SCIENCE TEACHING AND LEARNING THROUGH THE MEDIUM OF ENGLISH AND ISIXHOSA: A COMPARATIVE STUDY IN TWO PRIMARY SCHOOLS IN THE WESTERN CAPE

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A thesis submitted in fulfillment of the requirements for the degree of Doctor of Philosophy in the Faculty of Education, University of the Western Cape.

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DEDICATION

This thesis is dedicated to my late parents, Mpulana and Dlamini. Thanks for your love, care and guidance.

ABSTRACT

This thesis compares science teaching and learning in English and isiXhosa in the Intermediate Phase (Grades 4 – 6) in two primary schools in the Western Cape. It explores the effects of using learners' home language (isiXhosa) and second language (English) as languages of learning and teaching science. The study is part of a broader project called the Language of Instruction in Tanzania and South Africa (LOITASA). The LOITASA Project is a North-South-South link between Norway, South Africa and Tanzania which examines the effects of using African languages, isiXhosa and Kiswahili as languages of instruction in education.

This study is conceived against the background of English as a means of social, economic and educational advancement, and the marginalization of African languages in education. It explores the various language policies which influence the hegemony of English on the African continent, with special reference to South Africa.

Following an interactionist theoretical framework, this study investigated the relationship between language competence and teacher-learner interaction in science when English or isiXhosa were used as languages of instruction in the Intermediate Phase. It shows the importance of appropriate language input in facilitating teaching and learning in the classroom. The research followed a three year longitudinal design in which classroom observations, interviews and document analysis were used as key tools of investigation.

The research findings show that teachers and learners communicate better in their mother tongue, isiXhosa, than in English. Also, learners show better confidence in lessons conducted through the medium of isiXhosa than their counterparts taught through the medium of English.

From the results of the study, it is concluded that there is a positive correlation between the use of the learner's mother tongue as a medium of instruction and learners' conceptual development and academic performance in science. The study concludes with a recommendation that teacher development is necessary if African languages are going to compete with English as media of instruction in 21st century classrooms.

DECLARATION

I declare that **SCIENCE TEACHING AND LEARNING THROUGH THE MEDIUM OF ENGLISH AND ISIXHOSA: A COMPARATIVE STUDY IN TWO PRIMARY SCHOOLS IN THE WESTERN CAPE** is my own work, that it has not been submitted for any degree or examination in any other university, and that all sources I have used or quoted have been indicated and acknowledged by complete references.

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LIST OF ABBREVIATIONS

ATM	Automatic Teller Machine
BICS	Basic Interpersonal Communication Skills
CALP	Cognitive Academic Language Proficiency
CSEE	Certificate of Secondary Education Examination
DACST	Department of Arts, Culture and Technology
DEIC	Dutch East India Company
DET	Department of Education and Training
EFA	Education For All
FLA	First language Acquisition
GEAR	Growth, Employment and Redistribution
H	High status variety
IMF	International Monetory Fund
IKS	Indigenous Knowledge System
IL	Interlanguage
IRF	Initiate-Respond-Feedback
MTE	Mother Tongue Education
L	Low status variety
L1	First Language
L2	Second Language
LAD	Language Acquisition Device
LOITASA	Language of Instruction in Tanzania and South Africa
NEPI	National Education Policy Investigation
NGO	Non-governmental Organization
NOS	Nature of Science
OBE	Outcomes-Based Education
PanSALB	Pan South African Language Board
PGCE	Post Graduate Certificate in Education
PLC	Provincial Language Committee
PTC	Primary Teachers' Certificate

PRAESA	Project for the Study of Alternative Education in South Africa
RDP	Reconstruction and Development Programme
RNCS	Revised National Curriculum Statement
RSA	Republic of South Africa
SASL	South African Sign Language
SLA	Second Language Acquisition
STD	Senior Teachers' Diploma
SYPP	Six Year Primary Project
TL	Target Language
UNESCO	United Nations Educational, Scientific and Cultural Organization
UG	Universal Grammar
UWC	University of the Western Cape
WCED	Western Cape Education Department
WTO	World Trade Organization

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CHAPTER 1

CONTEXT AND PROBLEM

1.1 Introduction

The new South Africa was conceived in the spirit of democracy and equality for all its citizens. As a result, the changes that have been effected since its birth in 1994 are efforts to achieve unity, democracy and equality within the different sectors of the government (e.g. education, justice, health, etc.). In education specifically, the introduction of Outcomes-Based Education (OBE)[1] and the release of the Language-in-Education Policy in 1997 were efforts to redress the imbalances that occurred as a result of the apartheid education system. For instance, OBE aims at providing quality education to all South African children while the language-in-education policy promotes additive bi/multilingualism which implies the maintenance of mother tongue(s) while learning additional language(s).

