THE EFFECT OF A SCIENTIFIC LITERACY STRATEGY ON GRADE 6 AND 7 LEARNER'S GENERAL LITERACY SKILLS

by

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ABSTRACT

In this study I investigated the effect of a science literacy strategy on the development of grade six and seven second-language learners' general literacy skills in both their home language (isiXhosa) and language of instruction (English). The scientific literacy strategy used focuses on reading to learn science, writing to learn science, classroom discussion and argumentation. A mixed method design was used. Quantitative data were collected from baseline and post-testing of language skills of learners. Qualitative measures were generated through interviews of learners and teachers and classroom observations. The sample comprised of seven grades six and seven (multigrade classrooms) classes in seven primary schools situated in the rural areas near Hogsback in the Eastern Cape (five experimental schools and two control schools). Mean differences between the experimental and control groups for the reading, listening, writing and speaking aspects of the literacy tests were computed and the data generated were treated statistically using Analysis of Variance. The qualitative data were used to gain deeper insights into the quantitative results. The data suggest that the science literacy strategy statistically significantly improved the learners reading skills in English, their listening skills in both English and isiXhosa, and their writing skills in isiXhosa over a six-month period. Possible explanations for these results are that the reading material was in English only, extensive use of code-switching from English to Xhosa was made by the teachers while teaching, and that learner classroom discussion and writing in isiXhosa was encouraged.

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TABLE OF CONTENTS

LIST OF TABLES AND FIGURES

CHAPTER ONE

INTRODUCTION AND OVERVIEW

1. INTRODUCTION

It has been recognised for decades that there is widespread underachievement in science and mathematics education in South Africa (de Lange, 1981; Taylor & Vinjevold, 1999; Asmal, 2000; Howie, 2001; Reddy, 2006). However, problems associated with science and mathematics education are not confined to this country, but are international phenomena (Driver, Guesne & Tieberghien, 1995) and international research has shown that issues of language are key areas contributing to high failure rates in these subjects (National Centre for Curriculum Research and Development, 2000). In turn, recent research on science literacy suggests that teacher education and professional development strategies should assign a more important role to language in terms of learning and teaching science (Yore & Treagust, 2006), and a number of investigators have reported on strategies for improving reading, writing, discussing and doing science (Hand, Prain & Yore 2001; Heselden & Staples, 2002; Marlow, 2005).

The effects of language on science and mathematics teaching and learning are exacerbated when classes are conducted in a second language (Taylor & Vinjevold, 1999). In the Eastern cape, Xhosa is the widely spoken indigenous language and home language to 83.8% of the population, yet the official medium of instruction in the majority of schools from the beginning of grade 4 (ages 9-10) to grade 12 is English (Probyn, 2004). The right to choose the language of learning and teaching is vested in

the individual and schools have the right to choose their language of teaching and learning (Department of Education, 1997; National Centre for Curriculum Research and Development, 2000). Studies suggest that indigenous-tongue speaking parents prefer and choose that their children be taught in English for reasons of social mobility, opportunities to access technology and science, and as a wider means of communication (de Klerk, 2002; Setati, 2005).

Brinton, Snow and Wesche (1989) suggests that if teachers integrate all four language skills (reading, writing, speaking and listening) in content based lessons, learners not only understand information better but are able to interpret and evaluate it as well. Their view is based on the belief that content learning is the vehicle for language development, in other words, as much as learners are assisted in understanding the content of the subject, they also develop their language skill. In this study the effect of a science literacy strategy currently being offered by the Nelson Mandela Metropolitan University, which aims to improve second-language learners scientific literacy via writing, reading, inquiry, discussion and argumentation in both the learners' first and second languages, is investigated in terms of its effect on learners general literacy skills, *viz.*, reading, writing, listening and speaking skills.

2. LITERACY AND SCIENCE

Research in science education indicates that one must be able to read and comprehend in order to examine scientific information, and one must be able to compose (both in writing and orally) in order to communicate scientific results (Miller, 2006). On the other hand it is difficult for most learners, particularly those who learn through an additional language, to read and comprehend the content of technical learning areas such as science. This became evident from personal

experience in my language lessons when I used text from a content learning area to teach and assess learners reading and writing skills. Almost always the assessment of these skills would show very low levels of achievement. Brinton *et al*. (1989) suggest that a content based language teaching approach should eliminate the artificial separation between language instruction and subject matter classes. In their approach the activities of the class are specific to the subject matter being taught, and are geared to stimulate students to think and learn through the use of the target language. However, as noted before, an additional difficulty in our Eastern Cape context is that the target language of learning and teaching is English, which is not a native language of the majority of learners in the Eastern Cape.

The main question therefore is whether there could be a way of integrating content learning with language teaching purposes, i.e., to develop second-language learners reading, writing, listening and speaking skills. As mentioned earlier, Brinton *et al.* (1989) believe that content learning is the vehicle for language development, in other words, as much as learners are assisted in understanding the content of the subject, they also develop their language skills (Brinton *et al*., 1989; England & Webb, 2007). Science teachers in my school always complained about the lack of vocabulary in learners' mother tongue to explain some of the scientific concepts and terms. As a result learners would end up memorising the terms without actually understanding them. At the same time teachers wanted to establish how they could best promote reading and writing through science learning as they realised that their students were struggling readers.

3. SCIENCE LITERACY

Internationally, there has been increasing research and recognition in recent years of the central role of language in learning science (Miller, 2006), and on the introduction of reading and writing in science literacy (Yore & Treagust, 2006). These researchers believe that for someone to be judged as scientifically literate they must be proficient in the discourses of science, which include reading, writing and talking science. Others feel that science education becomes ineffective if it does not support learners in acquiring language skills (Yore, Bisanz & Hand 2003; Wallace, Hand & Prain, 2004). In fact Wallace *et al*. (2004) believe that reading and writing are essential activities that all students of science need to engage in to completely focus on their scientific understanding. They also believe that both skills have potential for fostering content learning, while Gee (2005) cited in Yore and Treagust (2006), believes that no domain represents academic language better than science. The definition of science literacy has been broadened from a focus on technical conceptions and terminology to include skills in communicating science concepts and, as such, it seems reasonable to attempt to research the effect of science literacy interventions in terms of general communication skills.

4. STATEMENT OF THE RESEARCH PROBLEM

As noted earlier, there are many problems associated with science education both nationally and internationally and that one issue associated with poor learner achievement is that of language. Researchers, such as Norris and Philips (2003), conclude that science understanding cannot be attained without the ability to read and comprehend textual information and write competently about the subject under study.

The Language in Education policy (Department of Education, 1996) as cited in the National Centre for Curriculum Research and Development (NCCRD) Research Project (2000) means that the right to choose the language of learning and teaching is vested in the individual and those schools have a right to choose their language of learning and teaching. A large number of urban (township) and rural schools in the South Africa choose English as a language of learning and teaching, despite the fact that learners in these schools have little contact with English speakers (Taylor & Vinjevold, 1999). As a result, learners struggle to comprehend texts that are written in English as a result of their low reading, speaking, listening and writing abilities in the language of learning and teaching.

The challenge of the scientific literacy approach adopted in this study is to find a way of integrating content learning with language teaching purposes, i.e., to develop these learners reading, writing, speaking and listening skills so that they learn science more effectively and enjoy the subject. Research conducted by Brinton *et al*. (1989) suggests that if teachers can integrate all four language skills in content based lessons, learners would not only understand information better, but would be able to interpret and evaluate it as well. This implies that if learners are learning through a language which is not their mother tongue, as it is the case in many South African schools, the integration of content, the target language and the home language should enable greater comprehension of the content of the subject.

The difficulties that South African teachers experience when teaching and learning takes place in a second language has been clearly recognised by Setati, Adler, Reed and Bapoo (2002), and extensive research has been documented on code-switching in South Africa (Adler, 2001; Setati, 1998). Code switching refers to the

practice of using two or more languages in a single linguistic episode (Moschkovich, 2007) and as something which can provide spontaneous and reactive discussion of concepts by learners and teachers in their home language (Setati, 2007).

The science literacy strategy currently offered by Nelson Mandela Metropolitan University (NMMU) aims at improving learners' scientific literacy via writing, reading, listening and speaking to learn science by using both the language of teaching and learning (LoLT) and the learners' home language via code switching where appropriate. The research problem underpinning this study is therefore whether this particular form of intervention to improve scientific literacy has an effect on learner's generic literacy skills.

5. RESEARCH QUESTION

The research question I want to investigate is:

Is the science literacy strategy used an effective method for improving learner's language skills?

The subordinate questions are:

- *Do the reading skills of learners in Grade 6 and 7 improve with the implementation of the science literacy strategy?*
- *Do the writing skills of learners in Grade 6 and 7 improve with the implementation of the science literacy strategy?*
- *Do the speaking skills of learners in Grade 6 and 7 improve with the implementation of the science literacy strategy?*
- *Do the listening skills of learners in Grade 6 and 7 improved with the implementation of the science literacy strategy?*

- *What are the reasons for improvement if, in fact, this does take place?*

6. METHODOLOGY

A mixed method design with both qualitative and quantitative aspects was used in this study for the collection of data. Quantitative data were collected from the baseline and post-testing of language skills of learners. The purpose of the baseline testing was to determine the literacy levels of learners before the scientific literacy strategy was implemented, and the post- testing was done to measure any change in learner's literacy skills that may have occurred after the implementation of the science literacy strategy. Data were collected from grade 6 and 7 multigrade classes in seven primary schools, five of which were experimental schools while the other two served as control schools.

Qualitative measures were generated through the following: language survey of schools to determine the languages of communication and official languages in the schools, interviews of learners and teachers which allowed them to share what they thought about the scientific literacy project, while classroom observations on how teachers teach using this strategy, and how learners respond to the subject matter, provided more quantitative measures for triangulation with the qualitative data.

7. SAMPLE

The research was done with grade 6 and 7 learners from seven primary schools which are situated in the rural areas below the Amatola Mountains near Hogsback in the Eastern Cape. Learners range between 11-14 years of age. Both the teachers and learners in these schools are Isixhosa first-language speakers while English is the language of teaching and learning in their schools. In these schools, Isixhosa is the

language of communication in the playground and at home, but English is officially the language of the classroom. Grade 6 and 7 learners were selected for this study as in South African schools with mostly second-language learners of English they have already switched over for two years (in grade 4) to English as the language of learning. This process forms part of the *subtractive educational* mode that is commonly used, i.e. one where learners are moved out of their main language (mother tongue) and into the official language of learning and teaching (LoLT) as early as possible.

8. DATA GATHERING INSTRUMENTS

Data were gathered through pencil and paper pre- and post-tests. These tests were both in Isixhosa (learners' home language) and English (Language of Learning and Teaching). The purpose of the tests was to test learners literacy levels in both languages since learners at this phase have only recently (two years previously) switched into English as the language of learning and teaching (LoLT). A classroom observation schedule was also used as means of collecting data. The schedules were designed to reveal the degree to which the language support teachers give while implementing the science literacy strategy and to also establish the language used by teachers and learners in the classroom during a science lesson.

The open-ended teacher interview schedules were designed to probe why the teachers used a certain language practice to support classroom communication; which language (Isixhosa or English) do they think would make a difference in implementing the science literacy strategy and why; which language do they believe communicates science better to the learners; what do they think made the difference in their lessons (if any); and why they choose to use more of a certain language over

another when they were teaching in their classrooms. All interviewees were asked the same questions in the same order and the interviews were conducted in English, the language of learning and teaching, but as the researcher is a first-language isiXhosa speaker, she could assist with translations where necessary. Learners were also interviewed to find out why they communicate using the language they use most in their classroom and what difference they feel that the science literacy strategy makes in terms of their understanding of science. Language survey forms were also used to collect data to determine the languages used in the schools both for communication and official purposes.

9. DATA ANALYSIS

The qualitative data (interviews) were inspected and categorised and then triangulated with the quantitative findings. The quantitative data were treated statistically to provide descriptive and inferential statistics using Analysis of Variance (ANOVA). A classroom observation schedule was used to determine the teaching strategies used in the classroom and how these strategies provide language support to the learners.

10. RELEVANCE OF THE RESEARCH

This research is relevant because as indicated earlier (NCCRD, 2000) language is recognised as one of the key reasons why learners do not perform well in maths and science. Wallace et al. (2004) believe that reading and writing are essential activities that all students of science need to engage in before they can completely focus on their scientific understanding. As already noted, in South Africa most schools choose to teach in English (de Klerk, 2002; Setati, 2005) which is not the home language of the majority of learners in this country. England, Huber, Nesbit,

Rogers & Webb (2007) recognise that learners in our South African context are faced with more than the 'three language problem' encountered at school by first-language learners. Second-language learners are faced with a 'four-language problem', i.e. home language, school academic language, English as the language of leaning and teaching, and science specific language. This situation makes it very difficult or them to comprehend texts and understand science concepts.

As such, conducting a study on the effect of a science literacy strategy on learner's basic literacy skills will hopefully be profitable in terms of informing the development of this particular approach which aims at improving second language learners' science literacy via reading, talking, listening and writing.

11. OUTLINE OF THE STUDY

Chapter one is an introduction to the theory on the relationship between scientific literacy and language. The research problem is formulated and the research question, methodology, sampling, instruments, relevance of research data analysis and the outline of the study are described.

In chapter two I review the literature relevant to the topic in terms of scientific and the historical context of language issues in South African schools in terms of the colonial, apartheid and post-apartheid eras, the current language policies in South Africa (both the *de jure* and *de facto* positions), issues of bilingualism, code switching and literacy in South Africa, problems in science education and scientific literacy, the role of language in science, and the scientific literacy strategy used in this study.

In chapter three I discuss the research approach, the objectives, the research question and methodology, describe the sample and data gathering instruments,

consider reliability and validity issues, and interrogate the ethical considerations of the study. The data generated by the study is presented in chapter four and is discussed in chapter five. Conclusions are drawn and recommendations are made in chapter six, based on the data generated and the literature review presented in chapter two.

CHAPTER TWO

LITERATURE REVIEW

1. INTRODUCTION

This chapter provides an overview of language policies in South Africa and reviews literature on language policy implementation in schools where the language of learning and teaching (LoLT) is not the learners' home language. The issues of bilingualism, mother tongue instruction and code switching are explored in the light of the current language practices in South African classrooms. Literacy levels in educational institutions are explored as are the effects that the introduction of language policies in South Africa has had on the literacy levels of learners in South Africa. Finally science literacy and the role of language in science are reviewed, as is the 'scientific literacy' strategy used in this study.

2. HISTORICAL CONTEXT OF LANGUAGE ISSUES IN SOUTH AFRICAN SCHOOLS

The context of language issues in South African schools is perhaps best understood thought the lenses of the countries colonial, apartheid and post-apartheid eras.

2.1 The Colonial Era

History records that during the colonial era, Dutch which was the initial medium of instruction in "white" schools, was replaced by English. When the Union of South Africa came into existence in 1910, English and Afrikaans became the

official languages of the country. This led to the establishment of both monolingual and bilingual schools, the language of learning and teaching being English and Afrikaans. As a result a number of dual medium and parallel medium schools were established, specifically for citizens of European origin (National Education Policy Investigation Report, 1992). African languages were introduced as school subjects.

2.2 The Apartheid Era

The use of English among black South Africans was on the increase with increasing availability of state and mission schools, and more interaction with English speakers in the ever growing cities and the workplace. Banda (2000) reports that the situation changed when the National Party came into power in 1948. The party's goal was to advance Afrikaans and reduce the influence of English in South Africa.

Before the passing of the Bantu Education Act of 1953, the home languages of African speaking learners were used as languages of learning and teaching for the first four years of schooling. After 1953, the home languages were to be the medium of instruction up until the eighth year of schooling, and after that half of the subjects were to be taught in English and the other half in Afrikaans (UNESCO, 1953) in Mckibeen and Brice (2001). Furthermore the government of the time encouraged the African Languages board to develop vocabulary and terminology of the African Languages in subjects such as science, geography etc., but they never got support as the nationalist government went on a deliberate campaign to deny black children authentic models of English and also not giving support to the African Languages Board (Heugh, 1995). The fact that for African learners some of the subjects were taught in English and others in Afrikaans met with opposition from the teacher unions and this is one of the factors that led to the 1976 uprisings. African parents regarded mother tongue instruction as a disadvantage to their children and felt that it was

depriving them of greater progress in life which according to them could be achieved if they were taught in English. Also black parents associate mother tongue education with mediocrity and failure (Banda, 2000).

The Education and Training Act 90 of 1979 allowed the parents to have a say in the choice of languages of learning and teaching for their children after the 4th year of schooling and to establish the De Lange commission to investigate the problems in 'Black' education. After ten years of the publication of the De Lange report, the government implemented the new language policy which presented parent bodies with three options:

- Straight for English from Grade 1
- A sudden transfer from home language to a first additional language as language of learning and teaching in Grade 4
- A graduated transfer from home language to a first additional language as LOLT during the first four years of schooling (NEPI Report, 1992)

2.3 The Post - Apartheid Era

The new government that came into power in 1994 encourages multilingualism. This is evident in the new constitution which officiated nine African languages in addition to English and Afrikaans (Constitution of the Republic of South Africa). Government legislated the use of mother tongue instruction (Department of Education, South African Schools Act, 1996) and in 1997 the Language in Education Policy (Department of Education, 1997) encouraged schools to promote multilingualism in various ways including using more that one language as the language of learning and teaching (Department of Education, 1997). The policy also gives the power to the school governing bodies (SGB's) to decide on the language

policies of their schools. However, the National Education Policy Investigation (NEPI) (1992) report reveals that parent's memories of Bantu education, combined with their perception of English as a gateway to better education, results in them choosing English. Banda (2000) believes that African parents do not see effective education in a language other than English and therefore feels that concern should be on how to change African attitudes towards mother tongue medium of instruction.

3. CURRENT LANGUAGE POLICY IN SOUTH AFRICA

In the post 1994 period, the South African government aimed at introducing new policies which would extend equity and enhance education through more democratic policies (NCCRD, 2000). One of the policies that were developed was the language policy as it became clear to the policy makers that there was a concern about the way language is learnt, how well it is learnt and the nature and impact of language of learning and teaching. It is important to note that when South Africa emerged as a democratic state in 1994 recognition of English and Afrikaans as dominant languages changed. This change is reflected in the constitution which recognizes 11 languages (IsiZulu, isiXhosa, Afrikaans, Sesotho, English, Setswana, Xitsonga, Siswati, Tshivenda, Sepedi, Sindebele) as the official languages of this country (Constitution of the Republic of South Africa, 1996). The constitution emphasizes that the state must take practical and positive measures to elevate the status and advance the use of indigenous languages which were previously marginalized by the apartheid government. With regard to education, the constitution states that everyone has a right to receive education in the official language/languages of their choice in public educational institutions where practicable (Constitution of the Republic of South Africa, 1996).

4. LANGUAGE IN EDUCATION POLICIES: THE DE FACTO POSITION

The language in education policy (LiEP) (Department of Education, 1997) allows schools to choose their own language of learning and teaching (LOLT). Another element of this policy is the principle of additive bilingualism which involves the maintenance of home language and an access to an additional language. Schools are expected to make explicit how they will promote multilingualism through a variety of measures and encourage communication across the barriers of race, language and religion. Curriculum 2005 is another document which acknowledged the importance of multilingualism (Department of Education, 2002). This policy further acknowledges that there should be no difference in functions ascribed to the main and additional languages. At the same time, the language policy in the Revised National Curriculum Statement (RNCS), which superseded C2005, clarified and elaborated the department of education's language in education policy (Department of Education, 2002). The RNCS states among others that all learners learn their home language and at least one additional official language. With regard to the LOLT, the policy recommends that, especially in the foundation phase, the learners home language should be used for learning and teaching where possible (Department of Education, 2002).

The language policies noted above demonstrate that the goal of the government is to promote multilingualism and to recognize African languages at national level, but from observations and the research done by many scholars, most communication at national level and government public services is still in English and to some extent Afrikaans (De Klerk, 2002, Banda, 2000, Probyn, Murray, Botha, Botya, Brooks & Westphal, 2002). In their research, Setati, Adler, Reed and Bapoo

(2002) noted that most teaching and learning materials used in South African schools are printed in either English or Afrikaans, whereas these languages are not the primary languages of the majority of learners and teachers. They also observed that learners in the schools where they did their research always spoke, read or wrote in English in the formal school context.

The Language in Education Policy (Department of Education, 1997) gives the right to South African schools to choose their LOLT's. However, the National Education Policy Investigation (NEPI) (1992) report reveals that parent's memories of Bantu education, combined with their perception of English as a gateway to better education, results in them choosing English. Gamede (1996) investigated the attitudes of high school pupils towards the use of African languages as LOLT and found that in Model C, rural and township schools, learners regard the African languages as useless. Similar findings from a research study in Cape Town on how English impacted on isiXhosa speaking students show that African learners still preferred English as the language of learning and teaching (Vesely, 2000). Brown (1998) reveals that in schools in Natal, English is still the LOLT even though the majority of learners in those schools are African learners.

It is clear that despite the fact that many African schools were denied the privilege to teach in their own languages during apartheid, they still choose English as the language of learning and teaching today. Research done by Probyn, Murray, Botha, Botya, Brooks and Westphal (2002) in the four Eastern Cape districts indicate that parents choose English as LOLT because they associate it with status and also regard it as a language of technological and scientific access. They do believe that their children should learn their mother tongue as a language, but not use it as the language of learning and teaching. Their findings indicate that many schools changed

their policies and introduced English as LOLT in Grade 4 because of the demands of the Curriculum2005 rather than to conform to the LiEP (Taylor & Vinjevold, 1999, NCCRD, 2000). In other words, as much as the LiEP required schools to maintain the home language, they focused on developing their learner's competence in the language of teaching and learning (NCCRD, 2000). The President's Education Initiative (PEI) researchers cited in Taylor and Vinjevold, (1999) also discovered that, in general, schools have not developed their language policies according to the language in education policy. In most cases the schools argue that the decision of school language policies was based on what parents and teachers perceived to be in the interests of the learners and the school, hence their choice of English as the language of learning and teaching.

Probyn et al. (2002) argue that the reason why most schools have not developed their language policies according to LiEP is because of lack of experience in designing policies, sudden introduction of curriculum 2005 where teachers had to change their teaching methodology from teacher centeredness to learner centeredness, the demands of the Revised National Curriculum Statement (RNCS)(Department of Education, 2002) and the current National Curriculum Statement (NCS), and lack of support from their district officials on how to formulate the expected language policies.

It appears ironical that learners, whose mother tongues are African languages, often do not value their languages and this poses a question of whether the goals of the government to change the linguistic situation in this country from being dominated by English and Afrikaans to promoting multilingualism will ever be achieved. Also, it seems as if the choice of language of learning and teaching made in schools is not considerate of whether the learners have access to English, for instance

in the case of rural schools, English as LOLT is introduced as early as grade 4 at the time when learners are not yet developed even in their first language (Nomvete, 1994; Mgudlwa, 1997 in Setati, 2000). Although much of the new language policy in South Africa aims at promoting multilingualism, in practice English still continues to dominate and, despite it being the language of minority in South Africa, it has become the language of power and of educational and socio-economic advancement in this country (Bourdieu, 1991) in Setati et al. (2002).

5. ISSUES OF BILINGUALISM

Heugh (2000) mentions that the term 'Bilingualism' is defined in different ways, for instance, originally, it meant the use of two languages as the medium of instruction. She further says that Bilingualism usually means the learning of two languages as subjects for example the first language and a second language as a medium of instruction. In South Africa, bilingual education is understood as mother tongue instruction (1st language medium) throughout school plus a second language taught as a subject to a high level of proficiency (Heugh , 2000). Hamers and Blanc (1989) on the other hand define bilinguality as a psychological state of an individual who has access to more than one linguistic code as a means of social communication. They further say that bilingualism refers to the state of a linguistic community in which two languages are in contact with the result that two codes can be used in the same interaction.

Heugh (2000) provides examples of Bilingualism models:

- Subtractive Education Model: the objective of this model is to move learners out of mother tongue into the official language. Sometimes this involves going

straight into the official language medium of instruction in the first grade in school.

- Early/ late exit model: The learner may begin with the mother tongue and then gradually move to the official language as medium of instruction. If the transition to the second language takes place within 1to 3 years it is called early exit model and if it is delayed to grade 5-6, it is called late exit transition model.
- Additive Bilingual education model: the objective is the use of mother tongue as a medium of instruction throughout, with the official language taught at school or use mother tongue and official language as two media of instruction. The target is a high level of mother tongue plus a high level of proficiency in the official language.

In South Africa, the Language in Education Policy (LiEP, 1997) promotes the principle of additive bilingualism which involves the maintenance of home language and access to an additional language.

5.1 Mother Tongue Instruction

The Language in Education Policy (LiEP) endorses multilingualism, an additive approach to bilingualism in education and gives individuals the right to choose the language of learning and teaching at their schools (Department of Education, 1997). The objective of additive bilingual education is to use mother tongue (MT) as a medium of instruction throughout (with the official language as a subject) or use MT and an official language as dual medium of instruction with the aim of achieving a high level of proficiency in both the mother tongue and an official language (Heugh, 2000). In spite of the government's policy of additive bilingualism,

schools have generally continued to choose English as a language of learning and teaching (LOLT) (Probyn et al., 2002; Taylor & Vinjevold, 1999; Banda, 2000).

