning and understanding of mathematics concepts in the classroom?

6. What else do you think can be done to improve the use of African languages in the teaching of mathematics?

7. In your opinion, do you think teachers involved in the teaching of mathematics will prefer to teach the subject in an African language i.e. SiSwati? Why?

8. In you opinion, do you think learners in grades 1 to 6 will find be able to handle/ understand the terminology contained in the dictionary?

END, Thank you

Appendix 6: Memorandum to Schools (Request for Permission)

Memorandum

To: The Principal

Attention:

Thembalethu Primary School

From: Mr. Thembinkosi Mabila

UNIFY Programme

University of Limpopo

P/Bag X1106, Sovenga 0727

Office: 015 268 2895/2987 (Office); Cell Number Was Provided

Date: 19 September 2006

Re: Request for permission to collect research data: 24th October 2006

I write to request for your school to grant me permission to collect data for a study titled:

Multilingualism and the development of African languages: A case study

This research is a study for a PhD research which aims to analyse SiSwati terminology found in the *Multilingual Mathematics Dictionary for grades 1 to 6* which was published in 2004.

The study also seeks to evaluate the 1997 Language in Education, which promotes use of mother tongue in teaching and learning.

I will like to administer two questionnaires in your school. One for teachers of mathematics in grades 1 to 6, and another one for grade 6 learners.

Thanking you in anticipation for your positive response,

Thembinkosi Mabila