After a decade of democracy, however, there are still problems that interfere with the implementation process of the new policies. For instance, with regard to medium of instruction, in spite of the fact that there are nine African languages that have official status, English is still in practice the dominant language in education. African languages, despite their official status, are still not used as languages of instruction beyond Grade 3 in black[2] schools, while English and Afrikaans are used as languages of teaching and learning from the first grade of schooling to university level.

In the light of the above brief background on policy implementation, the aim of this study is to explore the use of English and isiXhosa[3] as media of instruction in the Intermediate

[1] Outcomes-Based Education (OBE) is the basis for curriculum transformation in South Africa which was established in 1994. It encourages learner-centred and activity-based approach to education.
[2] In the context of this study the term "black" refers to all learners/people who are mother tongue speakers of African languages (e.g. isiXhosa). It will be used interchangeably with "African" throughout this study.
[3] IsiXhosa is one of the nine African languages accorded official status by the new South African language policy. It has the second highest number of mother tongue speakers, following isiZulu.

Phase (Grades 4 – 6) at two schools in the Western Cape. Actually, the study compares the teaching and learning process in science when conducted in the two languages (English and isiXhosa) with isiXhosa speaking learners. In other words, the study focuses partly on language-in-education policy implementation in schools, and on pedagogical practices in science when both an African language (isiXhosa) and English are used as media of instruction.

In this chapter I provide a brief background on the conception of this study by referring to the Language of Instruction in Tanzania and South Africa (LOITASA) Project to which this study is attached. My discussion reflects the research problem that is being investigated by this study, with the research questions that guide the research process. The chapter also highlights the rationale and objectives of the study in relation to teaching and learning on the one hand, and the debates around the current Language-in-Education Policy on the other hand. The chapter also introduces the structure of the study by outlining the contents of each chapter.

1.2 The Language of Instruction in Tanzania and South Africa (LOITASA) Project

A brief description of the Language of Instruction in Tanzania and South Africa (LOITASA) project is necessary in order to give a broader picture of how the present study was conceived. The LOITASA Project was launched in 2002 as a North-South-South link between three countries, namely, Norway (North), Tanzania (South) and South Africa (South). In South Africa the project is based in the Faculty of Education at the University of the Western Cape, whilst in Tanzania it operates in the Faculty of Education at the University of Dar es Salaam. As the name of the project implies, the overall aim of the project is to explore the use of African languages (Kiswahili and isiXhosa) as media of instruction in Tanzania (Kiswahili) and South Africa (isiXhosa).

In Tanzania, Kiswahili is used as a medium of instruction at primary school level, whilst isiXhosa is used as a medium of instruction until the end of the third grade in South

Africa. The initial plan of the LOITASA project was to use Kiswahili as a medium of instruction in some subjects at secondary school level, while isiXhosa would be used as a medium of instruction for three years after Grade 3. It was for this reason that Grade 4 was chosen as a starting point for the project in South Africa.

The LOITASA Project followed a three year longitudinal research design, from Grade 4 to Grade 6 in South Africa. It adopted the experimental research design of the Six Year Primary School Project (SYPP) that was conducted in Ife Province in Nigeria in the 1970s (Bamgbose, 2005). The SYPP made use of the learners' mother tongue, Yoruba, to teach mathematics, science and social studies in Nigerian primary schools. English was used as a medium of instruction in the control classes. The results of the SYPP showed that children performed better in their mother tongue than in English. Moreover, the delayed switch to English medium of instruction led to greater proficiency in English, and better understanding of mathematics and science concepts. Follow-up longitudinal studies also showed that the learners who had six years of mother tongue education coped better at the secondary and tertiary levels (Bamgbose, 2005; Desai, 2004).