Research shows that there is value in mother tongue instruction, for instance, Heugh (2000) reports that in South Africa, educational achievement of African pupils increased during the eight years of mother tongue education despite the poor resourcing of schools. Her findings are that between 1955 and 1975, there was a high pass rate at Grade 12 and after the reduction to four years of mother tongue instruction from 1976 onwards, the pass rate fell from 83.7% in 1976 to 44% in 1992. Reddy (2005) observes that after the 1976 uprisings mother tongue instruction for African children was reduced to four years followed by a switch to English for most students while Afrikaans speaking children continued to enjoy mother tongue education up to university education. As a result in a recent Maths and Science Achievement at South African Schools in Trends in Maths and Science Study (TIMSS) in 2003, mother tongue speakers of Afrikaans performed best of all South African students(Reddy, 2006). Macdonald's report (1990) cited in Heugh (2000) shows that students who were switched from first language medium (Setswana) to English medium at the beginning of Grade 5 were not able to cope with the linguistic requirements of the system at that point.

Research done by Macdonald (1991) addressed the nature of language and learning difficulties of young African learners in South African Primary Schools. She recommended that learners be given a foundation for thinking skills by starting off in first language and once mentally equipped English may be added. Heugh (2003) cites the work of Cummins (1984) which shows that transfer from mother tongue to official language is only possible once there is a firm foundation of academic and cognitive development in the mother tongue. Cummins hypothesis states that there is a

cognitive process where what is known in the first language can be transferred to the second language, and transfer from first language to the second language is not possibly until the first language is well established and the second language well known. In other words, children will learn an additional language successfully where they have mother tongue medium throughout. From Cummins hypothesis, Heugh (2003) concludes that transfer in additive bilingual program is made possible because the first language is made present as the primary language and language from which the knowledge and skills can be transferred. As Banda (2000) indicates, the problem is on how to change black's attitudes towards mother tongue medium of instruction as research shows the value of mother tongue instruction.

5.2 Current School Situation in South Africa

By promoting multilingualism, the government of South Africa aimed at maintaining the use of home languages while giving access to an additional language. Meanwhile, the response of the majority of black South Africans to multilingualism is the acceptance of English as a language of Learning and Teaching (Banda, 2000, de Klerk, 2002). Research done by de Klerk (2002) among the Xhosa speaking parents with regard to sending their children to English medium schools shows that parents want their children to learn English as they believe that it will open more job opportunities and is an important language for educational success. Lemmer (1995) mentions that some teachers and parents in South Africa are not aware of the first language cognitive development and the acquisition of additional languages. He believes that teachers and parents need to be aware that to develop an additional language, the first language needs to be promoted and maintained so that the acquisition of the second language is an additive rather than a subtractive process. Heugh (2000) defines additive multilingualism as a process of acquiring or gaining

competence in a second language while maintaining the first language and subtractive multilingualism is a process where skills and fluency in the first language is lost while the second language is learned. Furthermore she mentions that in African countries it is expected that children in schools should develop language, communication and thinking skills through a language they do not understand, in this case English which is mostly used as a LOLT in most schools.

5.3 Code switching in bi/multilingual classrooms

Code switching is described as a strategy for teaching and learning in a multilingual classroom (Setati, Adler, Reed & Bapoo, 2002). Code switching refers to alternations of language within a single conversation, often involving switches within a single speaker turn or single sentence (Rose & Dulm, 2006).

South Africa is a multilingual country and the constitution recognizes 11 official languages (Constitution of South Africa, 1996). In a multilingual country, the most common pattern is for people to be bilingual in an indigenous African language and English (De Klerk, 2006). The present LiEP (Act 27 of 1996) aims among other things to establish additive bilingualism as an approach to language in education. The policy further states that the LOLT must be an official language; the school governing bodies must determine the LOLT and stipulate how the school will promote multilingualism (Department of Education, 1997). This policy therefore gives the right to schools to choose the LOLT.

Research done by Probyn, (2002), Setati, (2002), and Rose and Dulm (2006) shows that most of the schools choose English as the LOLT despite the fact that learners in those classrooms are non- native speakers of English. This is happening

also despite the fact that the provincial education departments are currently aiming at equipping schools to offer mother tongue instruction (Rose & Dulm, 2006). Setati (2002) mentions that in classrooms where learners are taught in English whereas they are non native speakers of English code switching practices are possible to support classroom communication in general while learners continue to develop proficiency in the LOLT.

Rose and Dulm (2006) research focuses on code switching between English and Afrikaans in the multicultural and multilingual classrooms of a secondary school in the Western Cape. Their findings were that code switching between English and Afrikaans fulfils a purpose of clarifying, confirming and expansion of ideas in classrooms which may seem be seen to aid teachers and learners in attaining academic goals. They concluded that code switching may be used as a communicative tool by both teachers and learners in multilingual classrooms and it should not be regarded as socially unacceptable.

There are also researchers who see code switching as a valuable communication resource, for example, Peires (1994) says that code switching can be used as a tool in learning. Merrit et al. (1992), cited in Setati (2005), found that code switching provides an additional resource for meeting classroom needs because even if an official policy exists, teachers make individual moment to moment decisions about language choices that are mostly dictated by the need to communicate effectively. The study that Setati (1998) conducted in one Grade 5 class in South Africa concluded that code switching takes place in class for different functions, for example, the teacher code switches to paraphrase what has been said and doesn’t add any new information, give direction over carrying out the tasks, sometimes to explain terms and to encourage pupils to say their point of view.

Setati et al. (2002) recognize that code switching plays a role while teaching science or mathematics. They mention that teachers face the demand of having to teach both the discipline and English at the same time and learners have to cope with the new language of science and math as well as the new language (English) in which they are taught. Code switching is therefore recognized as an important aspect of a bi/multilingual classroom especially that in science classrooms, teachers have to find a way of moving learners from informal spoken language to formal written language (discourse specific talk). This process is complicated by the fact that learner's informal talk may be in a language that is not the learner's LOLT (de Klerk, 2006; Setati et al., 2002).

Code switching therefore is believed to lead to understanding and communication with English LOLT learners and may help to prevent communication breakdown between teachers and learners.

6. LITERACY IN SOUTH AFRICA

Literacy is traditionally regarded as school- based reading and writing (Hugo, 1991; Norris & Phillips, 2003) but it also means knowledge ability, learning and education. Norris and Phillips (2003) argue that a person can be knowledgeable without being able to read and write, by learning by trial and error, word of mouth and apprenticeship. However, for the purposes of this study, literacy will refer to a school based reading, writing, talking and listening.

6.1 Literacy in schools

Hugo (1991) observes that generally when learners start their primary school they are taught how to read and write, and as they go to secondary school it is required that they are able to understand new ideas and information in order for them

to relate these with what they already know and in apply them. To do this they need well developed reading and thinking abilities. Research done by National Education Policy Investigation (1992) in Smyth (2002) indicates that before 1994, first language African learners used their home language for the first four years of schooling and then changed to using English as Language of Learning and Teaching. It was believed that at this stage learners had reached a state of readiness which would enable them to cope with English as language of learning and teaching (Setati, 2000). The Threshold Project research revealed that this change into English as the language of learning and teaching resulted in the first language skills not being developed because learners at this age are still not literate in the first language and they are inadequately prepared for this change (Macdonald, 1990). Furthermore, the Threshold Project (Macdonald, 1990) reported that at the time of change to English, learner's writing skills in English were immature, lacking the vocabulary, syntax and ability to link ideas necessary for explanation in content subjects, and that their reading abilities revealed that they were unable to answer simple inference or factual questions (Macdonald, 1990). Setati (2000) argues that even at senior primary level pupils are far less capable of handling content subjects through English than through their mother tongue.

6.2 Literacy at tertiary level

When learner's literacy skills are not developed at school, learners tend to struggle at tertiary level (Hugo, 1991). He further states that in a research study that was conducted by the Student Service Bureau of the University of Orange Free State, out of 66 first-year, second-language students who were tested in reading levels, not one of them had a reading ability that was higher than Grade 8, and 13 of them were only able to read at Grade 1 and Grade 2 levels. Another study that was conducted by

the Unit for the Development of Language Abilities at the University of Pretoria also revealed that 2000 out of 6000 first year students had a language ability which was on the level of a Grade 7 learner (Hugo, 1991). Reading of textbooks was another area which was found by Van Rooyen (1990) to be challenging because learners could not deal with the language demands made by them specifically the grammatical structures associated with expository writing and the new subject specific vocabularies related to things of which the students had no direct experience. Rademeyer (2001) noted that even students whose home language was English or Afrikaans also had poorly developed reading and writing abilities. As such, even though new language policies have been introduced in South Africa they do not seem to have affected literacy in this country.

7. PROBLEMS IN SCIENCE EDUCATION

Most researchers recognize the language problems associated with science education, for instance, Yore & Treagust (2006) mention a three language (home language, instructional language, science language) problem which exists for most science language learners. They argue that no effective science education programme would be complete if it did not help learners to discuss science and to comprehend a full range of science text. They noted that learning to talk read and write science needs teaching about language since acquisition of language skills enable learners to argue meaningfully about science issues. In most South African schools, the language problems are exacerbated in science because learners are taught science in a language which is not their mother tongue (Setati, Adler, Reed & Bapoo, 2002). Learners come to school with informal ways of talking and teachers have to move them from informal spoken and written language to formal language (Setati et al., 2002). They

further state that in multilingual classrooms the movement from informal spoken language to formal written language (discourse specific talk) is complicated by the fact that learners casual talk may be in a language that is not the learners' language of learning and teaching.

Another problem with science education is the misconceptions that learners have about science (Black, 2006). Chimoro (2004) argues that children bring into the classroom socio-cultural characteristics from their environment which may create a wedge between what they are taught and what they learn. Black (2006) also mentions that many American science textbooks add to children's misconceptions as many textbooks do not explain scientific concepts correctly. To change learner's misconceptions, Black (2006) amongst a plethora of other science educationists suggests that teachers need to be competent, patient and make connections between what they learn in science classrooms and what they already know. Chimoro (2004) concurs with Black and state that science learning should emphasize the need to begin teaching with knowledge and experience of the learners and build that base to assist the development of their understanding of the world.

A research study done in Zimbabwe by Jegede and Okebukola (1991), cited in Chimoro (2004), found that science is not generally considered a subject for women which eventually results in the under representation of women in science. They noticed that learners found it very difficult to challenge scientific knowledge because they regard it as the absolute truth. Also, other religious ideologies in Zimbabwe are in conflict with scientific principles, especially in Biology, for instance, reference to experiments on human embryos may be sensitive to Islamic cultures. This means that teachers need to consider the effects of African culture on science education. Language problems, misconceptions in science and socio-cultural factors need to be

considered as possible challenges in science education; hence teachers need to be aware of such problems.

8. SCIENTIFIC LITERACY

There has been increasing research and recognition in recent years of the central role of language in learning science (Miller, 2006), and on the introduction of reading and writing in science literacy (Yore & Treagust, 2006). These researchers believe that for someone to be judged as scientifically literate they must be proficient in the discourses of science, which include reading, writing and talking science. Others feel that science education becomes ineffective if it does not support learners in acquiring language skills (Yore 2000; Wallace et al., 2004). In fact Wallace et al. (2004) believe that reading and writing are essential activities that all students of science need to engage in to completely focus on their scientific understanding. They also believe that both skills have potential for fostering content learning. Furthermore, Gee (2005), cited in Yore and Treagust (2006), believes that no domain represents academic language better than science. As such, the definition of science literacy has been broadened from a focus on technical conceptions and terminology to include skills in communicating science concepts.

Science literacy research recognizes the three language problem faced by learners who are studying science (England et al., 2007) and therefore suggests that teachers need to help students navigate among home language, instructional language and science language. Yore and Treagust (2006) warn that teachers will be able to help the students in the above problem only once their basic literacy skills are in place because in that way, learners would be able to learn the science content. This suggests that teachers need to be helped to see, understand and implement instructional

practices which rely on both language and science. The importance of language in science literacy has been acknowledged by other researchers as well, for example, Hand et al. (2001), mention that there has been more recognition of the role of language skills in science classrooms and on how an increased variety of language tasks might increase both science understanding and language arts performance. In other words, by providing students with opportunities to read, write and speak as scientists will increase both science and literacy knowledge. Yore (2000) is also of the view that science literacy requires the embedding of explicit language tasks and instruction into science inquiry. As mentioned earlier, science teachers do not think it is their responsibility to teach language skills, whereas Barton et al. (2001) believe that students will only be able to comprehend science texts and other material dealing with science content, if they are exposed to reading strategies.

Research conducted in 1998 by the National Centre for Curriculum Research and Development (NCCRD) concluded that there is a widespread underachievement in math and science and that language is one of the key areas contributing to the high failure rates(Taylor & Vinjevold, 1999). This conclusion was supported by the Third International Mathematics and Science study (TIMSS) report released in 1998, which suggested that attention should be given to the use of language in content subject classrooms. In conclusion it appears clear that language and content go hand in hand and one cannot teach one without the other.

9. ROLE OF LANGUAGE IN SCIENCE

Norris and Phillips (2003) argue that scientists use language to construct, describe and present science claims and arguments and therefore one can be a learned person with the knowledge of science and still have the ability to speak, read and

write in and about science. Recently, more international research on language and science literacy emphasize the need for more attention on reading, writing, speaking and listening in science classrooms as they believe that an increased variety of language tasks might increase both science understanding and language arts performance (Hand et al., 2001). For example, Huang (2006), views language as playing an important role in mediating students' science learning by providing a system for thinking and constructing understanding as well as means for communicating their ideas. At the same time Osborne (2002), state that establishing a knowledge claim in science involves a process of establishing what counts as data through conducting and checking observations and experiments and such activities are not done in the laboratory but in the papers scientists read and write and the presentations and arguments they engage in at the conferences.

9.1 Reading

Marlow (2005) views reading as another method to acquire scientific information in knowledge and skills and therefore feels that the science teacher needs to be an instructor of reading. Malatjie (2005) reports in his thesis that, the use of textbooks in science lessons appears to be limited and reading as a classroom activity remains rare. As a result, a number of students struggle to read and understand content area textbooks (Carnine & Carnine, 2004). They noted that these struggling readers vary between those who simple cannot read text to those who lack the necessary comprehension skills to reach grade level expectations in the content of science and social studies. They therefore emphasize that the science teachers need to be thoroughly grounded in science content and methodology and be instructors of reading as well.

Research findings by Lunzer and Gardner (1979), cited in Heldesen & Staples (2002), show that 11-12 year olds spend only about 9% of science lesson time reading from the blackboard or exercise books rather than from printed text. Inexperience in textbook reading according to Parkinson (1994), in Malatjies' research thesis (2005), would in the long run disadvantage learners as they would experience considerable problems in learning or reading and writing the scientific language. Also, Wellington & Osborne (2001), regard textbooks as important for learners to read and understand as this would enable them to operate successfully in their adult world. They believe that scientists are expected to be able to read critically and sceptically and so science departments and teachers need to teach learners reading skills as well as using reading to help them learn.

9.2 Listening

The issue of listening has not been given much value in research and has been rarely examined (Hagen, Huber, Kahlert, & Hemmer-Schanze, 2005). Hagen, et al. (2005) further mention that this skill of listening is taken for granted as a result it's hardly taught or learnt, as a result children in primary schools spend half to two thirds of a lesson listening compared to other basic skills such as reading, writing and arithmetic.

In science, Moore (1989) cited in Heldesen & Staples (2002) also observed that listening receives little attention in science whereas it is an important stage in learning and a basic communication skill. Science emphasizes hands on approach (Marlow, 2005) and research reveals that listening is a skill that can be seen as particularly important for modern hands on approaches or action teaching methods and in learning environments orientated towards application and problem solving. (Hagen et al., 2005). Heselden and Staples (2002) noted that teachers tend to talk

more forgetting that pupils can rarely cope with more than ten minutes of talk before their concentration wanes especially that this skill is not developed in the classrooms.

9.3 Speaking

According to Lemke (1990) science is a language that needs to be taught so that learners can learn to talk science just like in any other foreign language. He further states that talking science means observing, describing, comparing, classifying, analyzing, discussing, hypothesizing, theorizing, questioning, challenging, arguing, designing, experimenting, deciding, concluding, generalizing, reporting in and through the language of science.

Research shows that talking about science encourages pupils to try out new ways of arranging what they know, tests their understanding of key areas and increases their participation in their own learning (Heldesen & Staples, 2002). Scientists use oral language while talking to other scientists, addressing students, presenting and debating issues (Yore, Florence, Pearson & Weaver, 2002) and therefore talk is a vital tool in the construction of knowledge (Vygotsky, 1978). Parkinson (1994) argues that giving pupils the opportunity to think and talk about the meaning of what they have done allows them to internalize the information and make it their own and also helps them to create a sense that their ideas are valued.

Despite all the above, research indicates that remarkably little time in science lessons is actually devoted to speaking or discussion. Newton, Driver and Osborne (1999) found that less than 5% of science lesson time is given over to group discussions and fewer than 2% of interactions between teachers and pupils could be considered to be genuine discussions in which differing views are exchanged. One reason for this as pointed out by (Wellington & Osborne, 2001) is that teachers are

frequently so concerned with communicating a new idea that they forget that understanding the idea requires the opportunity to talk about it. On the other hand, general research on classroom discussion, particularly by social constructivists, has made science educators aware of the importance of discussion in science classrooms (Webb & Treagust, 2006).

9.4 Writing

As stated earlier in this chapter, Wallace, Hand and Prain (2004) believe that writing is an essential activity that all students of science need to engage in to completely focus on their scientific understanding and for fostering content learning. Recent research views writing as a means of learning science and this approach is called 'Writing to learn science'. In this approach, writing is integrated with hands on enquiry and is viewed as a process for transforming and constructing science teaching (Yore et al., 2003). Writing in science is seen to be able to provide the teachers with valuable information about learners understanding and misconceptions (England et al., 2007). As much as writing is seen to be contributing to learning, other researchers add that it occurs through a cognitive process (Klein, 2000). As a result it helps the students to understand difficult content, think critically, construct new knowledge, and produce positive effects on student recall and comprehension of text (Klein, 2000).

10. THE SCIENTIFIC LITERACY STRATEGY USED IN THIS STUDY

In South Africa mathematics and science teachers face the double challenge of teaching their subjects in English while learners are still learning this language (Setati, Adler, Reed & Bapoo, 2002). As a result, learner's reading, listening, speaking and writing skills in both their first language and English is poor. In addition to that there is evidence of poor learner achievement and under qualified science teachers

(National Centre for Curriculum Research and Development, 1998). Research in South Africa (Setati, 2000,National Centre for Curriculum Research and Development, 2000) shows that learners in some schools cannot read the learning materials provided for them as a result, such learners depend on their teachers for everything they learn.

The scientific literacy strategy used in this study recognizes the role of language in science education, the discussion around mother tongue instruction, that there are multilingual classrooms and that code switching is an aid to learning. This strategy is based on constructivist theory which states that talking and writing are important teaching and learning strategies because learners actively construct knowledge (England, et al., 2007). In learning science, talking and writing are important to improve retention of science learning over time.

According to Yore and Treagust (2006), teachers are encouraged to get their learners to learn to be able to talk and argue to learn science and learners must also be able to read science and read to learn science, just as they must learn to write science and write to learn science. Furthermore, learners must learn about metaphors and analogies that help explain science and learn to use metaphors and analogies to explain what they learn and understand about science.

The scientific literacy strategy also focuses on the roles of reading and discussion in enabling children to develop investigable questions in science classes. The purpose of discussion is to help learners, seek, share and construct knowledge and in promoting discussion learners are expected to disagree with one another, engage critically on issues and build positively on what others have said. The strategy then focuses on planning the investigation, doing the investigation, writing up the results of the investigation and further reading around the topic at hand. The writing is done on

science notebooks and learners are expected to use them for recording the data based on the investigable question.

The strategy used in this study is represented in its most basic form in Figure 2.1 where reading is taken as the initial stimulus for discussion.

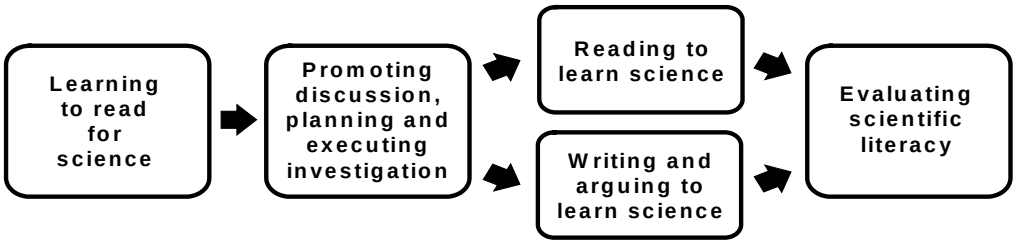


Figure 2.1: Simplified representation on the scientific literacy strategy used in this study.

The process is elaborated in figure 2.2 to include the notions of the fundamental and derived senses of science. A more linear description which illustrated the continuous nature of the reading, writing, talking and doing processes is shown in Figure 2.3.

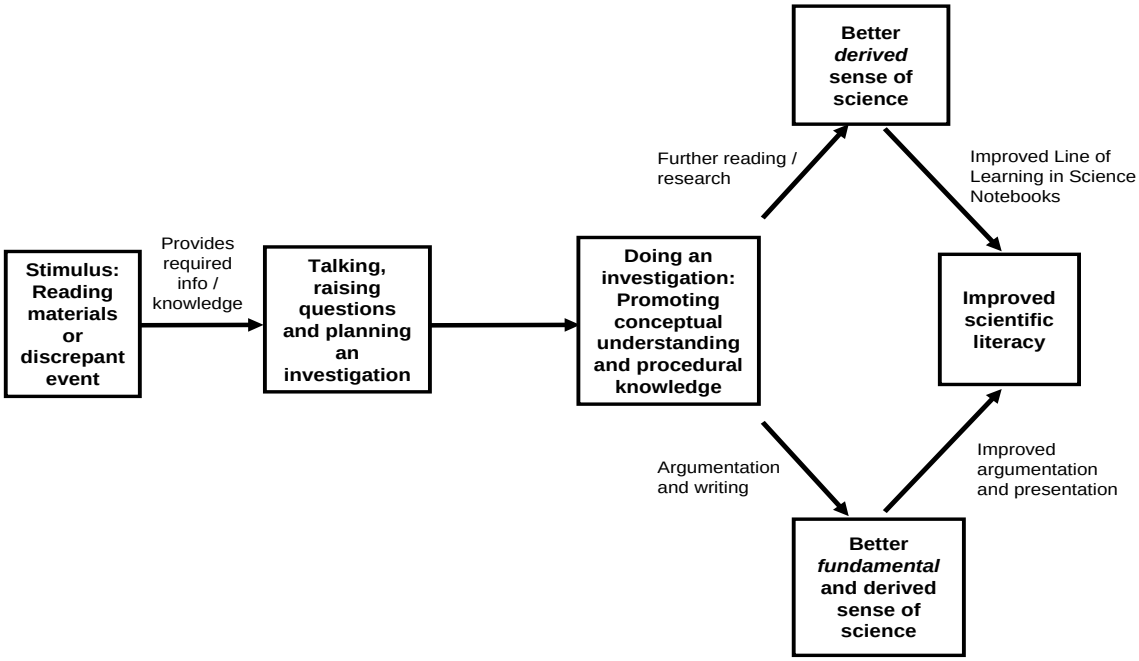


Figure 2.2: Elaborated representation on the scientific literacy strategy used in this study.

Issues of assessment are indicated in Figure 2.3.

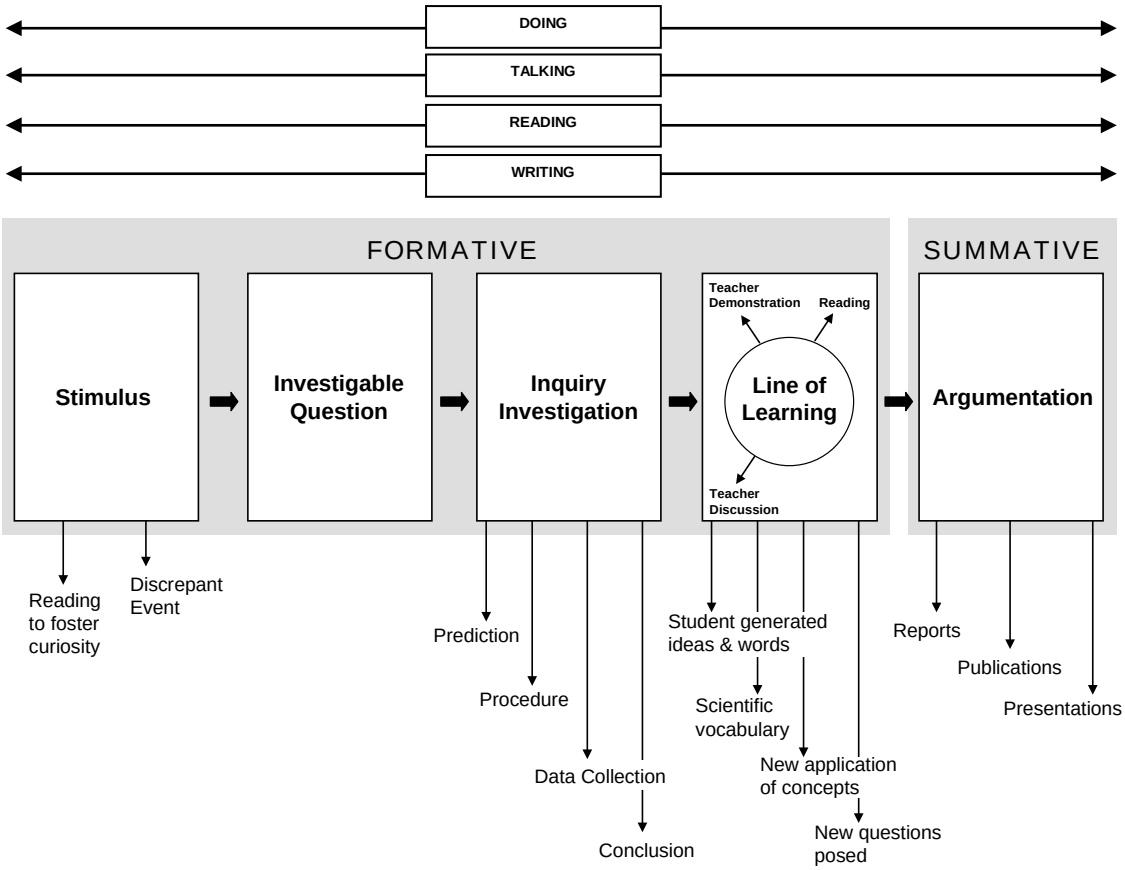
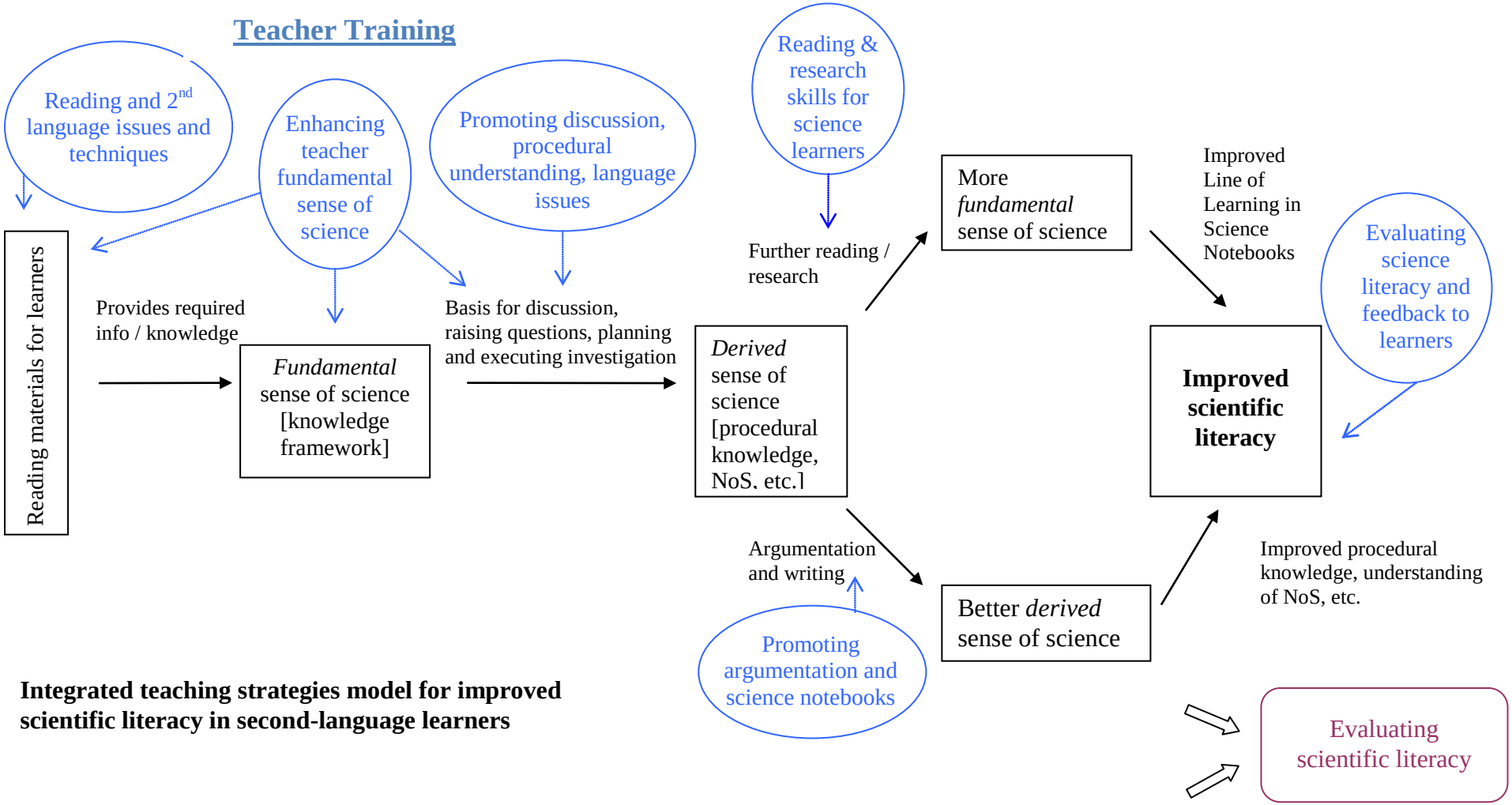


Figure 2.3: Assessment strategies promoted in the scientific literacy strategy

Issues of teacher development are represented in Figure 2.4.



Integrated teaching strategies model for improved scientific literacy in second-language learners

Figure 2.4: Issues of teacher development recognised by the scientific literacy strategy

11. CHAPTER SUMMARY

In this chapter I have provided an overview of language policies in South Africa by examining the historical context of language issues in South African schools and reviewed literature on the current language policy and how it is implemented in schools. I also explored the issues of bilingualism, mother tongue instruction and code switching. The literature on literacy levels of learners in South Africa both in schools and a t tertiary level is discussed. I also reviewed the problems that are found in science education. Finally, science literacy and the role of language (Reading, Listening, Writing and speaking) in science are reviewed, as is the 'scientific literacy' strategy used in this study.

CHAPTER THREE

METHODOLOGY

1. INTRODUCTION

In this chapter the notion of research paradigms is discussed and the philosophical underpinnings of the study are elucidated. The research methods used are motivated and the sample used for this study is described. The data gathering instruments and techniques used are also described and explained, the validity and reliability of the instruments used are considered, as are ethical considerations and the treatment of the data.

2. RESEARCH PARADIGMS

Mertens (2005:2) describes research as "a systematic investigation whereby data are collected, analysed and interpreted in some way in an effort to understand, describe, predict or control an educational or psychological phenomenon and which is influenced by the researcher's mental framework - referred to as the paradigm". The term paradigm is defined by Cohen and Manion (1994:38) as "the philosophical intent or motivation for undertaking a study" whereas Mac Naughton, Rolfe and Siraj-Blatchford (2001:32) view paradigms as "a belief about the nature of knowledge, a methodology and criteria for validity". Guba and Lincoln (1994:105) define a paradigm as "the basic belief system or world view that guides the investigation". The definitions above suggest that it is the choice of paradigms that sets down the motivation and expectations for the research.

2.1 Positivist and Post- Positivist paradigms

This paradigm predominates in the physical and biological sciences and assumes that science quantitatively measures independent facts about a single apprehensible reality (Healy & Perry, 2000). Positivists believe that the goal of knowledge is simply to describe the phenomena that we experience and that observation and measurement are at the core of the scientific endeavour (Krauss, 2005). The object of study in this paradigm is independent of researchers, knowledge is discovered and verified through direct observations or measurements of phenomena and facts are established by taking apart a phenomenon to examine its component parts (Krauss, 2005). Positivists aim to test a theory or describe an experience through observation and measurement in order to predict and control forces that surround us (Mackenzie & Knipe, 2006).

Positivism was replaced by post positivism after the Second World War (Mertens, 2005). According to Cook & Campbell (1979: 24), "the post positivists work from the assumption that any piece of research is influenced by a number of well developed theories apart from and as well as the one which is being tested". Post positivists see the world as ambiguous, variable and multiple in realities, what might be the truth for one person may not be the truth for another (O' Leary, 2004). Within a post positivism framework, both qualitative and quantitative methodologies are seen as appropriate for researching the underlying mechanisms that drive actions and events. The post positivism approach implies that subjectivity is inherent and should be acknowledged, and that complete and pure objectivity is impossible and should never be claimed. It also emphasises multiple measures and observations because all measurement is fallible and the purpose for research is to improve practice (Cohen & Manion, 1994).

2.2 Interpretivist/constructivist paradigm

While the positivist approach is that there is a single objective reality that is orderly and predictable, researchers who work within an interpretivist paradigm believe that each individual constructs their own view of the world based on experiences and perceptions. In this form of research, "the researcher tends to rely upon the participants' views of the situation being studied and recognises the impact on the research of their own background and experiences" (Creswell, 2003:8). Krauss (2005) refers to the constructivist researcher as most likely to rely on qualitative data collection methods and analysis or a combination of both qualitative and quantitative methods.

2.3 Transformative paradigm

Transformative researchers feel that the constructivist approach to research does not address issues of social justice and marginalised people (Creswell, 2003). Furthermore, Creswell (2003) mention that transformative researchers may utilise qualitative and quantitative data collection and analysis methods in much the same way as the constructivists. In other words he believes that a mixed method approach provides the transformative researcher structure for the development of more complete and full portraits of our social world through the use of multiple perspectives and lenses allowing for an "understanding of greater diversity of values, stances and positions" (Somekh & Lewin, 2005:275).

2.4 Pragmatic paradigm

Pragmatist researchers focus on "the what and how of the research problem" (Cresswell, 2003; 11). They are against the positivist position that truth about the real world can be accessed solely by a single scientific method (Mertens: 2005).

Tashakkori and Teddlie (1998), cited in Mertens and Maclaughlin (2003), describe the pragmatic researchers as someone who decide what they want to research guided by their personal value systems, that is, they study what they think is important to study. They also conduct their studies in anticipation of results that are congruent with their value system.

2.5 Paradigmatic approach in this study

This study falls to varying degrees within a number of the paradigms described above. As stated earlier the positivist paradigm is based on the philosophy that all phenomena are explainable and observation and measurement are at the core of the scientific endeavour (Krauss, 2005). This study also describes an experience through observations and measurements in order to predict and control forces that surround us.

In the positivist philosophy findings based on the study of representative samples can be used to make generalisations, making statistical analysis as a useful tool for this form of research (Popper, 1968). However, although use is made of statistical data, this study does not rely on positivist philosophy as it recognises the value of working directly with the experiences and understanding of others, hence it makes use of structured interviews and questionnaires. In other words, the qualitative data in this study is open to interpretation as researchers in the interpretive paradigm believe that human behaviour cannot be described through generalisations or universal theories (McFarlane, 2000).

In this study the objective is to attempt to measure the effect of a scientific literacy strategy on learner's generic literacy skills by using tests, observations, structured interviews and a language survey. Therefore the positivist and interpretive

paradigms seem appropriate frameworks within which to show the intent, motivation and expectations of this study. However, the study is also pragmatic in its approach as it has used a mixed method approach. Creswell (2003) mentions that the pragmatic paradigm places the research problem as central, and that it applies all approaches to understanding the problem at hand.

3. DATA COLLECTION METHODS

A mixed method design with both quantitative and qualitative aspect was used in this study for the collection of data. This approach to research is the one that involves gathering both numeric information (instruments) as well as text information (interviews) so that the final database represents both quantitative and qualitative information (Creswell, 2003). Some researchers such as Gorard (2004) view a mixed method research as a key element in the improvement of social science, creates researchers with an increased ability to make appropriate criticism of all types of research and often has greater impact because figures can be very persuasive to policy makers whereas stories are more easily remembered and repeated by them for illustrative purposes. Creswell (2005:510) mentions the advantages of using this method as follows:

- It is a good design to use if one seeks to build on the strength of both the qualitative and the quantitative data
- Quantitative data such as scores on instruments yield specific numbers that can be statistically analysed and can produce results to assess the frequency and magnitude of trends

- Qualitative data such as interviews that provide actual words of people in the study offer many different perspectives of the study topic and provide a complex picture of the situation
- When one wants to follow up a quantitative study with a qualitative one to obtain more detailed specific information that can be gained from the results of statistical tests, one can use the mixed method design.

Through this method the researcher seeks to explain in more detail through qualitative research the quantitative statistical results. The quantitative data was collected simultaneously with the qualitative data because they are seen as equal sources of information in this study.

Quantitative data was collected from the baseline and post testing of language skills of learners using pencil and paper tests. Creswell (2005:285) refers to a pre-test "as providing a measure on some attribute or characteristic that one assesses for participants in an experiment before they receive a treatment, whereas a post-test is "a measure on some attribute that is assessed for participants in an experiment after a treatment".

The purpose of the baseline testing was to determine the literacy levels of learners before the scientific literacy strategy was implemented and the post testing was to measure any change in learner's literacy skills that may occur after the implementation of scientific literacy strategy.

Qualitative measures were generated through open ended questionnaires for learners and teachers which allowed them to share what they thought about the scientific literacy project and which language they think would make a difference in implementing the strategy and which language they think communicates science

better. Structured interviews were also done with learners and teachers to confirm their responses in the questionnaires. The qualitative themes identified during interviews and questionnaires were quantified and given a score as to their frequency. They were also discussed on how they support statistical analysis.

Other qualitative data that were collected were provided by the language survey of schools. The purpose was to establish the language policies of schools involved in the study. The aim of using this data is to explain the learners statistical results generated in the quantitative data. Classroom observations on how teachers teach using the scientific literacy strategy and how learners respond to the subject matter provided more qualitative measures for triangulation with the quantitative data.

3.1 Baseline and Post- tests

The baseline and post- tests were designed for the Mpumalanga Primary Schools Initiative which was a project of the Mpumalanga Department of Education and the British government's Department for International Development (DfID) that operated in 1996. The project's main areas of focus were in the learning areas of English language, Mathematics and Science at the intermediate phase of primary schooling. The researcher, with the help of the IsiXhosa lecturers of the faculty of education at NMMU, translated the test into IsiXhosa which is the first language of the participants. The purpose of the tests is to test learner's literacy levels in both their first language and the language of teaching and learning. The learners at the intermediate and senior phases have only recently switched into English as the language of learning and teaching.

The language tests have four sections:

- Section A tested learner's reading comprehension skills. Learners were required to read different texts and then answer questions based on those texts. The second part of this section required the learners to make inferences based on what they have read and the third section required them to interpret a graph and then answer questions based on that graph. All these questions were multiple choice questions. The last part required them to complete a paragraph in the form of a writing frame, based on their interpretation of the diagram given.
- Section B tested learner's listening skills. The first part of this section required the learners to listen to a story and then answer multiple choice questions based on the story read to them. The second part of the section required them to follow instructions given by the researcher, for example, they would be asked to 'Draw a circle around a square" given on the answer sheet. The third part required them to complete a diagram by following instructions given by the researcher. The last part is an information gap table and the learners were required to complete the table after they have listened to the instructions from the researcher.
- Section C tested learners' writing skills. A picture story was given to them and they were required to write a story based on those pictures. The story is about a mother and a daughter who went to the store to buy ingredients for baking a cake. The pictures were intended to find out whether the learners could transfer information from a visual to a written mode, could write coherent meaningful sentences based on the pictures, could interpret the visuals and could write grammatically meaningful sentences.

- Section D tested learners ‘speaking skills. A focus group of five learners was randomly selected for this section to represent the group. The purpose of this section was to test whether learners could communicate fluently in both IsiXhosa and English. The groups were first asked to introduce themselves as an icebreaker before a discussion. They were presented with a demonstration on force, i.e., the researcher would drop a feather and a duster at the same from the same height and would ask the learners to first discuss in their group what they think happened and why. When the learners are discussing the researcher would be observing whether they all participate in the discussion, whether they are engaging in the discussion through exploratory talk by either bringing new ideas or agreeing on a certain idea with reasons. The learners were then required to report to the researcher about their discussion and their thoughts were probed by asking further questions based on the demonstration.

A copy of the tests is found in Appendix A of this report.

3.2 Classroom observation

Classroom observations in this study were done by both the researcher and an external observer. The purpose for bringing in an external observer was to avoid a situation where the researcher may be objective and have difficulty taking detailed field notes and participating simultaneously. Field notes were for the purpose of recording what the researcher has seen, heard, experienced and thought during an observation session.

One of the qualitative data techniques that were used in this study was the classroom observation schedule (see Appendix E). The schedule was designed to reveal the degree to which the language support teachers give while implementing the

science literacy strategy and to also establish the language used by teachers and learners in the classroom during a science lesson. Two classroom observations were made of each teacher in the experimental schools.

Before the classroom visits, teachers in the experimental schools were trained on how to implement the science literacy strategy. The strategy was work shopped with teachers in English but at all stages it was emphasised that using home language both for teaching and learning, as well as code-switching, was both legitimate and encouraged.

The scientific literacy strategy focuses on the roles of reading and discussion in enabling children to develop investigable questions in science classes. The purpose of discussion is to help learners, seek, share and construct knowledge and in promoting discussion learners are expected to disagree with one another, engages critically on issues and to build positively on what others have said. In other words teachers were expected to also focus on the language aspects of their science teaching as the strategy requires them to.

The classroom observation schedule focused on the following criteria:

- Language used for general communication in the classroom
- Language used by teachers when giving instructions, asking questions, explaining scientific concepts
- Language used by learners to answer questions, ask questions, discussion
- Opportunities for reading, writing ,listening and speaking during the lessons

- How teachers teach using the scientific literacy strategy and how learners respond to the subject matter.

A four point scale was used in the design of the instrument and the instrument recorded the school's name, teacher's name, grade observed, and number of learners in the class, researcher's name and the date of observation. To facilitate data analysis, the researcher used questions that required single response answers and close ended questions.

3.3 Interviews

Interviews were also used as data gathering techniques in this study. Gay and Airasian (2000) refer to them as a purposeful interaction, usually between two people, focusing on one person trying to get information from the other. They mention that interviews permit the researcher to obtain important data that cannot be obtained from observation and they can explore and probe participants' responses to gather more in depth data about their experiences and feelings. And they can also examine attitudes, interests, feelings, concerns and values more easily than using observation.

The teacher interviews were designed to probe the following:

- Why the teachers used a certain language practice to support classroom communication
- Which language (IsiXhosa or English) do they think would make a difference in implementing the scientific literacy strategy and why.
- Which language do they believe communicates science better to the learners?
- What do they think made the difference in their lessons (if any)?

- Why they chose to use more of a certain language over another when they were teaching in their classrooms

All interviewees were asked the same questions in the same order but these questions were open ended because they allowed both the interviewer and the interviewee the flexibility to probe for details or discuss issues (Kerlinger, 1970). These questions were planned for the purposes of guiding content, sequence and wording (Cohen & Manion, 1994). In this study the interviews were conducted in English, the language of learning and teaching, but as the researcher is a first language isiXhosa speaker, she assisted with translations where necessary.

Learners were also interviewed to find the following:

- Why they communicate using the language they use the most in their classroom
- What difference they feel that the scientific literacy strategy makes in terms of their understanding of science

Records of interviews with both learners and teachers were kept. Not all learners per experimental school were interviewed, but only a random sampling of learners participated. The qualitative themes identified during interviews were discussed on how they support statistical analysis.

3.4 Language Survey of the Schools

Qualitative data were collected from the experimental schools via the language survey forms (see Appendix H). These forms were designed at NMMU for the purposes of assisting the students in collecting data from their schools for a language policy assignment. Each school (experimental and control) was provided with the survey form which consisted of the following aspects:

- Languages used at each Grade level
- Languages used in the school for general communication
- Provision used for maintaining additional languages and home languages
- Languages used to communicate with parents and the department of education
- Languages spoken at school by teachers and learners

As mentioned in chapter two, the Language in Education Policy (1997) gives schools the right to formulate their own language policy. It was therefore significant in this research to do a language survey of schools so as to establish whether these schools have a language policy, when English as a language of learning and teaching is introduced, which language learners use for general communication and how is the additional language supported. The data collected helped to explain the language practices in the classroom as observed through the classroom observations and the interviews.

4. OBJECTIVE AND RESEARCH QUESTION

This study aims to measure change in reading and writing skills of learners after the implementation of a science literacy strategy and to investigate the teachers and learner's perceptions as to how and why the change took place. The methodologies mentioned in point three above have been used in an attempt to answer the research question of this study, *viz* "Is the scientific literacy strategy used an effective method for improving learner's language skills?"

As noted in chapter one, there are many problems associated with science education both nationally and internationally and that one issue associated with poor learner achievement is that of language. The Language in Education Policy

(Department of Education, 1997) as cited in the NCCRD research project states that schools have a right to choose the language of learning and teaching. As a result, a large number of urban (township) and rural schools in South Africa choose English as a language of learning and teaching despite the fact that learners in these schools have little contact with English speakers (Taylor & Vinjevold, 1999). Learners then struggle to comprehend texts that are written in English as a result of learner's low reading, speaking, listening and writing abilities in the language of learning and teaching. Researchers such as Norris and Phillips (2003), conclude that science understanding cannot be attained without the ability to read and comprehend textual information and write competently about the subject under study. The science literacy strategy currently offered by Nelson Mandela Metropolitan University (NMMU) aims at improving learner's scientific literacy via writing and reading to learn science by using both the language of teaching and learning (LOLT) and via code switching where appropriate. The research problem is therefore whether this particular form of intervention to improve scientific literacy has an effect on learner's generic literacy skills.

5. SAMPLE

The research was done with Grade 6 and 7 learners from seven primary schools, five of which were experimental schools and the other two control schools. These schools are situated in the rural areas below the Amatola Mountains near Hogsback in the Eastern Cape. Learners ranged between 11-15 years of age. The language survey that was conducted in these schools revealed that both the teachers and the learners are Isixhosa first language speakers while English is the language of learning and teaching in their schools. The survey also revealed that Isixhosa is the

language of communication in the playground and at home, but English is officially the language of the classroom.

These schools were selected for this study as in South African schools with mostly second language learners of English who have already switched over for two years (in Grade 4) to English as the language of learning. This process forms a part of the educational mode that is commonly used, that is, one where learners are moved out of their main language (mother tongue) into an official language learning and teaching (LOLT) as early as possible.

The participating teachers (only those from experimental schools) were introduced and trained on the scientific literacy strategy as the purpose of this study is to measure change in learner's literacy skills after the implementation of this strategy. Teachers from the control schools were given the same science material that was provided to the experimental schools, for example, magnets, big books (science stories), etc.

6. RELIABILITY AND VALIDITY OF INSTRUMENTS

According to Ary and Jacobs(1990:256), "the validity question is concerned with the extent to which an instrument measures what one thinks it is measuring and the reliability of a measuring instrument is the degree of consistency with which it measures whatever it is measuring". Creswell (2005:292) define threats as the "problems that threaten our ability to draw correct cause and effect inferences that arise because of the experimental procedures or the experiences of participants".

6.1 Tests

As stated earlier on, The literacy baseline and post-tests that were used were initially designed for the British Department for International Development (DfID)

sponsored Mpumalanga Primary Schools Initiative evaluation (Webb, Glover, Cloete, England, Feza, Hosking, King, Kruger, Morar, Nyamazane & Wessels, 1999) where the validity of the instruments was established.These tests were translated into the home language of the teachers and learners (isiXhosa) who participated in the research project. One of the possible weaknesses of the method used was that participants might have remembered responses on the post-test from the pre-test, but because of the time gap between the two tests it is probable that this was not the case, and even if it was it is as applicable to the control schools as to the experimental groups. Another possible threat would be when the control school and experimental school teachers communicate with each other the control school teachers learn information about the intervention. However, this possibility would be unlikely to affect the outcomes of the intervention as merely passing on information would not be sufficient (compared to the structured training given to the experimental group) to threaten the validity of the exercise.

6.2 Classroom observation schedule

As mentioned earlier, the aim of the study is to measure the effect of the science literacy strategy on learners' literacy skills and as such the classroom observation schedule was designed to establish both teachers and learners' language practices in the classroom. The schedule used is a modified version of the classroom observation schedule used and validated in a number of other studies (Webb, 2000).

6.3 Interview questions

As indicated earlier, all interviewees were asked the same questions in the same order. These questions were meant to further investigate what was observed in the classroom so as to triangulate these data with the statistical analysis.

6.4 Language survey form

These forms were designed by personnel at the Nelson Mandela metropolitan University (NMMU) for the purposes of assisting the students in collecting data from their schools for a language policy assignment and simply accumulated information from the teachers.

7. ETHICAL CONSIDERATIONS

Prior permission to do this research was granted by the Education, Research Technology and Innovation Committee (ERTIC) of the Nelson Mandela Metropolitan University after the researcher had made an application for approval by the Research Ethics committee according to the committee's standard protocol. When this approval was gained, the researcher approached the school management and the teachers of the participating schools. They agreed to sign the consent form and as the teachers noted that they were *in loco parentis* for their learners, individual learner consent was not elicited. The information given on the consent form assured the participating schools and teachers that pseudonyms were to be used throughout the study to ensure the participant's privacy and anonymity.

8. CHAPTER SUMMARY

In this chapter different paradigms have been discussed and the reason why this study falls within both the positivist and interpretive paradigm is explained. The reasons for using both the quantitative and qualitative approaches have been explained and the data collection method and instruments have been described. The validity and reliability of instruments have been discussed and the ethical process of conducting the study has been explained as well.

In chapter four the data collected through tests, questionnaires, interviews, language surveys and classroom observations will be analysed and presented. These findings will be discussed and interpreted in chapter five and conclusions will be drawn and recommendations made in the final chapter.

CHAPTER FOUR

RESULTS

1. INTRODUCTION

In this chapter I report on the quantitative data generated through the pre- and post-language (IsiXhosa and English) tests in terms of both descriptive and inferential statistics. I also present the qualitative data generated from the classroom observations in the experimental schools during the implementation of the science literacy strategy, as well as the data generated from the structured interviews conducted with seven teachers and a focus group of five learners from each of the five experimental schools and the two comparison schools. These data were triangulated and are discussed in chapter five within the framework provided by the literature review in chapter two.

2. QUANTITATIVE DATA

Quantitative data were generated by means of pre-and post-assessment tests which tested grade 6 and 7 reading, listening, writing and speaking skills. The Statistica general linear model routine was used and analysis of variance (ANOVA) and analysis of covariance (ANCOVA) was performed. ANOVA was used to identify the relationships between the dependant variable and a set of qualitative independent variables whilst ANCOVA was used to identify the relationships between the dependent variable and sets of quantitative independent variables. There were 134 grade six and seven learners (multigrade classrooms) in five different classes in the experimental group and 46 grade six and seven learners in the control group.

2.1 Differences between experimental and control groups

The mean differences between the experimental and control groups for the reading, listening, writing and talking aspects of the literacy tests were computed and Analysis of variance techniques were applied. A positive score reveals a higher score for the experimental group than the control group, a negative score vice-versa. These data are reflected in Table 4.1.

Table 4.1: Mean differences in scores of the experimental and control groups for the pre- and post-tests in reading, listening, writing and talking (positive scores indicate a higher statistic for the experimental group than the control group).

	Mean scores			
	Pre-tests		post-tests	
	English	Xhosa	English	Xhosa
Reading	-11.7*	-2.17	-4.73	-3.81
Listening	-19.62*	-9.21	-10.65*	2.38
Writing	0.62	-4.51	0.36	8.29*
Talking	3.38	-2.78	-4.62	3.92

* = statistically significant at the 99% level of confidence.

These data suggest that the control group of learners scored statistically significantly higher than the experimental group in the English pre-test reading and listening categories, and in the post-test English listening category. Although there were differences between the mean scores in the other categories, none of these scores was statistically significant. In the reading and listening categories these statistically significant negative differences in experimental mean score were reduced considerably in the English language categories and were reversed in terms of writing in Xhosa. It was also noted that the experimental group scored higher in Xhosa writing category than the control group in the post-test.

2.2 Comparison of changes in the experimental and control groups' pre- and post-test scores

Comparisons was made of the changes in pre- and post-test scores of the experimental and control groups' scores in all for literacy categories, viz. reading, listening, writing and talking. Again a positive score reveals a higher score for the experimental group than for the control group.

Reading

The mean differences in the changes between the pre- and post-test scores for the experimental and control groups in terms of reading are shown in table 4.2. (positive scores indicate a higher figure for the experimental group than the control group).

Table 4.2 Differences in mean score changes between the experimental and control groups for reading ability (n = 81).

	Mean change	p	Cohen's d
English	7.65*	0.007	0.47
Xhosa	-0.93	0.714	n/a

* = statistically significant at greater than the 99% level of confidence ($p \leq 0.01$) ; n/a = not applicable

The improvement in mean score of the experimental group compared to the control group in terms of English was statistically significant and the Cohen's d score indicates an effect size was close to being 'medium (0.2-0.5 = small effect; 0.5-0.8 = medium; ≥0.8 = large) , i.e., it had a medium effect in practical terms on the experimental group as a whole. Although it appears that the control group improved marginally more than the experimental group when reading in Xhosa, this result was not statistically significant and these data can be disregarded.

Listening

The mean differences in the changes between the pre-and post-test scores for the experimental and control groups in terms of listening are shown in table 4.3. (Positive scores indicate a greater statistic for the experimental group than the control group).

Table 4.3 Differences in mean score changes between the experimental and control groups for listening ability (n=81).

	Mean change	p	Cohen's d
English	9.16*	.0.01	0.60
Xhosa	11.48*	.0005	0.62

*=statistically significant at greater than the 99% level of confidence ($p \leq 0.01$); n/a= not applicable

The improvement in the mean score of the experimental group in English and Xhosa was statistically significant and the Cohen's d score indicates that it had a medium effect in practical terms on the experimental group as a whole.

Writing

The mean differences in the changes between the pre- and post-test scores for the experimental and control groups in terms of writing are shown in table 4.4. (Positive scores indicate a greater statistic for the experimental group than the control group).

Table 4.4 Differences in mean score changes between the experimental and control groups for writing ability (n=81).

	Mean change	p	Cohen's d
English	0.56	0.810	n/a
Xhosa	13.48*	0,0005	0.78

*=statistically significant at greater than the 99% level of confidence ($p \leq 0.01$); n/a= not applicable.

There was no statistically significant improvement in English in the writing categories whereas the Xhosa mean score shows improvement and statistical significance. The Cohen's D score indicates that an effect size was being medium (approaching large).

Speaking

The mean differences in the changes between the pre- and post- test scores for the experimental and control groups in terms of speaking are shown in table 4.5. (Positive scores indicate a greater statistic for the experimental group than the control group).

Table 4.5 Differences in mean score changes between the experimental and control groups for speaking ability (n=81).

	Mean change	p	Cohen's d
English	-8.00	0.401	n/a
Xhosa	6.23	5.23	n/a

n/a means not applicable

There were no statistically significant differences between the talking tests that could be detected. These data were not regarded in terms of statistical significance because of the small sample size, but it appears that speaking abilities were better in English than in Xhosa in the post- test.

2.3 Differences between reading, listening, writing and talking in English and Xhosa

The differences in scores between the learners' abilities in reading, listening, writing, and talking are shown in table 4.6 where a positive number indicates a higher score for the Xhosa test than what was attained when doing the same activity in English.

Table 4.6-Mean differences in scores between learners ability in reading, listening, writing and speaking (n=81)

Mean differences between Xhosa and English test scores

	pre-test				post-test			
	Mean diff	n	p	d	mean diff	n	p	d
Reading	9.53*	88	0.00	0.67	0.91	81	0.73	n/a
Listening	10.41*	88	0.00	0.57	13.03*	81	0.00	.70
Writing	-3.89	88	0.155	n/a	8.56*	81	0.00	.55
Speaking	-6.16	15	0.43	n/a	8.35	14	0.22	n/a

* = statistically significant difference at greater than the 99% level of confidence ($p \leq 0.01$) ; n/a = not applicable

These data reveal that the pre-test reading scores were statistically significantly better in Xhosa than in English, but this was not the case in the post-test where the differences in achievement had been reduced ten-fold and the mean score was not statistically significant. Conversely, in the case of listening, the better mean score in Xhosa increased in the post-test, remained statistically significant and revealed a greater effect size. The pre-test score for writing was better in English, but not statistically significant and this finding was statistically significantly reversed in the post-test – they then wrote better in Xhosa. Because of the small size of the sample used for the speaking test, no statistically significant differences could be detected, but it appears that their talking abilities changed from being better in English in the pre-test, to better in Xhosa in the post-test.

2.4 Analysis of co-variance (ANCOVA)

ANCOVA tests whether certain factors have an effect after removing the variance for which quantitative predictors (covariates) account. The inclusion of covariates can increase statistical power because they account for some of the variability. In the case of this study, analysis of co-variance revealed statistically significant changes in Xhosa language writing and listening skills after implementation of the strategy.

3. CLASSROOM OBSERVATIONS

Classroom observations were done to reveal the ways in which language was used by teachers to implement the scientific literacy strategy used in this study. Each of the five teachers was observed using a classroom observation scale with the following components:

- Use of language by the teacher
- Use of language by learners
- Teacher implementation of the science literacy strategy
- Listening activities
- Writing activities
- Speaking activities
- Reading activities

3.1 Baseline observations

Classroom observation (baseline) that was done before the implementation of the science literacy strategy revealed the following:

- Teachers were not confident to work out the investigations provided in their textbooks. When they finally did use them, it was the teachers who set up the experiments while the learners observed. It appeared that it was not clear to the learners what they were supposed to learn - and conclusions of the experiment were the ones that were written in the textbooks, not what they discovered from the investigation. There was very little input from the learners to teacher talk and, during the experiments, learner talk was done in Xhosa and it was not related to practical issues. After the experiment learners would read aloud from the textbook and the teacher would translate what they were reading into isiXhosa.
- There was very limited written work as teachers would say there was no time as the learners "*were slow*". Mostly, learners did not write the process of the experiment in their books, instead they were instructed to copy the textbook examples into their notebooks, not what they actually observed. There were no reading texts provided for learners to enhance their learning, nor were there group presentations or discussions - the learners listened and educators lectured. In other words, learners didn't demonstrate much understanding of what they were doing in class.

3.2 Observations during implementation

During the implementation of the scientific literacy strategy, two classroom observations were carried out in each of the experimental schools. As mentioned earlier; the purpose of the observations was, amongst others, to observe the choice of language teachers' use while implementing the science literacy strategy. The objective of this study is to measure the effect of the scientific literacy strategy on Grade six and seven learners reading and writing skills, so the focus of the researcher in these

classroom observations was on how language was used during the implementation of this strategy and whether there were opportunities for learners to engage in reading, writing, speaking and listening during the process.

Component 1: Language strategy teachers used when asking questions, giving instructions, teaching, explaining concepts and terms, and giving feedback

One area of observation during the implementation of the strategy was on the language used to ask questions, give instructions, teach, explain concepts and terms, give feedback etc. and how learners respond to the language that is being used in their science classrooms.

Table 4.7 illustrates the five teachers observed as teachers A, B, C, D and E and how they rated against the component being measured.

Table 4.7: Teachers use of language while implementing the scientific literacy strategy used in this study

Strategy	Teachers				
	A	B	C	D	E
Home language and switch to English		√	√		√
Discourages home language					
Use English and switch to home language				√	
Uses English only	√				

Teacher A used English to teach, to ask questions and to explain terms and concepts. Learners on both observations did not respond to teachers' questions, nor did they ask question or interact with the lesson. When the teacher asked them to do the investigations in their groups, they began to interact with one another in their home language and the teacher also used their home language to attend to their group questions. The learners seemed to be more engaged with one another in their home

language than when their teacher was communicating to them in English. None of the learners' in this class managed to respond to the questions in English, but when the teacher allowed them to use their home language, one observed some participation.

Teacher B and C's lessons were conducted in the learner's home language and English would only be used for terminology and concepts when the teachers couldn't find a Xhosa equivalent of the term. A strategy that these teachers used, for example to explain what 'force' means, would to demonstrate the action of 'pulling' and 'pushing' and tell their learners that what they were doing is 'force'. The other time that Xhosa was not used was when these teachers were reading from the posters in their introductory part of the lesson and the learners would also read those sentences in a chorus and the teacher would translate what they were reading into their home language. Learners in both schools mostly gave answers in English in a "yes" or "no" form, sometimes in one word sentences, for example, in school B the teacher asked "what form of energy is released from the fire" and the learners answer in a chorus form was "kinetic", but in their groups they would switch into their home language.

Teacher D, just like in Teacher A, used English only to teach, to ask questions and to give instructions, but would rephrase the question using the home language when the learners did not respond to the question or the instructions. Few learners in this classroom used English to ask questions and discussions in learners groups were in their home language only.

Teacher E and the learners communicated in their home language on both observations. This teacher had a vocabulary to use to explain the science concepts in Xhosa but during the course of the lesson the teacher switched to English.

A graphical depiction of these data is shown in Figure 4.1.

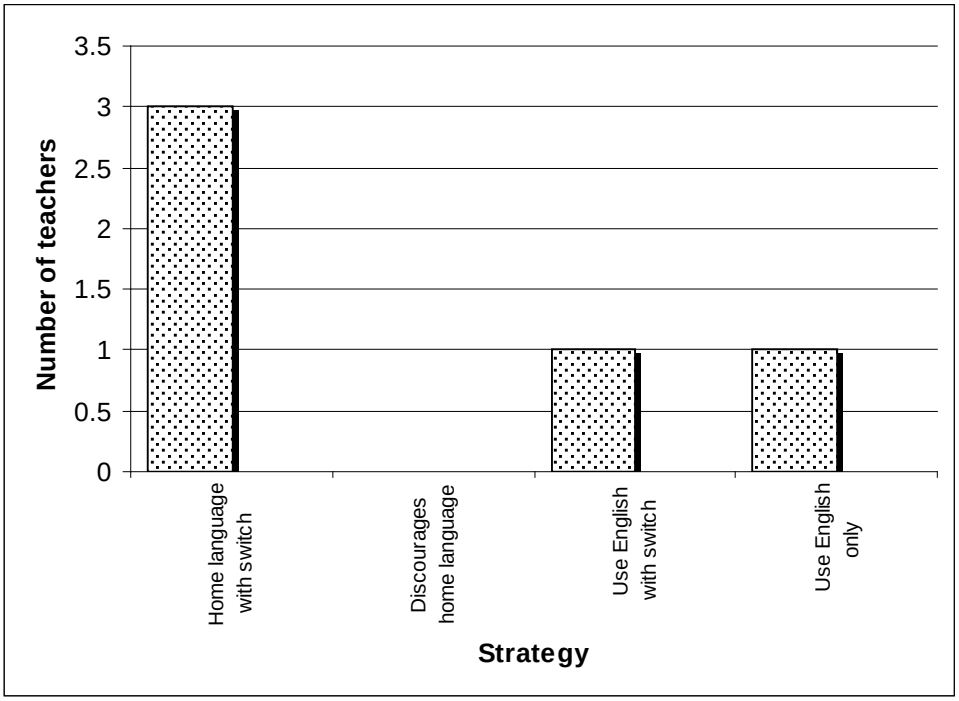


Figure 4.1: Language strategies used by participating teachers while implementing the scientific literacy strategy in this study

Component 2: Use of language by the learners

Component two focused on the use of language by the learners. The discussion on this category is mentioned in the component above. The following table illustrates how learners used language during these observations.

Table 4.8: Language used by learners during implementation of the scientific literacy strategy

Language use	Teachers classes of learners				
	A	B	C	D	E
Home language for group discussion	√	√	√	√	√
Seldom use English	√				
Use English and switch to home language		√	√	√	
Uses English only					

Although teacher A used English to teach, the learners seldom used English, instead communication was in their home language. Learners in teacher B, C and D's classrooms communicated mostly in their home language, however, they were able to

answer some questions in English although in a chorus form. Some of the learners could ask questions and answer in English full sentences but eventually switched to their home language.

A graphical representation of these data is shown in Figure 4.2.

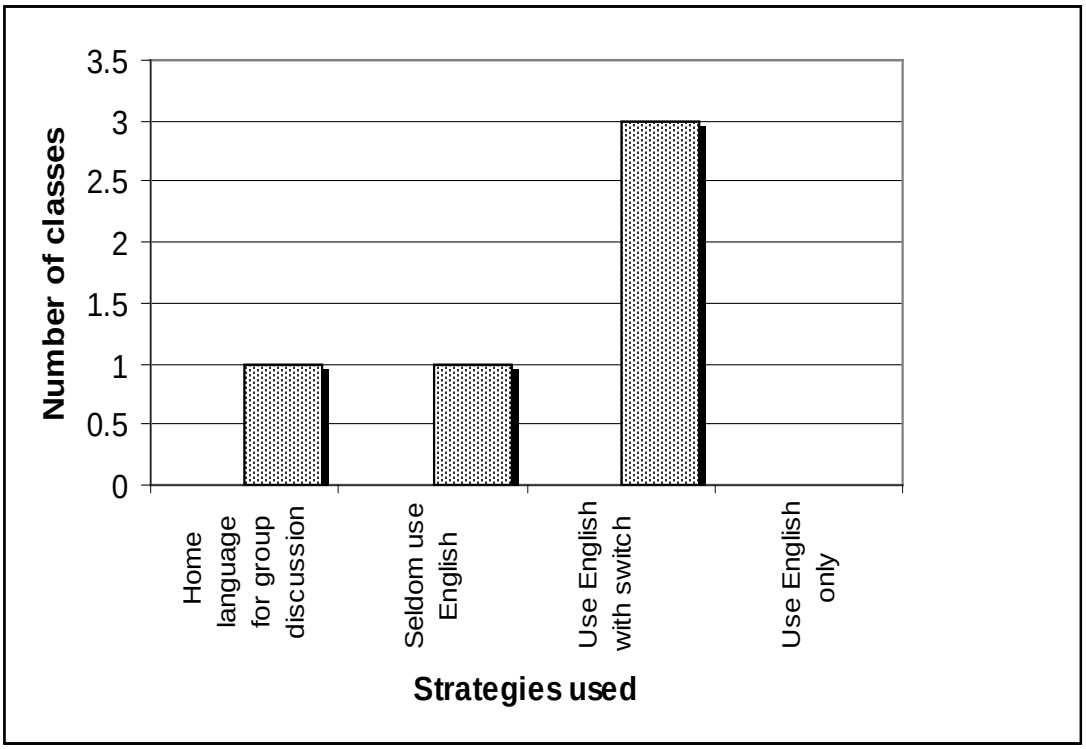


Figure 4.2: Language strategies used by learners during implementation of the scientific literacy strategy

Component 3: Teacher understanding/implementation of scientific literacy strategy

This component focused on the teacher understanding/implementation of scientific literacy strategy. Table 4.9 illustrates how teachers rated in this component**.**

Table 4.9: Teachers understanding of the scientific literacy strategy used in this study

Level of understanding	Teachers				
	A	B	C	D	E
Inadequate understanding of strategy					
Partial understanding of strategy					
Adequate understanding of strategy	√	√	√	√	√
Clear understanding of strategy					

Teachers in all five schools demonstrated an adequate understanding of the strategy. During the first observations, teachers explained in the learners' home language the meaning of the terms like "prediction", "procedure", "conclusion" "results" and "investigation "since these terms were to be used to record on their science notebooks the whole procedure of the investigations they were engaged in. As mentioned earlier, learners interacted in their groups using their home language but they wrote in their notebooks in English. What was observed is that their writing revealed incoherent findings and they couldn't write full and meaningful English sentences. In some instances, one could observe that not all learners in the groups managed to record their findings or write their reports in their notebooks. They would mostly copy from the board what their teachers give as notes for the lessons presented.

Components four, five, six and seven identified the degree to which teachers provide listening, speaking, writing and reading opportunities by planning listening,

speaking, reading and writing activities during the implementation of the scientific literacy strategy. Tables 4.10, 4.11, 4.12 and 4.13 illustrate how the teachers in all five experimental schools rated against these components.

Component 4: Degree to which teachers provide listening opportunities

Not one of the teachers observed provided any listening activities for their learners while implementing the scientific literacy learning strategy. In other words there were no planned activities where learners listening skills were tested. Listening was in the form of listening to instructions of which teachers had to translate those instructions into IsiXhosa in order for the learners to respond.

Table 4.10: Provision of listening strategies by teachers while implementing the scientific literacy strategy

Provision for listening opportunities	Teachers				
	A	B	C	D	E
No listening opportunities given	√	√	√	√	√
Limited listening opportunities given					
Adequate listening opportunities given					
Ample listening opportunities given					

Component 5: Provision of talking opportunities

This component focused on whether the teachers provide opportunities for learners to talk in the classroom during the implementation of the scientific literacy strategy and whether the learners were able to engage in authentic discussion.

Table 4.11: Provision of talking opportunities by teachers while implementing the scientific literacy strategy

Discussion level	Teachers				
	A	B	C	D	E
Learners do not discuss in groups					
Learners struggle to share ideas	√	√	√	√	√
Learners discuss and share ideas					
Learners given no opportunities to discus					

Although there were attempts at discussion, the learners in all classes struggled to discuss and share their ideas. This was mostly evident when they were expected to discuss in English. Since it was not the policy of the schools to allow learners to speak their home language in class most of the learners resorted to keeping quiet and only wait for the group moment to share ideas in their home language.

Component 6: Degree to which they wrote using the science notebooks strategy

Component six identified the degree to which the learners engaged in the science notebooks strategy. Table 4.12 illustrates how the learners rated against this component.

Table 4.12: Degree to which learners engaged in the science notebooks strategy

Writing	Teachers				
	A	B	C	D	E
Do not write at all					
Write ineffectively/incoherently	√	√	√	√	√
Write to record findings only					
Write effectively to enhance their learning					

The learners writing was ineffective in that they were not able to transfer what they were doing in experiments into a written form maybe because of their limited vocabulary in the language of learning and teaching.

Component 7: Learners ability to read texts and other materials provided during implementation of the scientific literacy strategy

This component focused on learners reading during the implementation of the scientific literacy strategy. Table 4.13 illustrates how they rated in this component**.**

Table 4.13: Degree to which learners read texts and other materials provided during implementation of the scientific literacy strategy

Writing	Teachers				
	A	B	C	D	E
Do not read at all					
Struggle to read	√	√	√	√	√
Read with limited effect on their learning					
Read effectively to enhance their learning					

During the process of the implementation of the strategy, in all schools, there appeared to be no planned activities on listening and reading. Chorus reading in two schools was done as part of the introduction of the lesson after which the teachers would translate to the learners what they were reading. Although learners were given opportunities to speak in their groups, ideas were not shared with the rest of the class. In some instances, even in those groups only a few learners would participate whereas others would be quiet. Since there were limited reading opportunities provided in all schools, the researcher could not conclude to say learners cannot read with comprehension or are not fluent readers. However, what was clear from the classroom observations is that learners preferred to be taught in their home language and that their writing skills needed to be developed.

4. INTERVIEWS

Interviews were held with both teachers and their learners. The outcomes of these interviews are presented below.

4.1 Teachers

The purpose of the interviews was to probe why teachers used a certain language practice to support classroom communication, which language (Isixhosa or English) do they think has made a difference in implementing the science literacy strategy and why, which language do they believe communicates science better to learners. All interviewees were asked the same questions in the same order and the interviews were conducted in English, the language of learning and teaching, but as the researcher is a first language isiXhosa speaker, the researcher assisted with translations where necessary. These data gave insight on the effect of the scientific literacy strategy on learners' language skills and also gave awareness to teachers on the role of language in science teaching.

The following questions were asked to each interviewee in the general categories written in italics:

- *Classroom communications in general* - Which language do you use to support general classroom communication?
- *Language used when implementing scientific literacy strategy* - Which language do you think makes learners understand science when you teach using the scientific literacy strategy and why?
- *Language support in the classroom* Do you provide your learners with opportunities to speak, read, write and listen in your science lessons and how?

- *Language for teaching and learning* Which language do you prefer to use when teaching science and why?

To communicate generally in the classroom, responses of teachers were interpreted to mean that the teachers preferred to use both Xhosa and English. One of the teachers said "my *learners do not follow instructions clearly when I use English only because their home language is Xhosa so it is easy for them to understand better when I mix the two"*. The other teacher's responses were that translation and code switching are the best ways of communicating in the classroom, for instance, one teacher indicated that " *my students do not understand at all when communication is done only in English and they only hear when translation takes place*". It was interesting to note that some of the teachers believe that English should be used for giving instructions, asking questions, giving feedback and asking learners to clean the board, because in that way their learners are learning to function in the English language and "*that would help the learners to understand English since their textbooks and exams are in English"*.

Regarding the language used when implementing the science literacy strategy, most responses were that they find it easier to give learners instructions in Xhosa when they are doing the investigations. One teacher mentioned that "*my learners have not reached a level of understanding in English; as a result I give them instructions in Xhosa"*. At the same time teachers acknowledged that it is difficult to explain the science terms in Xhosa as they don't have enough vocabulary as a result they try to explain to their learners in English *"even if they do not understand the meaning*". When learners are writing in their science notebooks they are encouraged to write in English "*even though their sentences are not complete sentences, because they make a lot of errors so I have to assume what they wanted to say in their writing'*. In teaching

the science investigations, all the teachers that were interviewed agreed that they mostly use both Xhosa and English, "*Xhosa for instructions and explanations and English for scientific terms which are also translated into Xhosa if possible*".

Teachers were asked whether they provide reading, writing, speaking and listening opportunities during their science lessons. None of the teachers that were interviewed provided any elaboration on how they provide these opportunities during their lessons even when the interviewer prompted them to elaborate. According to the teachers, reading is done when the learners are asked to prepare for the class work, speaking is mostly done in Xhosa when the learners answer questions or when they discuss in their groups. Two of the teachers that were interviewed agreed that listening is one of the important language skills although they said "we *ignore to recognise its importance in our teaching, but we do give instructions to our learners to follow especially when they do investigations, so when they are able to follow the instructions we believe that they are developed in their listening skills"*. All the teachers felt that they were not giving their learners enough writing opportunities, for example one teacher confessed that she has only given the learners two class tasks since the beginning of the year and these two tasks were one word questions as they believe it is difficult for the learners to understand meaningful sentences. They regard the science notebooks as one way of providing opportunities for learners to write. One teacher said "*although the notebooks provide opportunities for writing, they do not help our learners to write well, they do not make them construct good sentences*'.

All seven teachers preferred to teach in both English and Xhosa as they believed it is "an effective way of teaching".

4.2 Learners

The learner interviews were conducted to find out which language helps them best to understand the scientific literacy strategy and why?, how they communicated in the classroom , what they have learned in the science investigations and whether they feel that the opportunities for reading, writing, speaking and listening they are given in class helped them to understand the strategy better.

In all schools, learners preferred that their home language should be used to ask and answer questions, for group discussion, giving instructions and to be used by their teachers to ask questions in class. One of the learners even said *"It would be good if our teachers give us a chance to write in either Xhosa or English because when the teacher uses English only, we do not understand"*. When asked whether they could communicate in English, they said that even though their teachers expect them to develop their English language skills since English is the language of learning and teaching in their schools, they still prefer their teachers to explain everything in Xhosa.

Regarding the science investigations, learners in the experimental schools agreed that they enjoyed doing the investigations. Their comments revealed that they learnt something from those investigations, for example, one learner said *"The investigation on electricity has taught me to be careful in using electricity even at home, now I know that water and electricity don't mix, unless I want to be choked"*. Others were overwhelmed by the investigation on water vapour because *"every time it rains, they understand that the whole process began with water vapour"*. The interviewees also agreed that the science literacy strategy made a difference in their understanding of investigations because *"unlike before, they are now involved in doing the investigation other than reading it from the book and watching the teacher*

doing it on their behalf". Moreover, they felt that their understanding of investigations was because their teachers gave them instructions in their home language. They regarded the science notebooks as giving them opportunities " *to write more in class" , "to remember what they have been doing and to be able to go back to their notes even if one was absent he could refer to somebody else's notebook*".

Learners were asked whether they are given opportunities to listen, read, write and speak during science lessons. Most of them felt that most of the time "*it is the teachers who do the talking; we only speak in groups when we are given a task to do and we always communicate in Xhosa and write in English"*. They further mentioned that "*following instructions is not easy when given in English; hence we like it when teachers give us instructions in Xhosa*". Their answers about reading revealed that they were not reading during the science lessons because "*most of the time it is our teachers who read for us and the only chance we have is when we read from the charts and we do that aloud as a whole class"*. Furthermore, they mentioned that they write mostly in their class work books after the lesson "*not many times as we have 6 class works since January"* and most of the writing is done '*during the investigations on our science notebooks"*.

The language they preferred to be taught science with is Xhosa as "*we don't understand English well"*. Others felt that "*English and Xhosa are languages that help us to understand science because when we do not understand science terms or explanations in English, it always helps us when the teacher explains in Xhosa"*. A few of the interviewees said that they like English and they would like to be taught in English because "*we want to understand science in English*".

5. LANGUAGE SURVEY

Another information gathering technique used in this study was the language survey form. This form was used to find out about the languages that are used in the schools at various grade levels, languages for general communication and provision for support for those languages that exist in the school (both the language of learning and teaching and the home language). All the schools that participated in the research indicated that English was the language of learning and teaching, however teachers use other teaching strategies like code switching to support learning in the classroom. The survey also revealed that English is introduced in the intermediate phase (Grade 4). Both learners and teachers were isiXhosa first language speakers and English is a second language and is the language of learning and teaching in these schools.

6. CHAPTER SUMMARY

In this chapter I reported on the data generated through the language (IsiXhosa and English) pre- and post-tests. I also reported on the qualitative data generated from the language survey form as well as the interviews of learners and teachers from both the experimental and control schools. A report on classroom observations during the implementation of the science literacy strategy and the results of the language survey is also presented.

CHAPTER FIVE

DISCUSSION

1. INTRODUCTION

In this chapter the quantitative and qualitative data that were generated in this study are discussed. I firstly focus on the results that emerged during the data analysis of English and IsiXhosa pre- and post-tests. These data are then examined within the theoretical framework presented in chapter two. The qualitative data gathered from the classroom observations, language survey of schools and interviews of learners and teachers are discussed thereafter and also referenced within the context of the literature review.

2. QUANTITATIVE RESULTS

The mean differences between the experimental and control groups for the reading, listening, writing and speaking aspects of the literacy tests were computed and Analysis of Variance techniques were applied. The statistically significant differences and other aspects of these data are examined and discussed below.

2.1 Reading

Although there were English language reading material such as textbooks, magazines and novels in the classrooms prior to introduction of the scientific literacy strategy, baseline observations suggest that little to no English reading took place. Lunzer and Gardner (1979) found that learners are mostly familiar with reading from the blackboard rather than from printed texts. What was observed in the experimental and control schools was that when learners do read, they do so aloud in chorus. This type of reading activity suggested that the learners were still at a stage where they

lacked the necessary comprehension skills to reach grade level expectations of understanding (Carnine & Carnine, 2004). That this was the case became evident when teachers asked questions based on what they were reading and the learners could not give correct answers.

Even during observations made during implementation of the scientific literacy strategy, little to no reading activities were observed in some of the experimental schools during the course of the study. Nevertheless, it cannot be said that no reading took place at all in these classrooms (teacher's reported that they had used the 'Big Book' to 'read towards an investigable question'), and it is therefore probable that the improvement in the experimental groups' reading in English was as a result of the reading activities which were used as part of the implementation of the scientific literacy strategy, and which were in English only. Matjila and Pretorius (2004) mention that the reason why so many learners do not understand what they are reading in school is that they are not adequately proficient in the language of learning and teaching, which is the language of their textbooks. They also state that reading is an ability that must be acquired and practised through exposure to written language. In light of Matjila and Pretorius' statements, it is probable that the limited attempt that was made in this study to introduce learners to reading for understanding in the Language of Learning and Teaching had some positive effect.

2.2 Listening

As mentioned in chapter four, the statistical results revealed an improvement in the Isixhosa listening category and this can probably be explained in the context of the scientific literacy strategy in terms of the fact that in most schools learners were given instructions in their mother tongue, used their mother tongue in group discussions and teachers code switched during their presentation of lessons. In the few

instances that the participating teachers taught in English throughout the lessons, one could observe that the use of English was a barrier during the lessons as learners would be quiet throughout and their discussions in groups took place entirely in IsiXhosa. Research shows that learners who learn through a second language may experience difficulties as they have little exposure to English in their daily lives, and therefore have the widest gap to make up as they learn through the medium of English (Burkett, Clegg, Landon, Reilly & Verster, 2001)

In contrast, code switching is a strategy for teaching and learning in multilingual classrooms which uses a significant amount of the mother tongue while teaching in a second language (Setati et al., 2002; Rose & Dulm, 2006). In this study the learners were exposed to a significant amount of IsiXhosa in their science classes in a context of making sense of the investigations that they were doing, as opposed to the less academically directed isiXhosa they heard and engaged in during school assembly, on the sport fields and during break time. Learner's listening abilities improved in IsiXhosa probably not only because it is the language they mostly hear in their classrooms, schools and at homes, but because they engaged in it in a directed and meaningful way in an academic context.

2.3 Writing

The mean difference between the English and IsiXhosa writing scores was significantly different in favour of English in the pre-test, but changed to being statistically different in favour of Xhosa in the post–tests. This is a significant and unexpected finding and a possible explanation for this may be attributed to the language that was mostly used during the implementation of the scientific literacy strategy. Both the experimental and control groups, just like many other schools in South Africa, officially use English as a language of learning and teaching, but the

observations that were done during the implementation of the strategy showed that teachers and learners mostly communicated in their mother tongue during the science lessons. Both the experimental and control schools revealed very little writing in English both in the baseline study and during the intervention period. Written work was mostly in the form of one word sentences or cloze statements which were mostly copied from the blackboard. When learners were expected to write in their science notebooks in English, it was clearly evident that this was very difficult for them to do. What was observed was that most of the learners would firstly write their investigative reports in their home language, and then translate them into English. The English translations often revealed incomprehensible sentences, sentence fragments, and inconsistency in verb tenses. Some of the learners did not even write their observations in their science notebooks, probably because it took them a long time to translate them or they found it too difficult to formulate sentences in English. England et al. (2007) mention that writing should be able to provide the teacher with valuable information, but in this case the learners' writing was not comprehensible enough to provide information about whether they understood the science investigations or not. It is also significant to note that the learners' performance in the writing category of the pre-tests in IsiXhosa did not show that they were competent even in IsiXhosa, but compared to the English writing task they were much better. Heugh (1995) state that when children start school they may not get a solid enough grounding in the early years, in terms of cognitive and literacy skills in their home language, and then it becomes very difficult for them to cope with the transition to the second language. This appears to be the case for the learners who participated in this study who were initially very weak in writing in both their home language and English. However, the statistically significant improvement in their isiXhosa writing skills after recording

their thoughts in their home language using the science notebooks strategy, suggests that the scientific literacy approach provided a context that was meaningful enough to stimulate improvement.

2.4 Speaking

There were no statistically significant differences noted between changes in scores between the pre-test and post-test scores of the experimental and control groups. The lack of statistically significant differences is probably due to the small sample used in this category and it was quite clear that the learners generally appeared to feel more comfortable when communicating in their mother tongue in the classroom.

3. QUALITATIVE DATA

Qualitative data were generated from the classroom observations in the experimental schools during the implementation of the science literacy strategy. Data was also generated from the structured interviews conducted with seven teachers, (five from the experimental schools and two from control schools) and a focus group of five learners from each of the five experimental schools.

3.1 Classroom observations

Baseline Observations

Baseline observations revealed that there was very little talking, reading and writing on the part of learners during the lessons observed. Mostly, talking was done by the teachers, writing was based on what was written on the board, reading was done aloud by the teachers and the learners listened to what their teachers were telling

them. Also, as indicated earlier, the learners' books revealed very limited writing in both IsiXhosa and English.

The researcher reasoned that as very little discussion took place in the classroom, it was probable that the teachers were not familiar with ways and strategies of eliciting talk in the classroom. This reasoning warranted the implementation of a workshop on discussion techniques for the experimental group of teachers. After they had been trained in the scientific literacy strategy one could observe that they were trying to provide opportunities for discussion in terms of group work and learners were also writing what they had discussed in their science notebooks after every investigation, unlike during the baseline observations where there was little evidence of writing taking place.

Use of language by Teachers and Learners

Classroom observations revealed that some of the teachers in the experimental schools used English for explaining concepts, asking questions and giving instructions, but would immediately reiterate into the learner's mother tongue. In such classes learners would either respond to questions in incomprehensible English or simply in Xhosa. It was also noted that in classes where teachers used English throughout the lessons, learners did not respond when they were asked questions. One could observe from their faces that they wanted to say something but did not have the confidence to respond in English to the teacher's questions. In this class, learners answered in a chorus form 'yes' or 'no' whenever the teacher asked questions and when they were asked to predict what they thought was going to happen in their investigations they did not respond, most probably because they could not express themselves in English using full sentences. However when the same learners were given a task in small groups, they communicated easily in their home language.

During the few times in which instructions were given in English it was observed that learners would confirm from one another whether they had understood correctly and the learners who seemed to have a better understanding of English would explain to the rest of the group in their home language. During the teaching process, science concepts and terms were explained in Xhosa where there was an equivalent of a Xhosa word. In some cases teachers would demonstrate the meaning of terms, for example, the meaning of the term 'force'. Two teachers out of five pulled and pushed the desks in their classrooms to explain that 'force is a 'push or a pull'. This demonstration suggests that these teachers couldn't find a Xhosa equivalent of the word 'force'.

Overall, the classroom observations revealed that teachers mostly used code switching to teach science. This is consistent with the findings of a number of researchers such as Setati, Adler, Reed and Bapoo (2002) and Rose and Dulm (2006) who noted that in classrooms where non-native speakers of English are taught in English, code switching practices are likely to happen. At the same time it was evident that the kind of 'discussion' that took place in these classrooms is what Sinclar and Coulthard (1975) in Webb and Treagust (2007)describes as the 'Initiation –Response –Feedback' (IRF) process where "the teacher asks a question, the learner makes a simple statement as an answer or reject it" (2007:37).

In the experimental group classrooms that were observed it appeared that learners were given many opportunities to discuss the findings of their observations in groups and, as mentioned earlier, their discussion took place mainly in their home language. As the researcher is a first language speaker of isiXhosa, it was possible for her to understand the discussions that learners were engaged in, which in most cases showed a lot of reasoning and relevance on the task they were doing. What is

noteworthy, however, is that the learners' reasoning was in their home language and that they struggled to translate it into English when they were instructed by their teachers to record their findings in English. At the same time, their discussions were only in their respective groups, and they were not given many opportunities to engage critically in either English or IsiXhosa with the rest of the class by sharing their findings and conclusions. It is true that "in order for a meaningful discussion in class to take place, learners have to both understand the language being used and have a good understanding of the subject being spoken about" (Webb, 2007:32).

The fact that learners in all five experimental schools used their mother tongue to discuss in groups suggests that they had not yet developed sufficiently in the second additional language, which is the language of learning and teaching in their schools. Cummins (1984), cited in Heugh (2003), notes that transfer from mother tongue to official language is possible once there is a form of foundation of academic and cognitive development in their mother tongue. In other words it appears that the learners at these schools are at a stage where they are still developing in their mother tongue. Smyth (2003: 93) argues that "learners should be given the opportunity to develop academic language proficiency in the home language in order to provide a sound conceptual and linguistic basis in the second language".

Researchers, such as Yore and Treagust (2006), mention a three language (home language, instructional language, science language) problem which exists for most science language learners. Learners come to school with informal ways of talking and teachers have to move them from informal spoken and written language to the formal language of schooling, and then to the formal language of science. The three language problem is exacerbated in many South African schools by the fact that the language of learning and teaching in schools is not the learners' home language,

and that science is taught in a language which is not their mother tongue (Taylor & Vinjevold, 1999; Setati et al., 1998).

The results of the Trends in Maths and Science Study (TIMSS) survey in 2003 reveal that mother tongue speakers of Afrikaans performed best of all South African students because they learned their content subjects in Afrikaans, which is their mother tongue (Reddy, 2005). The results of the quantitative data in this study revealed an improvement in learners' mother tongue (IsiXhosa) in terms of their listening, writing and speaking abilities during the implementation of the Integrated Scientific Literacy initiative. These data, consideration of the value of mother tongue instruction by some researchers, particularly in terms of learner involvement (Webb, 2007), and the fact that Yore & Treagust (2006) stress that learning to talk, read and write science is vital for learners to argue meaningfully about scientific issues, begs the question whether science could be more meaningfully and effectively taught in IsiXhosa to the children involved in this study.

Teacher Implementation of the Science Literacy Strategy

What was observed in this study was that the learner's level of science discourse was very simple. In all experimental schools there was evidence that indicated that the teachers understood the aspects of the science literacy strategy; for example they all managed to follow the procedure in which the strategy was to be implemented. They planned the investigations, guided learners on how to do them and how to write results on their science notebooks. Although the scientific literacy strategy uses the science notebooks as a teaching and learning tool for understanding science content and process skills and provides learners with opportunities to describe in writing the questions they are investigating, their findings and their interpretation of these findings (Nesbit, 2007),it appeared that the learners understood the procedures

to be followed during the investigations, what was equally clear was that they were not able to write the reports in a coherent paragraph in English as expected.

During the implementation of the strategy classroom observation revealed that the interaction between teachers and learners was mostly characterised by a situation where, for example, the investigable question would be written on the board, learners would be asked in English whether they understood what the question requires of them and immediately the same statement would be translated into Xhosa, probably to assist learners' to understand of what they were supposed to do. Sometimes borrowing in English would be done, for example 'i-magnet' (the Xhosa word for 'magnet' exists, but is seldom used in everyday conversation). Researchers in science education such as Miller (2006) and Yore and Treagust (2006) believe that for someone to be judged as scientifically literate they must be proficient in the discourses of science, which include reading, writing and talking science. For the learners in this study to be proficient in the discourse of science means that they should be able to understand and interact in the language of science, which in their case is in English. As noted earlier, language is thus a formidable barrier in terms of learning science for these learners, and their lessons end up being chorus teaching exercises (Heugh, 2005).

Reading Activity

In the Threshold Project (MacDonald, 1990) it was reported that at the time of change to English in Grade 4 South African learner's writing skills in English are immature, lacking the vocabulary, syntax and ability to link ideas necessary for explanation in content subjects, and that learners reading scores revealed that they were unable to answer simple inference or factual questions (Macdonald, 1990). Setati (2000) argues that even at senior primary level learners are far less capable of handling content subjects through English than through their mother tongue. In terms

the scientific literacy strategy used in this study the reading activities focused on learning to read for science and reading to learn science. To help learners to learn to read for science, the teacher's focus is on language competences and success indicators when reading to learn science are that learners are able to show that they understand how written material is organised and are able to use thinking maps in order to assist them to make sense of a written text (Webb, 2007).

The scientific literacy strategy focuses on the roles of reading towards discussion to develop investigable questions in science classes. As such, the teachers in the experimental schools were trained on how to provide opportunities for reading and discussion whilst implementing the science literacy strategy. England et al. (2007) note that stories can help to develop concepts and vocabulary in a variety of learning areas and the participating teachers were trained on how to use 'Big Books', i.e. story books which stimulate interest and provide some background to help learners formulate investigable questions (England, et al., 2007).

It was observed in most of the experimental schools during the implementation of the science literacy strategy that few reading opportunities were provided to the learners. Similar observations are alluded to in Malatjie's (2005) report, i.e. that the use of textbooks in science lessons appear to be limited and reading as a classroom activity remains rare. The only reading activity that was observed in one of the experimental schools was when learners were reading from a science poster and their teacher translated what they were reading into Xhosa. It appeared as though learners were only decoding, in that they were simply translating the written symbols into language, and that they were almost totally dependent on their teacher's translation for understanding what they were reading.

Although the teachers in the experimental schools reported that integrating reading with teaching science was a new approach for them, and they confessed that they had previously regarded reading as a language activity which is not something to be promoted in science classes, they were adamant that reading activities had taken place in their classes during their implementation of the Integrated Scientific Literacy strategy, and that they had used the 'Big Books' provided. These self-reports were supported by the fact that the quantitative pre-test data generated in this study revealed a mean difference between the English and IsiXhosa reading scores in favour of IsiXhosa, but showed no statistically significant difference in the post-test appears to bear out their self reporting in that gains were made in English reading scores (the language of the reading materials provided). As such, the findings of researchers like Matjila and Pretorius (2004), who argue that reading is an ability that must be acquired and practised through exposure to written language, and others like Marlow (2005) who view reading as a method to acquire scientific information, knowledge and skills, and therefore feel that the science teacher needs to be an instructor of reading and writing, are important pointers when discussing the effects of strategies to promote scientific literacy in children.

Listening Activities

As the literature reveals that listening is one of the important skills in learning science, and that is particularly important in learning environments orientated towards application and problem solving (Hagen et al, 2005; Marlow, 2005), the observation process focused on whether teachers gave opportunities for listening activities during the implementation of the science literacy strategy.

South African research reveals that at the end of Grade 4 second-language learners are able to read and understand about 3000 words and about 9000 words are

understood in spoken language, which is usually the home language, and that during these years learners are better at listening comprehension than reading comprehension (Matjila & Pretorius, 2004). From the classroom observations made, it became evident that the most common listening opportunities provided were the instructions given to learners in order to conduct the science investigations. As mentioned earlier, instructions in the classrooms were given in Xhosa and learners interacted with one another in IsiXhosa. As they learners did most of the listening in their mother tongue, the quantitative improvement in their listening skills in their home language revealed by this research was possibly as a result of this aspect of the implementation of the science literacy strategy.

Writing Activities

As part of the implementation of the science literacy strategy learners were expected to write investigative reports in their science notebooks. The qualitative data generated from observations revealed that their writing was generally in incoherent English - they could not write full sentences and coherent paragraphs. The qualitative data generated revealed no statistically significant improvement in English writing category but a statistically significant improvement in their isiXhosa writing abilities with a large effect size. These data are compelling and in this instance are judged to be the result of the fact that the learners first wrote their notebooks in their home language, and then attempted to transfer their writing into English. In instances where the researcher observed this phenomenon, it was observed that they struggled with translating words and sentences from IsiXhosa to English. The dramatic improvement in the children's home-language writing skills could reasonably be considered to be unexpected as in the 'reverse situation, i.e., when learners' language skills are not fully developed in their mother tongue it is usually difficult to transfer such skills to

the second language (Nomvete, 1994). As is the case typical to second-language learners in schools of the type that participated in the Scientific Literacy strategy, the Threshold Project research by Macdonald (1990) reveals that the change into English as the language of learning and teaching results in first-language skills not being sufficiently developed as learners at this age are still not literate in the first language and they are inadequately prepared for this change (Macdonald, 1990)Despite improvements, the learners writing skills still need to be improved and there is a need for further investigation of how science notebooks could be effectively used to improve learner's writing skills. There is also a need to investigate how learners could be helped to cross the bridge from oral to written language.

Speaking Activities

This component of the observation process focused on whether the teachers provided opportunities for their learners to speak in their classroom during the implementation of the science literacy strategy, and whether learners were able to engage in authentic discussion. Classroom observations revealed that the learners in all schools visited were only able to share ideas in a manner that would stimulate discussions, debates and arguments in science in their mother tongue. As noted before, the quantitative data revealed no improvement in the learners' English speaking abilities, although some improvement in Xhosa was evident. The improvement was noted and possibly attributed to the effect of the science literacy strategy despite the fact that the teachers (who themselves used code-switching) generally did not encourage their learners to have extensive whole-class discussions in Xhosa. In the cases were they did instruct their learners to share their findings with the rest of the class in English, they remained quiet. One may possibly conclude that they felt intimidated when asked to speak aloud in front of the researcher or were not

comfortable with speaking English. However, the learners did have small-group discussions in their mother tongue and it is assumed that were they given an opportunity they might have been able to talk science and have authentic discussions on science topics in their mother tongue in a broader forum.

The fact that there was no sharing of ideas in the classroom in English suggests that an interesting aspect of bilingual literacy studies such as this one is to investigate how second-language learners can be assisted to develop their second-language skills in terms of discussing, classifying, questioning, challenging, arguing an reporting in and through their official language of teaching and learning in their science classrooms.

3.2. Interviews

Interviews were held with both the teachers and the learners. The first purpose of the interviews was to probe why the teachers use a certain language practice to support classroom communication, which language (IsiXhosa or English) they think would make a difference in implementing the science literacy strategy and why and, which language they think communicates science better to the learners. The teachers in the control schools were also asked the same questions. Learners were also interviewed to find out why they communicate using the language they use most in the classroom and what difference they feel the science literacy strategy makes in terms of their understanding of science.

Data from teacher interviews revealed that they preferred to use both English and isiXhosa and that they recognised code switching as a viable strategy to be used in their science classrooms. Although classroom observations revealed that isiXhosa is the language teachers mostly used in the classroom, some teachers also believed

that English should be used in the classroom for teaching and learning as the learners would be learning to function in the language. They acknowledged that English plays a vital role in the world as a *lingua franca*, the language of business and commerce, and as the language of learning and teaching in most schools including their own. On the other hand, some of the teachers felt that their learners have not reached a level of understanding English even though they had been introduced to English four or five years previously. When the teachers were asked whether they provide listening, reading, writing and speaking opportunities in their science classrooms, they all agreed but could not elaborate on how they do it. Their response was in contrast to what was observed. For instance the baseline observations revealed that the teachers read for the learners, did most of the talking, and that learner's writing in their class work books was limited. During the implementation of the scientific literacy strategy instructions were given to learners in their home language, opportunities to talk in groups were provided, and opportunities to write in the science notebooks were also provided. However, the fact that the teachers could not elaborate on how they provide these language skills' suggests that they are not clear on the role of language in science teaching and not aware of the studies and theories around the role that language plays in science teaching and learning.

As with the teachers, learners preferred that their home language be used alongside the language of learning and teaching (English). Surprisingly they mentioned their awareness of the functions of English in our society such as using English to express thoughts, to ask for directions, to ask for permission, to buy in a shop and so on. They also found the science investigations helpful in stimulating their love of science, yet they revealed that they were not confident to read, write, speak and follow instructions in English.

Both the teachers and the learners' interview responses suggest that the theories of mother tongue instruction and code switching should be given a prominent role in second language classrooms. From classroom observations and literature it is clear that learning through a medium of language other than the home language is a challenge to any learner, no matter how intelligent. This difficulty to learn through English was evident when learners in the classrooms observed became quiet when asked to engage in a whole class discussion using English. Setati et al. (1998) mention that the use of the learner's first language in teaching and learning provides the support needed while the learners continue to develop proficiency in the language of learning and teaching. Furthermore Setati et al. (1998) are of the view that code switching in second language classrooms becomes a means for exploratory talk and that second-language learners should be allowed to use their mother tongue for classroom communication. They believe that the movement from informal spoken language (exploratory talk) to formal written language (discourse specific writing) is complicated by the fact that learner's exploratory talk may be in a language that is not the learner's language of learning and teaching (Setati et al., 1998). The quantitative data, classroom observations and interviews revealed that although learners in this study were grade six and seven's, and that although English was introduced to them in grade 4, they were still not fully developed in both Xhosa and English language skills.

3.3. Language surveys

In both the experimental and control schools, the language survey (questionnaires) revealed that both the teachers and the learners are second language speakers of English and Xhosa is their mother tongue. According to the Language in Education Policy (Department of Education; 2007) schools have a right to choose the language of learning and teaching (LOLT). Schools in this study chose English as the

LOLT and this confirms research by Banda (2000) and de Klerk (2002), which reveals that the response of the majority of black South Africans to multilingualism is the acceptance of English as a language of learning and teaching. Although English is the LOLT in these schools, teacher interviews revealed that they lack the necessary confidence to speak this language easily, and that mostly resorted to code switching when teaching. The survey also revealed that both isiXhosa and English are the languages for communication (classroom, assembly, staff meetings) in the experimental and control schools, English only is used for correspondence with the Department of Education. IsiXhosa is used to communicate with parents. English is introduced from Grade 4 whereas in the Foundation phase learners are taught in their mother tongue.

4. OVERVIEW OF THE QUANTITATIVE AND QUALITATIVE DATA

The scientific literacy strategy used in this study recognises the role of language in learning science as it promotes writing, talking, reading, discussion and arguing. Yore and Treagust (2006) note that learning to talk read and write science is important because acquisition of language skills enable learners to argue meaningfully about science issues. In most of the schools sampled for this study it appears that a problems exist particularly because learners are taught in a language which is not their mother tongue, something that has regularly reported in South African literature (Setati, Adler, Reed, & Bapoo, 2002,). Setati et al. (2002) further note that learning in English results in poor skills in reading, listening, writing and speaking skills. This was evident in this study because both the experimental and the control group mean scores in English and IsiXhosa pre-tests showed very low levels of learner's performance than it was expected.

Reading

As indicated earlier, the quantitative data revealed an improvement in the experimental groups' English reading scores. Generally, the schools in this study did not lack reading material as it was evident in the classrooms that were observed that there were mini-library boxes which had reading material ranging from novels to story books and magazines in both IsiXhosa and English. When the researcher enquired from the teachers whether these books were used during teaching, they mentioned that they were mostly used during the English and IsiXhosa language periods (personal communication). It appeared as if these books were used to familiarise the learners with reading stories. When the teachers in the experimental schools were trained on scientific literacy stories they were introduced to them as a way of eliciting discussion in the classroom when doing the scientific investigations. As a result, each school was provided with "big books' which contained stories that related to science investigations. The teachers reported that they did expose their learners to reading for this purpose, but few reading opportunities that were seen during the classroom visits. Those that were seen were in the form of reading from science posters and textbooks.

Nevertheless, it is reasonably clear that despite the evidence of reading materials in isiXhosa and English in the schools, the learners reading abilities remained very poor. It may therefore be reasonably inferred that the statistically significant improvement in the participating learners' English reading abilities can probably be attributed to the limited implementation of the Scientific Literacy strategy of engaging them in shared and individual reading for the purpose of initiating classroom discussion towards formulating investigable questions in science, in other words reading in a real-life context towards activities of real interest.

Listening

The statistical results revealed an improvement in the isiXhosa listening category and this can be explained by the observations that learners did most of their listening during the Scientific Literacy intervention in their home language. Although their teachers used English when teaching to varying degrees they mostly code switched and translated some of the terminology into IsiXhosa. When the children read to in English in one of the schools, the teacher translated what she was reading into IsiXhosa. During the group discussions they communicated with one another in IsiXhosa and both the teachers' and learners' interviews confirmed that IsiXhosa was the language that was mostly used and listened to in their school environments. This however, is no different to what usually happens in these schools on an everyday basis, so the question remains as to why their isiXhosa listening skills improved over the period of intervention. A possible and tentative explanation may be one that is similar to that which was proposed to explain the improvement in English reading abilities i.e. that listening to language which requires closer attention as the content is considered to be important for achieving meaningful and interesting goals. The difference in this case is that the activity was listening rather than reading and that the language medium was their mother tongue rather than their second language.

Writing

The mean difference between the English and isiXhosa writing scores was significantly different in favour of English in the pre-test, but changed to being statistically significantly different in favour of isiXhosa in the post-tests. Classroom observations that were done before the implementation of the scientific literacy strategy revealed that there was little written work of any kind to be seen in the learners' books. Teacher interviews also revealed that teachers did not give learners

much written work as “we don’t have time to mark”. The science notebooks that were introduced during the implementation of the scientific literacy strategy gave learners an opportunity to write after each investigation. As a result learners experienced more writing practice than before, but of a type that was largely incoherent and incomprehensible in English. When they were asked to write their reports of the investigations in isiXhosa one could at least make sense of what they have written although it was not perfect in terms of structure and semantics. The improvement in isiXhosa writing was therefore probably a result of increased exposure to IsiXhosa - it was stressed that it was acceptable, even expected, that the learners record their thoughts in their home language in their science notebooks.

Speaking

Before the implementation of the scientific literacy strategy, classroom observations revealed a lot of teacher-talk in that teachers did the investigations and the learners listened and then copied from the board what their teachers regarded as notes. However after they were trained to implement the scientific literacy strategy, learners were given an opportunity to think by predicting what they thought the results of the investigations would be. They were also given an opportunity to discuss in groups, interact with one another but, as noted earlier, their interactions were in their mother tongue. As the researcher is the first language speaker of isiXhosa she was able to observe that the learners struggled with translating their reasoning and thoughts in isiXhosa into English when they were asked to report in English. The fact that there were no statistically significant mean differences between the English and Xhosa speaking scores in either the pre- or post-tests is probably due to the small sample that was used for this category, as it was clear that the learners were much more comfortable speaking in their home language.

5. ANSWERING THE RESEARCH QUESTION

The research question in this study was: *Is Science Literacy Strategy an effective method for improving learner's language skills*? The data suggests that there were statistically significant improvement in learners listening, and writing in IsiXhosa, but there was only a statistically significant improvement in English in terms of reading skills. These improvements can reasonably be attributed to influences within the Integrated Scientific Literacy strategy. Therefore, an answer to the research question could be that the Scientific Literacy intervention strategy as it is currently executed did have an effect on learner's language skills, but that this improvement was patchy and mainly affected the learners' skill in their home language (apart from reading in English). These data highlighted issues of language in second language science classrooms in South Africa, and the possible positive effects of the strategy of code-switching by teachers (as supported by South African researchers such as Setati (1998) and Adler (2001), as well as international research (National Centre for Curriculum Research and Development, 2000). As the learners in this study appeared to feel more comfortable when communicating in their mother tongue in the classroom, but that English is the Language of Learning and Teaching of choice in these schools, it is possible that the Scientific Literacy approach combined with carefully formulated code-switching strategies could enhance both learning of science and these learners' general literacy skills.

6. CHAPTER SUMMARY

The discussion in this chapter focused on both the quantitative and the qualitative data that was generated from this study. The focus was on the results that emerged during the data analysis of pre and post English and Isixhosa tests and this data was examined within the literature review discussed in Chapter two. Also the qualitative data gathered from the classroom observations, language surveys of schools and interviews of learners and teachers were discussed and referenced to the literature review.

Both the quantitative and the qualitative data suggest that the scientific literacy strategy had an effect on learners' language skills but this improvement mainly affected the learner's skills in their home language (apart from reading in English).Data also showed that teaching and learning in this study rarely took place in English but in Xhosa and this was consistent with the findings of researchers such as Macdonald (1990) and Heugh (2002) who support mother tongue instruction. Also, there is evidence of code switching throughout the lessons observed and studies reveal that code switching plays a role in second language classrooms, for example, researchers such as Setati(2002), Dulm and Rose(2006) believe that in second language classrooms, code switching is a viable strategy for teaching .Finally the data suggest that the scientific literacy strategy combined with carefully formulated code switching strategies could enhance both learning of science and the learners general literacy skills.

CHAPTER SIX

CONCLUSIONS AND RECOMMENDATIONS

1. INTRODUCTION

The most interesting findings of this study, which aimed at measuring the effect of a science literacy strategy on learner's reading, listening, writing and speaking abilities, were the statistically significant improvements in the participating learner's home language (isiXhosa) listening and writing skills. Less surprisingly, as the reading materials provided were in English only, there was also an improvement in learners' English reading skills. Teachers attitudes to, and use of, code switching strategies to support learning, and learners reversion to their home language at almost every opportunity, also warrant further comment.

2. LANGUAGE AND CODE-SWITCHING

The fact that the participants' first language listening and writing skills improved despite teaching and learning supposedly mainly taking place in English (the official language of instruction), suggests that the intervention was probably introduced at a time when learners were still developing their first language and the second language was not well known to them. This notion is supported by the teacher interviews that took place as part of the study where it was reported that English was introduced to these Grade 6 learners in Grade 4. Studies by Nomvete (1994) indicate that in most cases South African learners who do not speak English as their first language, and who are schooled in English, have not fully developed in their first language at this early stage. Heugh (2003) notes that transfer from first to second

language is not possible until the first language is well established and the second language well known. As such, a logical conclusion is that the learners preferred (or were only able) to discuss issues through their home (first) language and then to translate their discussions, sometimes with difficulty, into English.

The finding of an improvement in learner's language of learning and teaching (English) in terms of their reading skills suggests that the scientific literacy strategy, which promoted the use of English language 'Big books' as a strategy to enhance reading, probably helped the participating learners to improve their reading skills. The data also suggests that the reported exposure to other English reading material (in what is assumed to be a meaningful context for the learners) during the implementation of the scientific literacy strategy, improved their reading skills.

The fact that code switching was observed throughout the study as a teaching strategy to support learning supports other research findings in South Africa, i.e. code switching is a common strategy used in classrooms where the language of learning and teaching is not the home language (Dulm & Rose, 2006; Setati, 2000; Peires, 1994). The frequent use of this strategy suggests that the language realities of second language classrooms require a strategy that recognizes the learner's home language as well as the language of learning and teaching. Moreover, it was interesting to find out from informal discussions with the teachers participating in this study that code switching was not a planned part of their lessons, in other words their lesson plans did not indicate when English only, isiXhosa only or code switching was going to occur. One explanation for this that is supported by the data generated in this study could be that the teachers are not aware that code-switching is an acceptable practice in the South African context and that the Language in Education Policy of South Africa

encourages schools to use more than one language as a language of learning and teaching (Department of Education, 1997).

As far as authentic discussion is concerned, the group discussions that took place during the scientific literacy intervention were not guided in the sense that their teacher's questions seldom elicited exploratory talk and argumentation. The discussions were limited to the findings and conclusions of their investigations. Also there was very little input from the learners to teacher talk and sometimes the talk that was done in groups was not directly related to the task at hand.

In terms of writing it was interesting to note that learners would sometimes write their reports in both isiXhosa and English, which not only indicates their preference for their home language, but also suggests that sometimes they could not find an equivalent of an isiXhosa word in English (and vice-versa). Also, the fact that there was an improvement in their isiXhosa literacy skills suggests that home language mental engagement played an important role in both enabling the learners to construct meaningful knowledge and in honing their home language skills.

3. RECOMMENDATIONS

The most apparent outcome of the intervention, namely that the participating learners developed more in their home language when participating in the scientific literacy strategy than in English, suggests the following. Firstly, it appears that it might be profitable for the scientific literacy strategy to be remodelled to incorporate and indicate when explicit code switching could be used during implementation. Also, provision of the reading resources in the learners' home language and explicit guidance in writing in the science notebooks in the learners' home language followed

by translation into English, should profit both scientific understandings and language development, both in the home language and in English.

Secondly, discussions with teachers around the use of language during implementation of the scientific literacy strategy did play a role in changing their perceptions on language use in their classrooms. Some teachers confessed that they were not aware of the role of language in learning science; they thought that language was for language teachers and could not be integrated in content learning. Therefore in-service training (INSET) on how language can be integrated to improve conceptual understanding should be considered as an important area for subject-specific providers of INSET.

Thirdly, the fact that many teachers are negative in terms of the use of home language in their teaching, despite the fact that their learners show little sign of understanding what they are trying to get across, suggests that more explicit efforts by teacher trainers and curriculum developers are required to develop a better understanding of what constitutes effective code-switching strategies and its probable effects and to raise the legitimacy of code switching in the eyes of teachers teaching in second language classrooms. The scientific literacy strategy is one such curriculum intervention and, as already suggested, can provide an exemplar as how to integrate code-switching and other language strategies across the curriculum.

Lastly, even though group discussions were a core part of scientific literacy strategy, there was very little input from learners to teacher talk. This suggests that teachers find the discussion aspect of the strategy difficult, and that there is a need to investigate more effective ways of enabling teachers facilitate discourse specific talk.

4. FURTHER RESEARCH

As indicated in chapter four, learner's writing revealed incoherent and incomprehensible sentences, therefore further research could be done on how the science notebooks strategy could be improved to better scaffold better writing skills in second-language learners.

Secondly, this research supports international findings that mother tongue plays a prominent role in learning content subjects. In South Africa it is not only the teachers who are negative in terms of the use of home language in their teaching; in the main parents want their children to be taught in English, and usually 'the sooner the better' (Probyn et al. 2004). This suggests that further research is required as to parental attitudes and their understandings of the relationships between language and learning

5. CONCLUSION

As noted earlier, Alidou and Brock-Utne (in Alidou et al., 2006) report that classroom observation studies conducted in several countries in Africa (Benin, Burkina Faso, Guinea-Bissau, Mali, Mozambique, Niger, South Africa, Togo, Tanzania, Ethiopia, Ghana, and Botswana) reveal that the use of an unfamiliar language such as English often results in traditional and teacher-centred teaching methods, e.g. chorus teaching, repetition, memorization and recall. Teachers do most of the talking while children remain silent and passive. In a South African study, Setati & Adler (2001) also show that when teachers use English mainly for explanation, rote learning of procedures takes place and opportunities for developing meaningful learner-centred scientific talk and writing are limited. Nigerian teachers regularly complain that their attempts to teach any subject are hampered by their

pupils' inability to understand and speak English (Volunteer Services Overseas, 2006). The data generated in this study support the above findings, viz. that one cannot ignore the role of mother tongue in learning, and that code switching is probably a valuable strategy in second language classrooms that needs to be made explicit to teachers.

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APPENDICES

APPENDIX A

ENGLISH LANGUAGE ASSESSMENT

READING, LISTENING AND WRITING

FIRST NAME: ……

LAST NAME: ……

SCHOOL: ……

GRADE: ……

AGE: ……

WRITE ALL YOUR ANSWERS IN THIS BOOKLET

SECTION A: READING COMPREHENSION

EXAMPLE QUESTION

Instructions: Read the short story below.

Thabo was reading a book when his mother called to him from the kitchen. He ran quickly to find her. She wanted him to go to the shop to buy some beans.

Example Question X

Put a tick in the box beside the correct answer.

X. What did Thabo's mother want him to do?

A. ☐ (1) do his homework
B. ☐ (2) go to the shop
C. ☐ (3) ride his bicycle
D. ☐ (4) look after the baby

Thabo's mother wanted him to go to the shop to buy beans.
So B is the correct answer. You must put a tick in the box beside B.

DO NOT TURN THE PAGE UNTIL YOU ARE TOLD.

Read the passage below and then answer the questions that follow.

Zola and The Donkey

A bus pulled up at the edge of the pavement near where Zola was standing with the donkey by his side. Some people got out and others got in and as Zola watched them he had an idea. He jumped on to the bus with the rest of the crowd and the bus drove off, leaving the donkey behind.

Along the street went the bus, it turned the first corner and then rounded another. It travelled slowly, rattling as it went, for it was a rattling old bus. As it slowed down for another stop, Zola glanced through the window at the back. The donkey was galloping after the bus.

Zola closed his eyes tightly for a second. When he opened them again, there was a man standing in front of him with a big leather pouch slung over one shoulder. “Five cents, please” said the man, holding out his hand.

1. What pulled up near Zola?

A. ☐ (1) A back window.
B. ☐ (2) A pavement.
C. ☐ (3) A man.
D. ☐ (4) A bus.

2. What did Zola have by his side?

A. ☐ (1) An idea.
B. ☐ (2) A leather pouch.
C. ☐ (3) People.
D. ☐ (4) A donkey.

3. Zola got on to ……. bus.

A. ☐ (1) an old
B. ☐ (2) a new
C. ☐ (3) an empty
D. ☐ (4) a free

4. What did the donkey do?

A. ☐ (1) It closed its eyes.
B. ☐ (2) It galloped after the bus.
C. ☐ (3) It slowed down.
D. ☐ (4) It rattled along the road.

5. In the passage “rattling” means….

A. ☐ (1) brand new.
B. ☐ (2) dirty.
C. ☐ (3) clean.
D. ☐ (4) noisy.

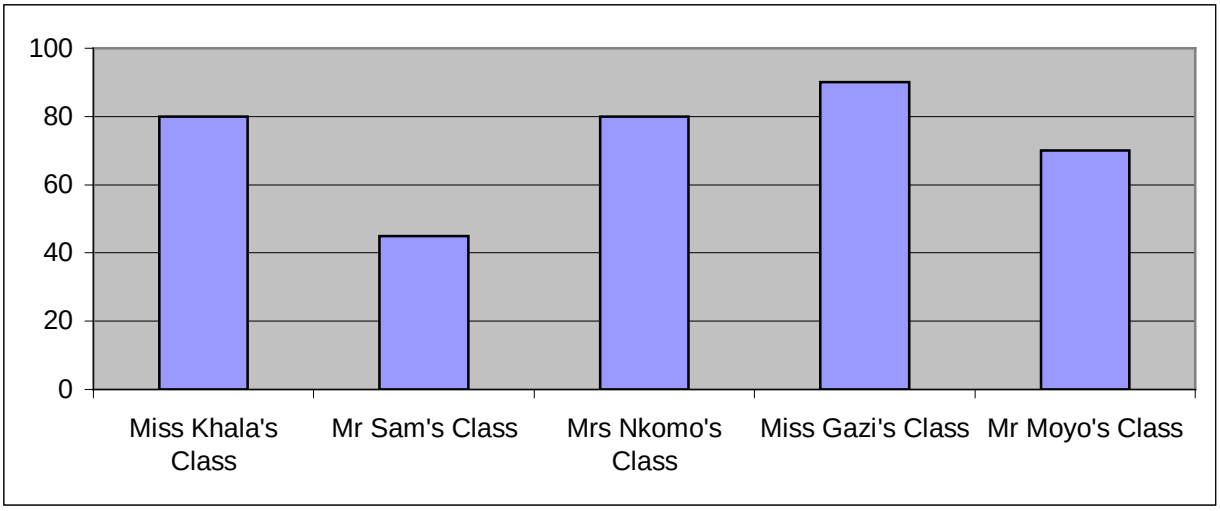
Read the passage and graph below and then answer the questions that follow.

Empty bottles

Ikhwezi School had a bottle collection. Children in each class brought empty bottles to school. The principal made a bar graph of the number of bottles from five classes.

Use this to answer the questions.

Number of bottles



Classes

6. Which class brought 45 bottles?

A. ☐ (1) Miss Khala's class.
B. ☐ (2) Miss Gazi's class.
C. ☐ (3) Mrs Nkomo's class.
D. ☐ (4) Mr Sam's class.

7. The principal asked each class to collect at least 50 bottles. How many classes have collected that many.

A. ☐ (1) 2
B. ☐ (2) 3
C. ☐ (3) 4
D. ☐ (4) 5

8. Which class got the prize for collecting the most bottles?

A. ☐ (1) Mr Sam's Class.
B. ☐ (2) Mr Moyo's Class.
C. ☐ (3) Miss Khala's Class.
D. ☐ (4) Miss Gazi's Class.

9. Which two classes collected exactly 80 bottles?

A. ☐ (1) Miss Khala and Mrs Nkomo's classes.
B. ☐ (2) Miss Khala and Mr Moyo's classes.
C. ☐ (3) Miss Gazi and Mrs Nkomo's classes.
D. ☐ (4) Miss Gazi and Mr Moyo's classes.

Read the passage below and then answer the questions that follow.

Maize

The most important food crop in Malawi is maize. Maize is one of the many cereals. Cereals are plants which produce grain that is made into flour. The grain of maize comes from the cob. A good maize crop grows two to four metres high and has dark green leaves. Maize takes a lot of plant food from the soil, so it should not be grown on the same field for two full years.

Maize is planted **before** the rains begin in November and is ready for harvest in April. When maize is harvested, the cobs are stored in grain bins until they are needed. The bins are raised off the ground on posts too prevent animals from eating the grains. When maize grains are pounded, the outer part of the grain is made into bran and the inner part into while flour. Bran is often used as animal feed. If the maize is ground in a maize mill, the whole of the grain is made into a grey flour.

10. Maize is …

A. ☐ (1) plant food.
B. ☐ (2) made of green leaves.
C. ☐ (3) a food crop.
D. ☐ (4) harvested once very two years.

11. How many months does it take from when maize is planted to when it is ready for harvest.

A. ☐ (1) 12 months
B. ☐ (2) 9 months
C. ☐ (3) 6 months
D. ☐ (4) 3 months

12. In Malawi, maize is planted first before the rains begin because…

A. ☐ (1) the workers do not want to get wet.
B. ☐ (2) it takes a lot of plant food from the soil.
C. ☐ (3) it needs water to grow.
D. ☐ (4) it does not need water to grow.

13. Maize has dark green leaves because…

A. ☐ (1) it can provide bran, white flour, and grey flour.
B. ☐ (2) it gets plant food, sun and water.
C. ☐ (3) the leaves do not see the sun very much.
D. ☐ (4) it does not get enough water.

14. When maize is pounded, we get two products which are…

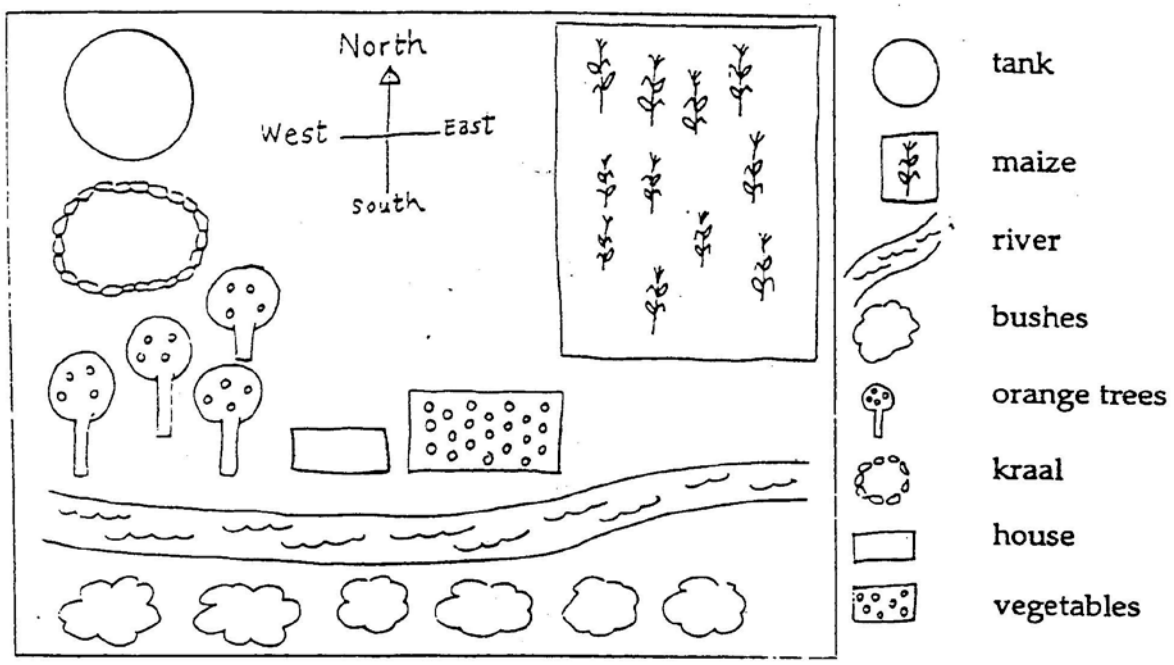
A. ☐ (1) grey flour and white flour.
B. ☐ (2) grey flour and bran.
C. ☐ (3) white flour and bran.
D. ☐ (4) grey flour and cobs.

15. Grey flour comes from the grinding of …

A. ☐ (1) all of the maize grain.
B. ☐ (2) the outer part of the maize grain.
C. ☐ (3) the inner part of the maize grain.
D. ☐ (4) the whole grain.

Look at the map of Mr Makalima's farm below. Complete the description of the farm below the map by putting one word from the key in each blank.

Mr Makalima's Farm



Mr Makalima has a small farm. His farm is a mixed farm. His house is beside a small (22) …….. from where he gets his water. The water is pumped up into a large cement storage (23) …… in the north west corner of the farm. Near there he has built a (24) ……. for the cattle. He grows (25) …….. in a big field on the east side of the farm. He grows a few (26) …….. for his family and workers in a garden beside his house. On the other side of his house he has planted an orchard of (27) …… trees. The farm is quite profitable, but he has a big problem with the monkeys which live in the (28) ……. on the other side of the river and raid his trees and crops.

B. LISTENING COMPREHENSION

Your teacher will read a story to you. Listen carefully to it and answer the questions below. YOU WILL ONLY HEAR THE STORY ONCE. You will be allowed to look at the questions before you hear the story. Listen carefully to this story and put a tick in the box beside the correct answer to the questions.

1. At what time did Themba leave his house?

   A. ☐ (1) 06:00
   B. ☐ (2) 11:00
   C. ☐ (3) 03:00
   D. ☐ (4) 09:00

2. Why did Themba climb onto one of his donkeys?

   A. ☐ (1) Because he wanted to look for the sixth donkey.
   B. ☐ (2) In order to take the donkeys to the market.
   C. ☐ (3) In order to count the donkeys.
   D. ☐ (4) Because he was tired of walking.

3. Why could Themba not find the sixth donkey?

   A. ☐ (1) Because it had run away.
   B. ☐ (2) Because his friend has it.
   C. ☐ (3) Because there were only five.
   D. ☐ (4) Because he was sitting on it.

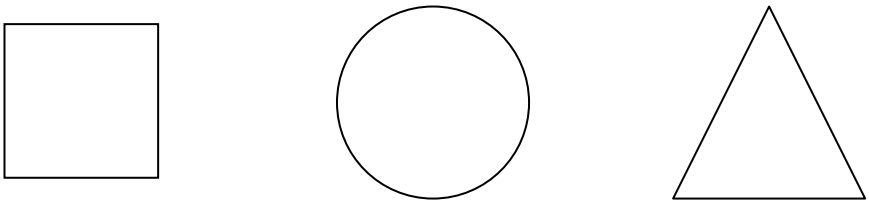
4. Themba's friend was …

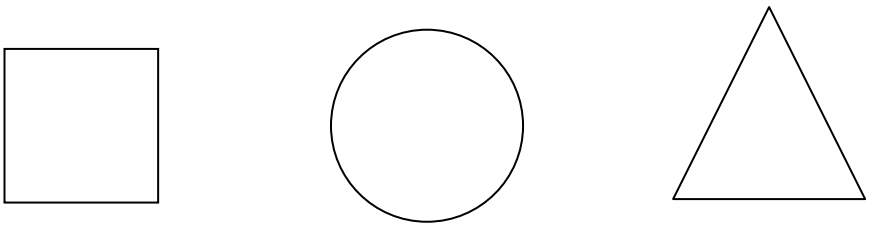
   A. ☐ (1) surprised.
   B. ☐ (2) disappointed.
   C. ☐ (3) amused.
   D. ☐ (4) angry.

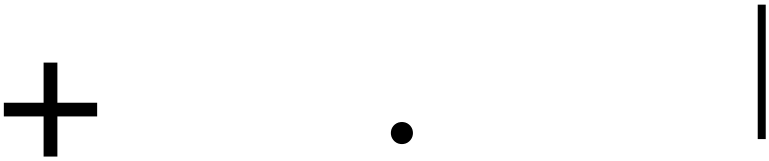
5. Themba's friend called him a donkey because he thought that Themba was …

A. ☐ (1) very clever.
B. ☐ (2) very stupid.
C. ☐ (3) in a hurry.
D. ☐ (4) a donkey.

Your teacher will read instructions to you. Listen carefully to each instruction and follow it. YOU WILL ONLY HEAR THE INSTRUCTION ONCE.

6. 

7. 

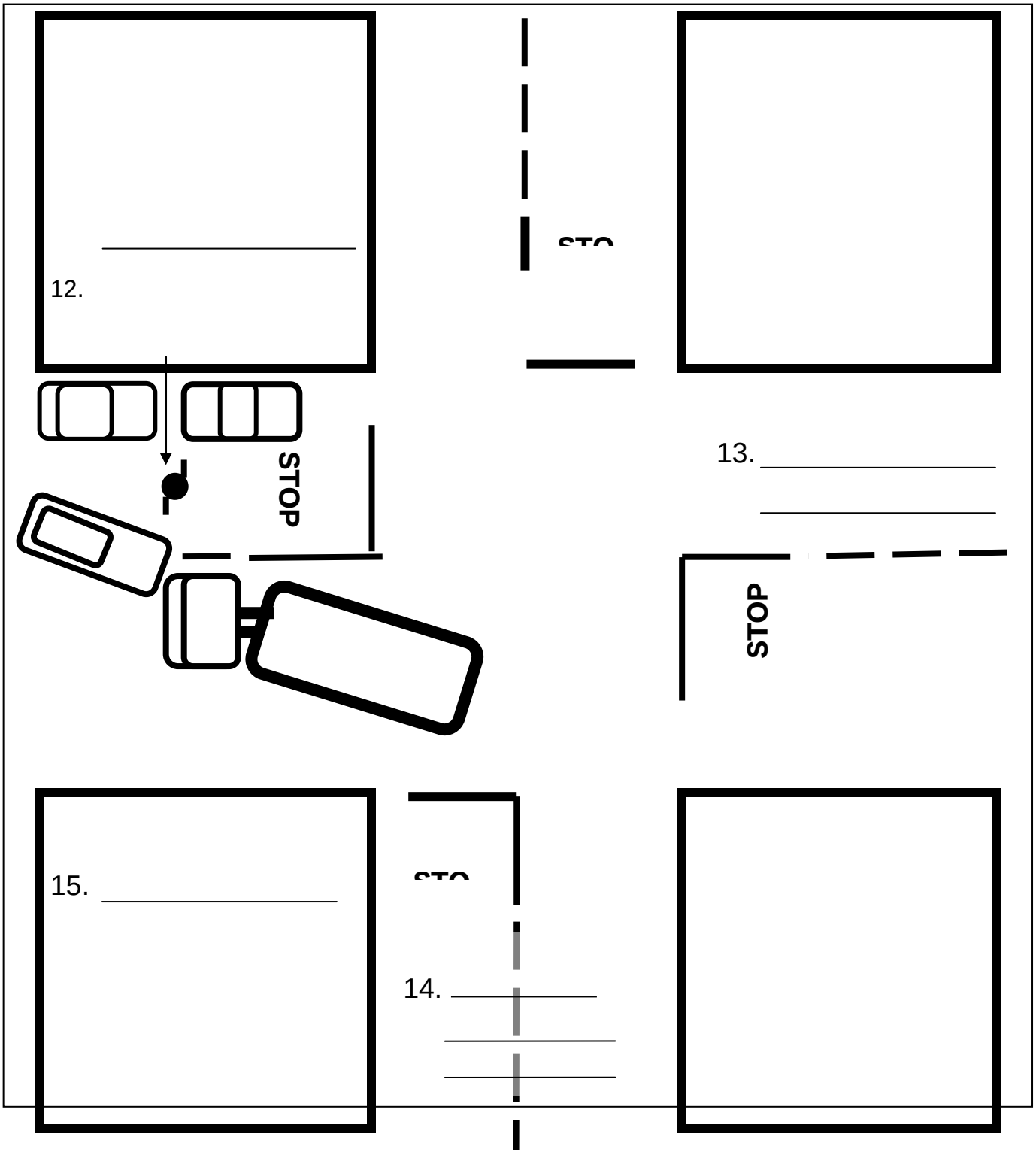
8. 

9. A. ☐ (1) ……..
B. ☐ (2) ……
C. ☐ (3) ……..
E. ☐ (4) ……

10.

11.

In this question you must write down your answers on the map provided below. Thami has to draw a sketch map of an accident. He has drawn the streets and the buildings, but the can't write in their names. He asks you to fill in the names. Look at the sketch map below. Listen to Thami and write on the map what he tells you to.



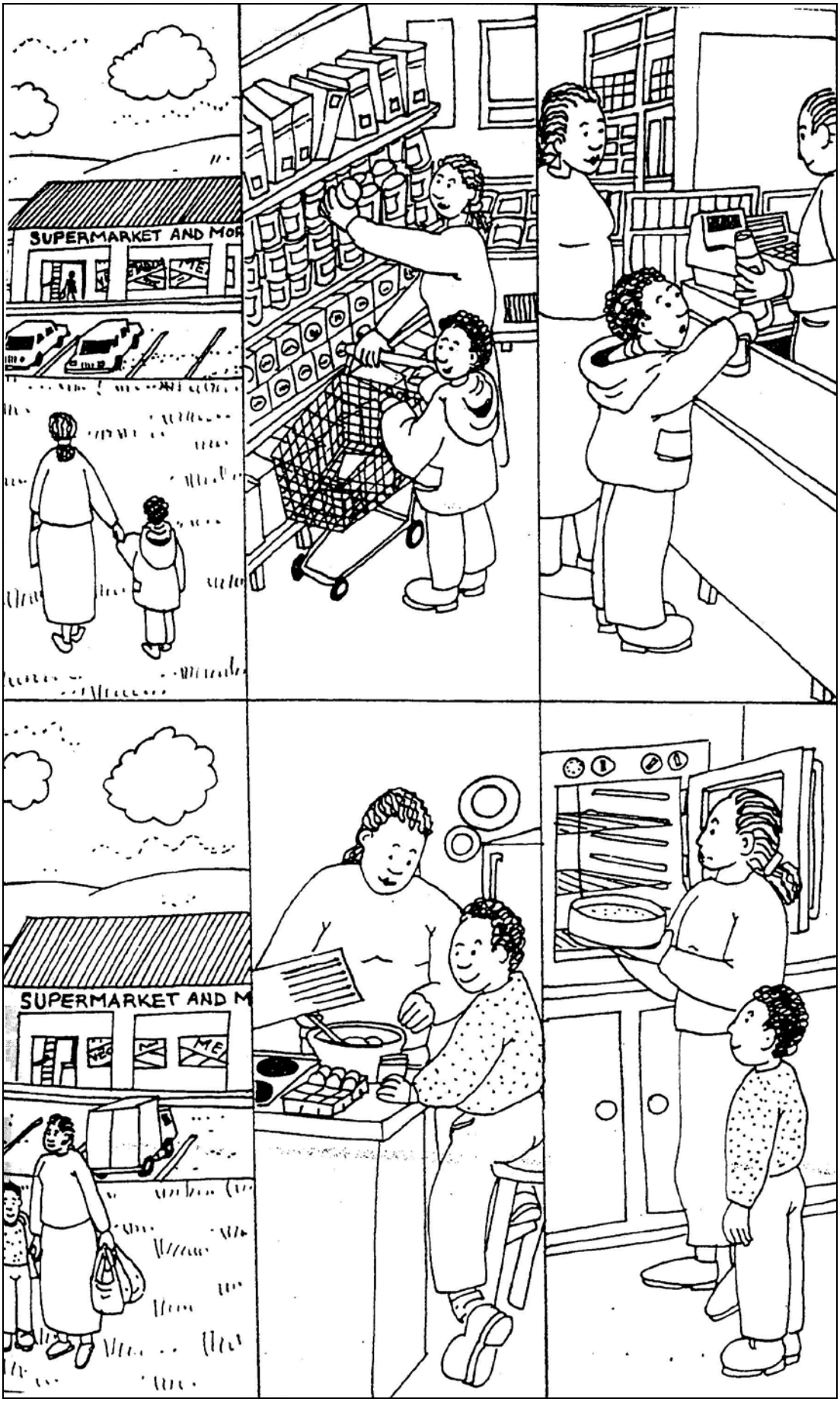
Listen to the information which you teacher will read to you, then fill in the information in the correct place in the table below.

	Where they live	**Where they work**	**How many children they have**
Nosisi	15.	*At a bank*	16.
Thabo	17.	18.	19.
Zanele	20.	21.	22.

C. WRITING

On the next page there is a picture story. The picture story has 6 pictures.

Write a story about what you see in the pictures in the space below:


SUPERMARKET AND MOR
SUPERMARKET AND M

APPENDIX B

UVAVANYO LWESIXHOSA

UKUFUNDA,UKUMAMELA NOKUBHALA

IGAMA: …….

IFANI: …….

ISIKOLO: …….

IBANGA: ……..

IMINYAKA: ……

BHALA ZONKE IIMPENDULO ZAKHO KULE NCWADI

ICANDELO A: UVAVANYO LOKUQONDA

UMZEKELO WOMBUZO

IMIYALELO: Funda elibali lifutshane lingezantsi.

UThabo wayefunda incwadi ngelixa abizelwa ekhitshini ngumama wakhe. Wayembizela ukumthuma evenkileni ayokuthenga iimbotyi.

.

Umzekelo Wombuzo

Beka itick(√) ecaleni kwempendulo oyikhethileyo.

Umama ka Thabo wayefuna enze ntoni?

E. ☐ (1) umsebenzi wakhe wasekhaya
F. ☐ (2) aye evenkileni
G. ☐ (3) adlale ibhayisekile yakhe
H. ☐ (4) ajonge umntwana wakowabo

Umama ka Thabo wayefuna aye evenkileni. Ngoko ke u B yimpendulo echanekileyo. Beka I tick(√) kwibhokisi esecaleni kuka B.

MUSA UKUTYHILA KWIPHEPHA ELILANDELAYO UNGAXELELWANGA.

Funda lomhlathi ungezantsi uze uphendule imibuzo elandelayo.

UZola ne Donki

Kwamisa ibhasi kwipavumente uZola awayeme kuyo kunye nedonki yakhe.Ithe yakumisa ibhasi, abantu behla abanye bakhwela. Ngalo lonke eloxesha uZola wayebabukele waze wagqiba ukuba akhwele ibhasi kwesosiphithiphithi sabantu abakhwelayo, ashiye idonki ngemva.

Ihambile ibhasi igoqoza kuba yayigugile. Ithe xa isondela iza kumisa kwesinye isitalato, uZola wagqiba ukuba aphose amehlo efestileni ngasemva. Uthe akujonga waqaphela ukuba idonki iphala emva kwalebhasi ayikhweleyo.

Uye wavala amehlo akhe okwethutyana, waza wathi xa ewavula wabona indoda exakathe isingxobo esikhulu sesikhumba. Le ndoda iye yakhupha isandla isithi”iisenti ezintlanu”.

16. Kwamisa ntoni kufuphi noZola?

A. ☐ (1) ifestile yasemva.
B. ☐ (2) ipavumente.
C. ☐ (3) indoda.
D. ☐ (4) ibhasi.

17. Kwakume ntoni ecaleni kukaZola?

A. ☐ (1) ingcinga.
B. ☐ (2) isingxobo sesikhumba.
C. ☐ (3) abantu.
E. ☐ (4) idonki.

18. UZola wakhwela ibhasi eyayi …….. .

A. ☐ (1) gugile
B. ☐ (2) ntsha
C. ☐ (3) ngenabantu
E. ☐ (4) simahla

19. Yenza ntoni idonki?

A. ☐ (1) ivale amehlo.
B. ☐ (2) iphale emva kwebhasi.
C. ☐ (3) ithobe isantya.
E. ☐ (4) igoqoze endleleni.

20. Kulo mhlathi ungentla “Ukugoqoza “ kuthetha….

A. ☐ (1) ubutsha kraca.
B. ☐ (2) ubumdaka.
C. ☐ (3) ukucoceka.
E. ☐ (4) ukungxola

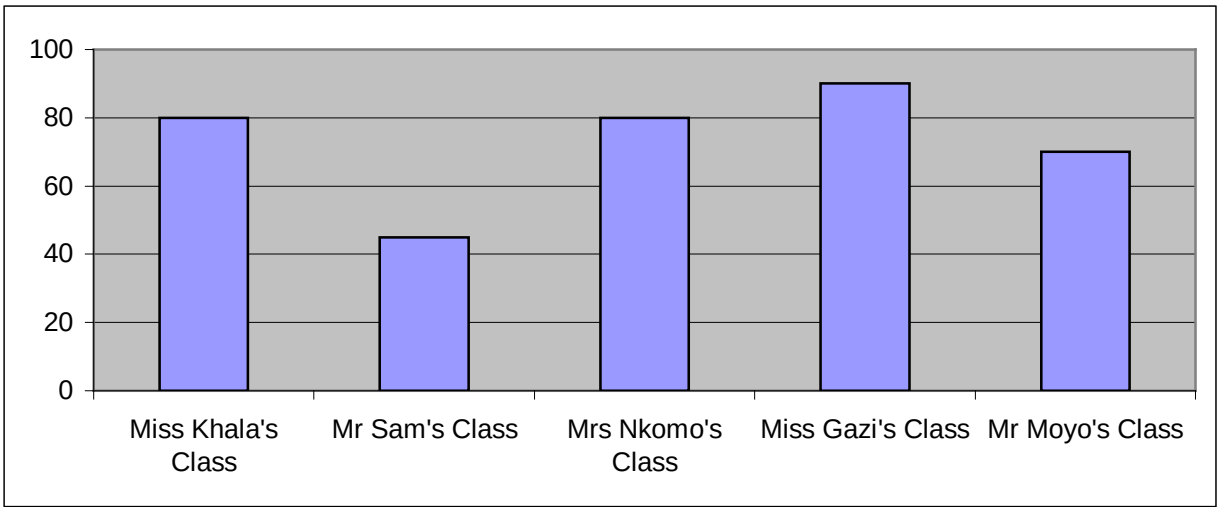
Funda lomhlathi ungezantsi kunye negrafu "graph" oyinikiweyo uze uphendule imibuzo elandelayo .

Iibhotile ezingenanto

Abantwana besikolo saseIkhwezi babekwiphulo lokuqokelela iibhotile.Inqununu yenze "ibar grafu" ukuthelekisa iibhotile ezithe zaqokelelwa kwiiklasi ezintlanu.

Qaphela usebenzise le grafu "graph" ingezantsi ukuphendula imibuzo.

Inani leebhotile



Iiklasi

21. Yeyiphi iklasi ethe yeza neebhotile ezingama 45? Yeka…

A. ☐ (1) Nkszn Khala .
B. ☐ (2) Nkszn Gazi .
C. ☐ (3) Nkskz Nkomo .
E. ☐ (4) Mnu Sam' .

22. Zingaphi iiklasi ezathi zaqokelela ubuncinane iibhotile ezingama 50 ngokomyalelo wenqununu..

A. ☐ (1) 2
B. ☐ (2) 3
C. ☐ (3) 4
D. ☐ (4) 5

23. Yeyiphi iklasi eyathi yafumana ibhaso ngokuba iqokelele ezona bhotile zininzi? Yeka …

A. ☐ (1) Mnu Sam.
B. ☐ (2) Mnu Moyo.
C. ☐ (3) Nkszn Khala.
E. ☐ (4) Nkszn Gazi.

24. Zeziphi iiklasi ezathi zaqokelela ngqo iibhotile ezingama 80?Zezika…

A. ☐ (1) Nkszn Khala no Nkskz Nkomo.
B. ☐ (2) Nkszn Khala no Mnu Moyo.
C. ☐ (3) Nkszn Gazi no Nkskz Nkomo.
E. ☐ (4) Nkszn Gazi no MnuMoyo.

Funda lo mhlathi ungezantsi uze uphendule imibuzo elandelayo.

Umbona

Okona kutya kubalulekileyo kuveliswa eMalawi ngumbona.Umbona yenyeyeesiriyeli.Iisiriyeli zizityalo ezivelisa iinkozo zokwenza umgubo.Iinkozo zombona zivela kwisikhwebu. Umbona ophilileyo uthi ukhule ube ngangeemitha ezimbini ukuya kwezintlanu ubude. Umbona uthatha izondlo ezisemhlabeni kungoko kungafuneki ukuba kulinywe emhlabeni omnye ixesha elingangeminyaka emibini

Umbona utyalwa ngaphambi kokuba kune iimvula zika Novemba, uze ulungele ukuvunwa ngo Apreli.Xa umbona uvunwa, izikhwebu zigcinwa kwiinkonxa zeenkozo kude kube lixesha lokuzisebenzisa.Iinkonxa ziyaphakanyiswa zixhonywe ukuthintela izilwanyana zingazityi. Xa umbona ungqushwa. Iqokobhe leenkozo lithi lenziwe amakhatshu uze umphakathi wenziwe umgubo. Amakhatshu la asetyenziswa njengokutya kwezilwanyana. Ukuba umbona usilwe ngelitye lokusila, ukhozo lulonke lwenziwa lube ngumgubo ongwevu

25. Umbona …

A. ☐ (1) sisondlo somhlaba.
B. ☐ (2) wenziwe ngamagqabi aluhlaza.
C. ☐ (3) sisityalo esivelisa ukutya.
E. ☐ (4) uvunwa kanye kwiminyaka emibini.

26. Kuthatha iinyanga ezingaphi ukuze umbona ulungele ukuvunwa?

A. ☐ (1) 12 iinyanga
B. ☐ (2) 9 iinyanga
C. ☐ (3) 6 iinyanga
D. ☐ (4) 3 iinyanga

27. Kutheni lento umbona eMalawi utyalwa phambi kokuba kufike iimvula?

A. ☐ (1) abasebenzi abafuni ukunethwa xa besebenza.
B. ☐ (2) umbona uthatha izondlo ezisemhlabeni ezininzi.
C. ☐ (3) umbona ufuna amanzi ukuze ukhule.
E. ☐ (4) umbona awufuni manzi ukuze ukhule.

28. Umbona unamagqabi aluhlaza kuba…

A. ☐ (1) uvelisa amakhatshu, umgubo omhlophe nongwevu.
B. ☐ (2) ufumana izondlo ezisemhlabeni, ilanga namanzi.
C. ☐ (3) amagqabi akatshiswa lilanga.
E. ☐ (4) awufumani manzi oneleyo.

29. Xa umbona uthe wagutywa, uvelisa…

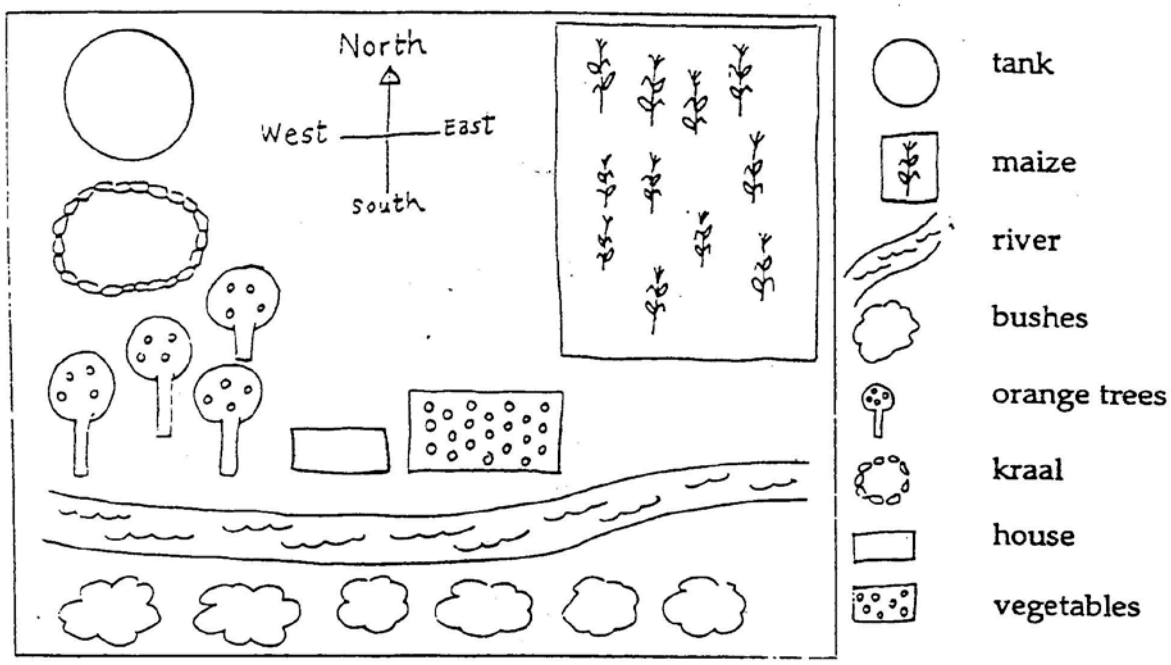
A. ☐ (1) umgubo omhlophe nongwevu.
B. ☐ (2) umgubo ongwevu namakhatshu.
C. ☐ (3) umgubo omhlophe namakhatshu.
D. ☐ (4) umgubo ongwevu nezikhwebu.

30. Umgubo ongwevu uveliswa ngokuguba …

A. ☐ (1) ukhozo lulonke lombona.
B. ☐ (2) iqokobhe lokhozo lombona.
C. ☐ (3) umphakathi wokhozo lombona.
E. ☐ (4) ukhozo lulonke.

Jongisisa iMap yefama ka Mnu Makalima uze unike inkcazelo ngayo ngokuba ugcwalise izikhewu ezikulomhlathi

Ifama ka Mnu Makalima



UMnu Makalima unefama encinci enezinto ezininzi. Indlu yakhe isecaleni ko(16) …….. omncinci apho afumana khona amanzi. Amanzi lawo athi ampontshelwe kwi(17)……. .elikhulu lokugcina elenziwe ngesamente emntla ntshona yekona yefama yakhe.Ecaleni kwalapho wokhe u(18)……. .benkomo zakhe.Utyale u (19)…….kwimpuma yefama yakhe. Utyale ne (20)…….. kwigadi yakhe esecaleni kwendlu esenzela usapho lwakhe nabasebenzi.Kwelinye icala lendlu yakhe utyale imithi yeziqhamo ye(21)…….Inengeniso ifama yakhe ngaphandle nje kwengxaki yeenkawu ezihlala kwi(22)…….elikwelinye icala lomlambo. Ezi nkawu zithi zimoshe izityalo zakhe nemithi.

B. UVAVANYO LOKUMAMELA

Utitshala wakho uzakufundela ibali.Limamelisise elibali, uze uphendulo imibuzo engezantsi.

UZAKULIFUNDELWA KANYE KUPHELA ELI BALI.

Uvumelekile ukuba ujonge imibuzo kuqala phambi kokuba ufundelwe elibali.Mamelisisa elibali uze ubeke √)itick(kwibhokisi esecaleni kwempendulo oyikhethileyo.

6. Uhambe nini uThemba endlwini yakhe?

A. ☐ (1) 06:00
B. ☐ (2) 11:00
C. ☐ (3) 03:00
E. ☐ (4) 09:00

7. Kwakutheni uThemba aze ahambe ngenye yeedonki zakhe ?

A. ☐ (1) Kuba wayekhangela idonki yakhe yesithandathu.
B. ☐ (2) Ukuze ase iidonki zakhe emarikeni.
C. ☐ (3) Ukuze abale iidonki ezikhoyo.
E. ☐ (4) Kuba wayekhathele ukuhamba ngeenyawo.

8. Kwakutheni uThemba angayifumani idonki yesithandathu?

A. ☐ (1) Yayibalekile.
B. ☐ (2) Yayikumhlobo wakhe.
C. ☐ (3) Kuba iidonki zazintlanu kuphela.
E. ☐ (4) Kuba wayekhwele yona.

9. Umhlobo kaThemba wa…… …sesisenzo

A. ☐ (1) mangaliswa.
B. ☐ (2) dana.
C. ☐ (3) hlekiswa.
D. ☐ (4) banomsindo.

10. UThemba ubizwe ngokuba yidonki ngumhlobo wakhe kuba …

A. ☐ (1) wayekrelekrele.

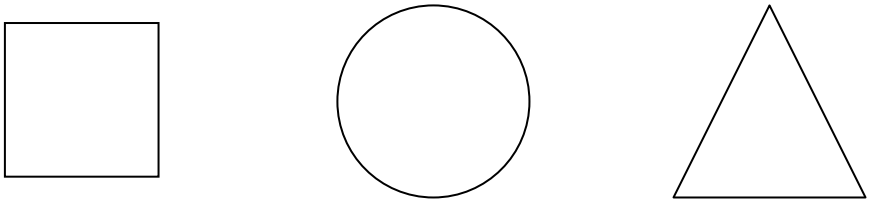
B. ☐ (2) wayesisidenge.

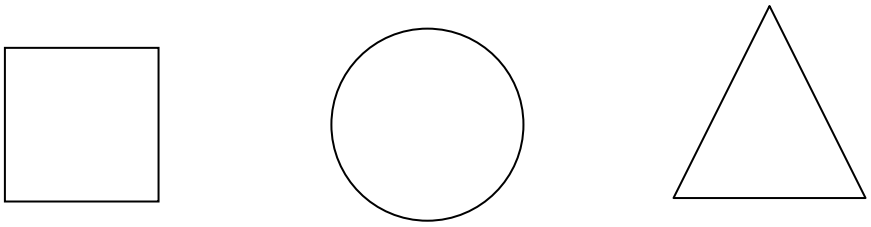
C. ☐ (3) wayengxamile.

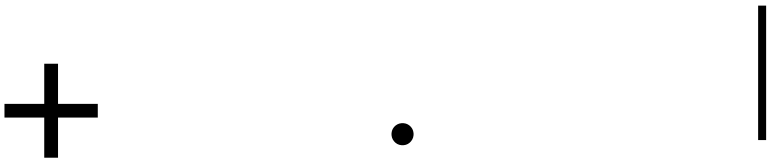
F. ☐ (4) wayeyidonki.

Utitshala wakho uzakufundela imiyayelo.Yimamelisise uze uyilandele.

LE MIYALELO IZAKUFUNDWA KANYE KUPHELA.

6. 

7. 

8. 

9. A. ☐ (1) ……..

B. ☐ (2) …….

C. ☐ (3) ……..

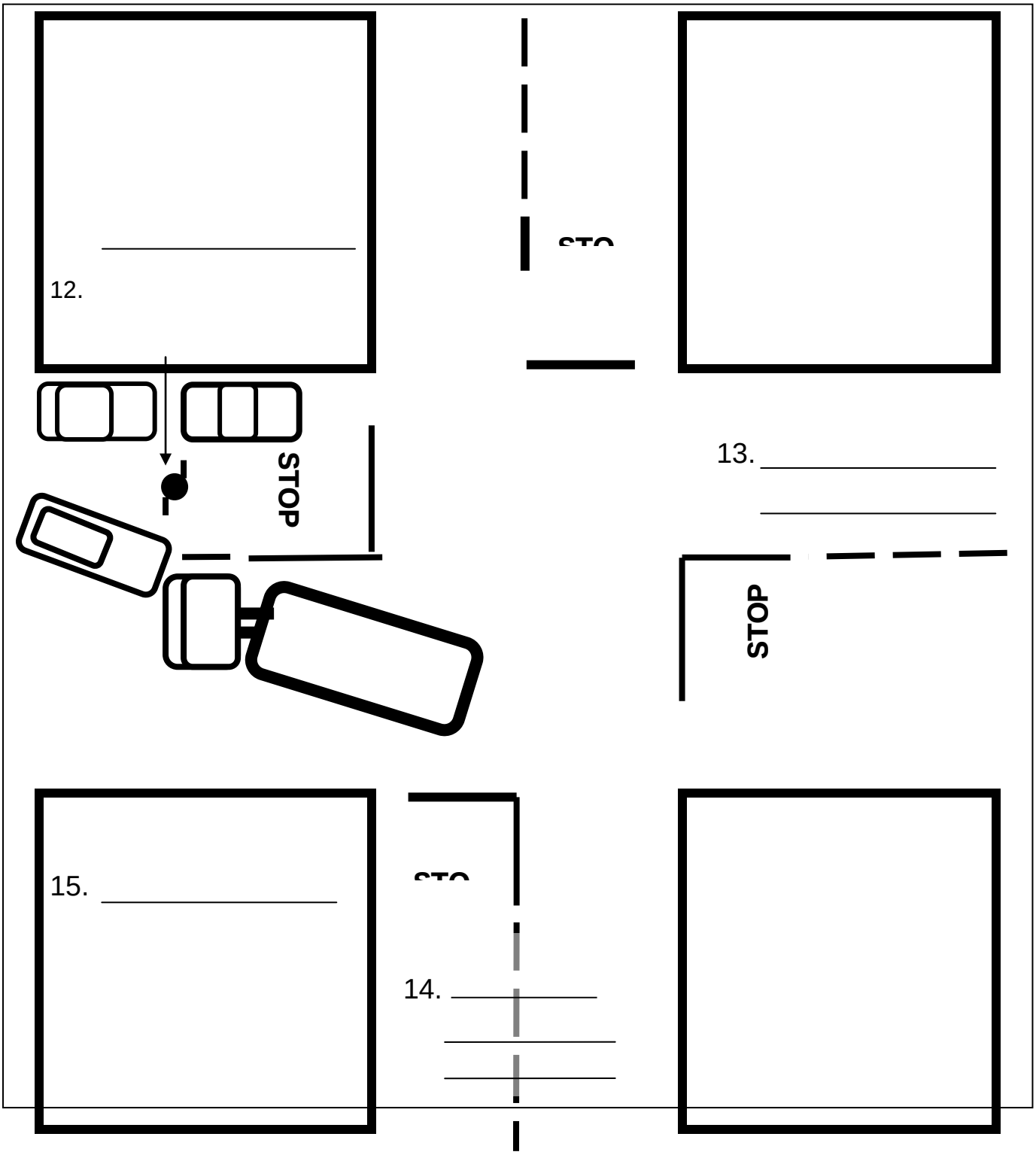
G. ☐ (4) …….

10.

11.

Kulo umbuzo bhala iimpendulo zakho kule “Map” uyinikiweyo ngezantsi. UThami kufuneke ezobe I”Map” yentlekele ewayeyibukele.Uzizobile izitalato kunye nezindlu kodwa akakwazi ukubhala amagama azo.

Ngoko ke ,jongisisa I”Map” engezantsi uze umamelisise kuThami ukuze wena ubhale amagama ezitalato nezindlu.



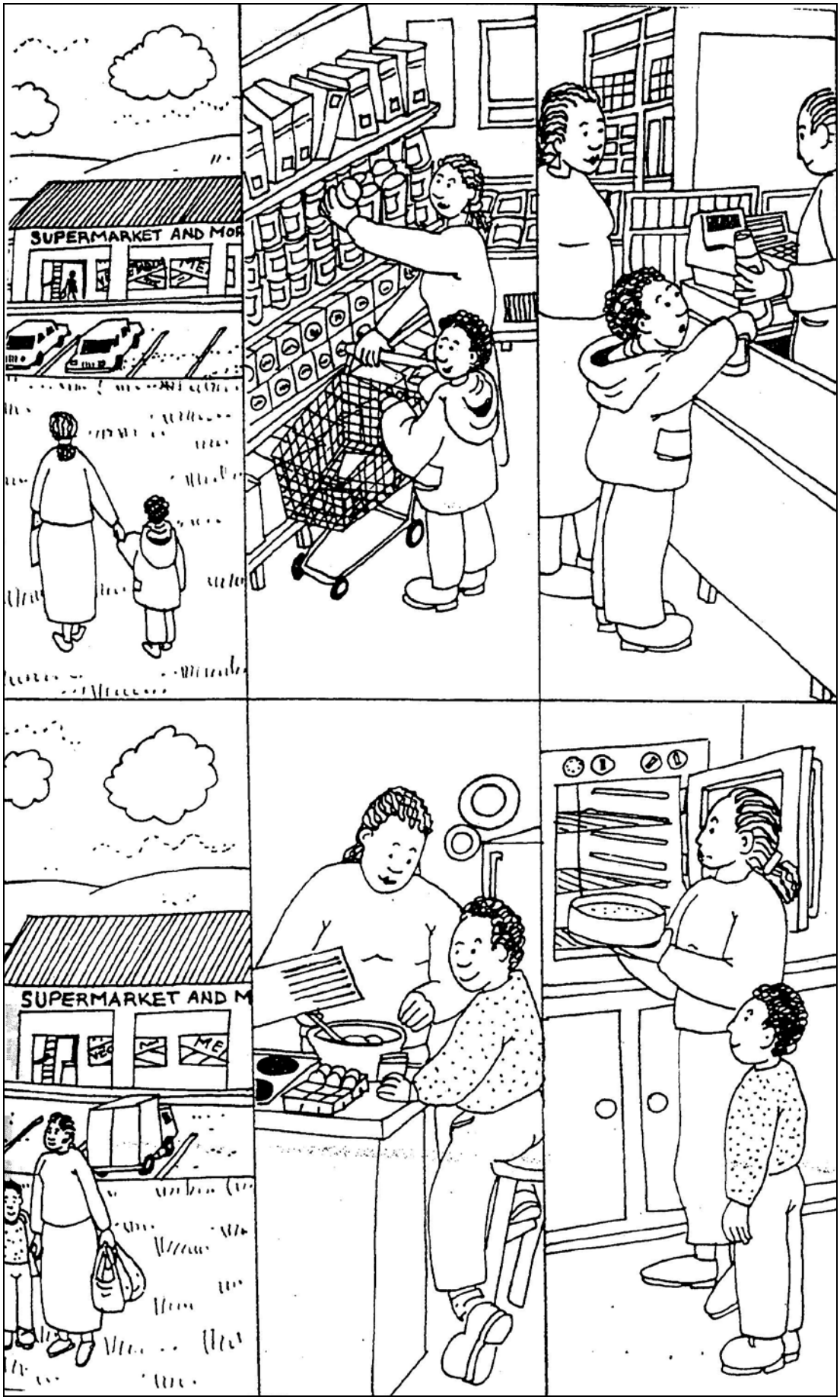
Mamela inkcazelo ezokufundwa ngutitshala, uze ugcwalise lonkcazelo akufundele yona kwizikhewu ezikule "table" ingezantsi.

	Apho bahlala khona	**Apho basebenza khona**	**Bangaphi abantwana babo**
Nosisi	15.	*Ebhankini*	16.
Thabo	17.	18.	19.
Zanele	20.	21.	22.

C. UVAVANYO LOKUBHALA

Kwiphepha elilandelayo kukho umfanekiso webali. Lo mfanekiso webali unemifanekiso emithandathu.

Bhala ibali ngokubonayo kwimifanekiso kwizikhewu ezingezantsi: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APPENDIX C

LISTENING TEXTS

Question 1

Themba left his house in the early morning with six donkeys. He was on his way to the market place to sell them. After a while he became tired and climbed onto one of his donkeys.

As he was riding, he started to count his donkeys. “One, two, three, four, five… Now where is the sixth donkey?”

He climbed down and counted again, and there were six donkeys. He climbed up again and started his journey. After a while he counted his donkeys again. There were only five.

A friend passed by and Themba told him about his problem. “A while ago there were six donkeys, but then there were only five. Then there were six and now there are only five”.

His friend laughed and said, “There are one, two, three, four, five donkeys , and you are sitting on the sixth donkey. You, yourself are the seventh donkey.”

Question 2

6. For question 6, put the letter K in the triangle
7. For question 7, draw a circle around the square
8. For question 8, draw a line from the plus sign to the full stop
9.For question 9, which line is the longest? Put a tick in the box beside the longest line.
10. For question 10, draw a plus sign on the left of the line
11. For question 11, draw a circle on the right of the line

Question 3

A young man ran out of Africa Bank.

He ran between two cars that were parked in front of the bank into Church Street in front of an on-coming car. Can you write Africa Bank on the building next to the two cars.

A car that was travelling along Church Street towards the Four-Way Stop at the intersection of Church Street and Nelson Mandela Drive saw the young man and swerved to the right in order to avoid hitting him. Can you please write Church Street

on the street on the other side of the four way stop intersection and Nelson Mandela Drive next to number 14.

The car crashed head-on into a truck that had just turned into Church Street in front of the Checkers supermarket. Can you write Checkers on the building next to the truck please.

Question 4

Nosisi and Thabo both live in Alice. Nosisi works at a bank and Thabo works at PEP Stores. Nosisi has three children and Thabo has five children. Zanele has four children and she lives in Cathcart. She is a teacher and works at a school near Cathcart.

LISTENING TEXTS

Umbuzo 1

Ngenye intsasa ,uThemba uvuke waya emarikeni eyokuthengisa iidonki zakhe ezintandathu. Emva kwexesha ehamba nazo iidonki,uzive ediniwe waza wagqiba ukukhwela enye yazo. Uthe esahamba njalo, waqalisa ukuzibala,"nye, mbini, ntathu, ne, ntlanu.' Uthe wamangaliswa akufumanisa ukuba idonki yesithathu akayiboni. Ngokukhawuleza, wehlile kule donki ayikhweleyo, wabala kwakhona. Kwesi sihlandlo ufumanise ukuba ukuba iidonki zintandathu, wazewaqhubeleka nohambo lwakhe. Emva komgama ehambile, uphinde wazibala ezidonki wafumanisa ukuba zintlanu.

Kukwelothuba kanye apho athe wadibana nomhlobo wakhe owayezihambela endleleni waze wambalisela ngengxaki yakhe. Uthe kumhlobo wakhe ' Ndisuke ekhaya needonki ezintandathu, ndathi xa ndisendleleni ndibala ndafumanisa ukuba zintlanu. Ndiphinde ndabala kwakhona ndafumanisa ukuba zintandathu, kodwa ngoku ziphinde zantlanu.

Umhlekile umhlobo wakhe waze wabala naye' nye, mbini, ntathu, ne, ntlanu, eyesithandathu yile uyikhweleyo'. Ugqibezele ngokuxelela uThemba ukuba uyidonki yesixhenxe.

Umbuzo 2.

6. Kumbuzo we6, beka u 'K' kunxantathu
7. Kumbuzo we7, zoba isangqa esijikeleze isikrwere
8. Kumbuzo wesibhozo, zoba umgca osuka kuphawu olungudibanisa uyokutsho kwisiphumliso.
9.Kumbuzo wethoba: Ngowuphi umgca omde? Beka itick(√) kwibhokisi esecaleni komgca omd.
10. Kumbuzo weshumi: Zoba uphawu lukadibanisa ekhohlo lomgca obhaliweyo.
11.Kumbuzo weshumi elinanye, zoba isangqa ekunene komgca obhaliweyo.

Umbuzo 3

Umfana uphume ebaleka eAfrica Bank. Ubalekele phakathi kweemoto ezimbini ezazimise phambi kwebanka, wangena kwisitalato sase Church kwaye ngelolixa kwakusiza imoto ngaphambili.

BHALA IAFRICA BANK KWISAKHIWO ESISECALENI KWEZOMOTO ZIMBINI

Imoto eyayigqitha ngesitalato iChurch isiya kwiStop esinqamleze izitalato iChurch ne Nelson Mandela Drive iye yambona umfana lowo yaze yajikela amavili emoto ngasekunene ukuze ingamgili.

BHALA UCHURCH STALATO KWELINYE ICALA LENDLELA ENQAMLEZILEYO.
BHALA UNELSON MANDELA DRIVE ECALENI KUKA NAMBA14.

Imoto leyo ithe yangquzulana netrakhi eyayisandul'ukungena esitalatweni sase Church phambi kwevenkile yakwaCheckers.

BHALA UCHECKERS KWISAKHIWO ESISECALENI KWETRAKHI.

Umbuzo 4

Unosisi noThabo bahlala eAlice. UNosisi usebenza ebhankini ,yena uThabo evenkileni yakwaPep.Bathathu abantwana bakaNosisi, bona abakaThabo bahlanu. UZanele ohlala ecthcarth unabantwana abane, kwaye ungutitshalakazi osebenza kwisikolo esikufuphi ne Cathcart.

APPENDIX D

SPEAKING ASSESSMENT

Focus group of five learners. Two assessors – one to ask the questions and the other to assess.

Speaking task (30 minutes)

Greeting and introductions:

Hello. I am Nokhanyo. What is your name? Where do you live? How old are you? And your name? etc.

Introducing the Discussion:

I have two things here, a small cork and a feather. If I drop them at the same time from the same height (1m), *which one of them will hit the ground first and why?*

Yes Thandi? …….. but why do you think that the cork will hit the ground first? And you Sipho? What do you think? Etc. etc.

OK let us try it. Watch to see what happens. (You drop the objects)

Developing the discussion.

So the cork hit the ground first and you say it is because it is heavier than the feather. Now let us try to drop a big cork and a small lighter cork at the same time from the same height. Which one will hot the ground first? Yes, Nomsa ……. Etc. etc.

Now let us see what happens – Drop both corks – they should hit the ground at the same time.

As you can see, it is not the weight of the object that makes it fall faster or slower? So we are back to the same question, why did the cork hit the ground before the feather?

Continue the discussion.

Now, if we put the cork and the feather in this glass tube and we sucked all of the air out of the tube, which will fall faster?

Continue the discussion.

APPENDIX E

CLASSROOM OBSERVATION SCHEDULE – Literacy

School Name: ..... Province: .....

Teacher Name: ... . Gender: .....Qualifications: .....

Grade Level:..... ….. Number of learners: .....

Observer Name: ..... …….. Date of observation:……...

Component 1: Use of Language by the teacher(asking questions, teaching, giving feedback, explanation of terms and concepts, etc)			
4 Teacher uses English only.	3 Teacher uses English and switch to home language when necessary.	2 Teacher discourages use of home language even when learners do not seem to understand.	1 Uses home language only.
Description:.....			
Component 2: Use of language by learners(asking questions for clarity etc)			
4 Leaners use English fluently.	3 Learners use English but switch to home language .	2 Learners seldom use English.	1 Learners use home language only
Description:.....			
Component 3: Teacher implementation of scientific literacy strategy (Posing or letting learners pose an investigable question, Guiding learners towards: prediction, procedure, results, conclusion and doing the line of learning).			
4 Teacher demonstrates clear understanding of the scientific literacy strategy .	3 Teacher demonstrates adequate understanding of the scientific literacy strategy	2 Teacher demonstrates partial understanding of the scientific literacy strategy .	1 Teacher demonstrates inadequate understanding of the scientific literacy strategy.
Description:.....			

Component 4: Listening (teacher provides adequate opportunities for listening activities)			
4 Learners are given an opportunity to demonstrate their listening skill	3 Learners are given an opportunity to demonstrate their listening skill to a reasonably extent	2 Learners are given an opportunity to demonstrate their listening skill to a limited extent	1 No listening opportunities given
Description:			
Component 5: Speaking(teachers provide opportunities for speaking activities)			
4 Learners are given an opportunity to discuss and share their ideas with the rest of the class	3 Learners discuss and share ideas with the rest of the class to a reasonably extent	2 Learners struggle to discuss and share ideas with the rest of the class	1 Learners do not discuss nor speak in their groups
Description:			
Component 6: Learner Writing with Science Notebooks			
4 Learners write effectively to record findings and enhance their learning	3 Learners write to record their findings but the text is so simplified that it does not enhance their learning	2 Learners write ineffectively – reveals only incoherent findings	1 Learners do not write at all
Description:			
Component 6: Learner Reading			
4 Learners read effectively from written text to enhance their learning	3 Learners read from written text with limited effect on their learning	2 Learners struggle to read from written text with limited to no effect on their learning	1 Learners do not read at all
Description:			

APPENDIX F

ASSESSMENT RUBRIC FOR SPEAKING

	1 ELEMENTARY	2 THRESHOLD	3 LOWER INTERMEDIATE	4 UPPER INTERMEDIATE	5 ADVANCED
Contribution to the discussion	Little or no contribution	Only partial contribution	Contributes meaningfully some of the time	Contributes meaningfully most of the time	Complete and enthusiastic interaction & participation
Fluency of speech	Not fluent. A lot of hesitation and/or repetition.	Partially fluent with a high frequency of hesitation and repetition.	Reasonably fluent with a fair amount of hesitation or repetition	Mostly fluent with only some hesitation or repetition	Completely fluent with not hesitation or repetition
Clarity of communication	Not clear or audible at all.	Partially clear and audible.	Reasonably clear and audible.	Clear and audible.	Completely clear and audible.
Comprehensibility of information provided by learners	Barely comprehensible – listener can barely understand	Partially comprehensible – difficult to understand the meaning	Reasonably comprehensible, but a fair amount of statements not clearly understandable.	Comprehensible, with only some statements not clearly understandable	Completely comprehensible.
Communication skill/confidence exhibited	Not at all confident – hardly establishes eye contact at all.	Partially confident, only establishes eye contact one or twice.	Reasonably confident – establishes, but maintains eye contact some of the time.	Confident – maintains eye contact most of the time.	Confident – maintains eye contact all of the time.
Appropriateness of language use	Language use is not appropriate to the communicative context.	Language use is partially appropriate to the communicative context.	Language use is reasonably appropriate to the communicative context.	Language use is mostly appropriate to the communicative context.	Language use is completely appropriate to the communicative context.
Turn taking	Does not follow turn-taking conventions.	Follows turn-taking conventions to a very limited extent.	Follows turn-taking conventions to a reasonable extent.	Follows turn-taking conventions to a large extent.	Follows turn-taking conventions completely.
Use of home language / code switching	Uses home language frequently.	Uses home language to a large extent	Uses home language to a reasonably limited extent.	Only uses home language on one or two occasions.	Does not use home language at all.
Grammatical error	A high frequency of errors	A reasonably high frequency of errors.	A reasonably limited degree of error	Very few errors	Only one or two errors.
Pronunciation error	A high frequency of errors that contribute to incomprehensibility of information communicated.	A reasonably high frequency of errors that result in partial incomprehensibility.	A reasonably limited degree of error that does not affect comprehensibility.	Very few errors that do not affect comprehensibility.	Only one or two errors that do not affect comprehensibility.

APPENDIX G

INTERVIEW QUESTIONS

TEACHERS

1. Which language do you use to support communication in your classroom and why?
2. Which language do you think makes learners understand the scientific literacy strategy and why?
3. Do you provide learners with opportunities to speak, read, write and listen when you teach? How?
4. Which language do you mostly use to teach during your science lessons? Why?

LEARNERS

1. Which language do you use to communicate in your classroom?
2. Which language makes you understand when your teacher uses the scientific literacy strategy? Why?
3. Does your teacher provide you with an opportunity to read, write, speak and listen during your science lessons/
4. Which language do you prefer to be taught science with? Why?

APPENDIX H

LANGUAGE SURVEY FORM

Conduct a survey at your school in order to find out the information needed to complete the tables below:

Total number of learners at the school	
Total number of languages spoken at the school	
Languages of learning in the school	
Languages used most frequently in the classroom	
Grade at which other languages are introduced	
Grade at which other languages are introduced as languages of learning	
Languages used for assessment in the school	

Home languages of educators and learners:

LANGUAGE	NUMBER OF EDUCATORS THAT SPEAK THE LANGUAGE	NUMBER OF LEARNERS THAT SPEAK THE LANGUAGE