The South African part of the LOITASA Project started in two primary schools in 2003 with Grade 4 teachers and learners. Details on how the schools and research subjects were selected are given in Chapter 5. In each school there was an experimental group which was taught in isiXhosa, and a control group which was taught in English. The project focused on two learning areas or subjects: Natural Sciences and Geography. Desai (2004:120-121) gives reasons for the choice of the experimental design (instead of dual medium of instruction in English and isiXhosa) in conducting the LOITASA Project which I summarise below:

1. Teachers' low level of proficiency in English.
2. An effort to change people's negative attitudes towards isiXhosa as a medium of instruction.
3. Developing isiXhosa as a language which would lead to the development of terminology in isiXhosa.

4. Separating the learning of English as a subject, and the learning of Science and Geography.

One of the challenges of using isiXhosa to teach Geography and Science was the lack of teaching and learning materials in these two subjects. With the help of Skoolcor, a company that produces school materials for all the subjects in English and Afrikaans, Grade 4 Geography and Science materials (written in English) were purchased. They were then translated into isiXhosa, and I was responsible for editing the science material, while a colleague from the Xhosa Department edited the Geography materials. The materials were based on the new outcomes-based education curriculum, and were divided into modules that were learner-friendly and cost-effective (Desai, 2004).

The above description of the LOITASA Project should be seen as an overall framework on which the present study is based. Although the LOITASA Project has determined the research design and duration of this study to some extent, the research activities and literature have been gathered by the researcher to suit the purpose and design of the present study. Therefore, this study took into account the overall aim of the LOITASA Project, while addressing the research problem which is within the scope of this study. All the following discussions refer to the present study, and any reference to the overall LOITASA Project will be explained.

1.3 Background to the study

The birth of democracy in South Africa in 1994 meant that many changes had to be implemented in various spheres of the government in order to redress the imbalances of the apartheid government. The Constitution of the Republic of South Africa (1996) acknowledges the richness of diversity in South Africa, and it was then adopted as a vision and determination to:

- Heal the divisions of the past and establish a society based on democratic values, social justice and fundamental human rights…
- Improve the quality of life of all citizens and free the potential of each person… (RSA Constitution, 1996:1).

The implication of the above is that changes had to be effected in various sectors of the government such as education, health, justice, and many others. To accommodate linguistic and cultural diversity, the RSA Constitution (1996:3) conferred official status on eleven languages, nine of which are African languages (Sepedi, Sesotho, Setswana, siSwati, Tshivenda, Xitsonga, isiNdebele, isiXhosa and isiZulu). The other two languages, namely Afrikaans and English were the only official languages during the apartheid era. The constitution, therefore, aimed at elevating the status of the previously marginalized languages by making use of them in formal and official domains such as education, health, law, and others.

In line with the new constitution, the Language-in-Education Policy (1997) was adopted to bring about language changes in education. The current South African Language-in-Education Policy sets out to redress the discriminatory policies of the past that had affected either the learners' access to education or their success in it. In other words, it aims at building a non-racial South Africa by recognizing, respecting and strengthening linguistic and cultural diversity.

The following are the aims of the current South African Language-in-Education Policy:

4.3.1 to promote full participation in society and the economy through equitable and meaningful access to education;
4.3.2 to pursue the language policy most supportive of general conceptual growth among learners, and hence to establish additive multilingualism as an approach to language in education;
4.3.3 to promote and develop all the official languages;
4.3.4 to support the teaching and learning of all other languages required by learners or used by communities in South Africa, including languages used for religious purposes, languages which are important for international trade and communication, and South African Sign Language, as well as Alternative and Augmentative Communication;
4.3.5 to counter disadvantages resulting from different kinds of mismatches between home languages and languages of learning and teaching;
4.3.6 to develop programmes for the redress of previously disadvantaged languages.
(National Department of Education, Language-in-Education Policy, 1997:4-5).

The aims of the policy that are stated above correspond with the norms and standards that were published in terms of section 6(1) of the South African Schools Act of 1996. The norms and standards recognize diversity as a valuable asset, and they aim at:

5.1.1.1.1 protecting, promoting, fulfilling and extending individuals' language rights and means of communication in education;
5.1.1.1.2 facilitating national and international communication through promotion of bi- or multilingualism through cost-efficient and effective mechanisms;
5.1.1.1.3 redressing the neglect of the historically disadvantaged languages in school education

(National Department of Education, Language-in-Education Policy, 1997:6-7).

To accommodate the "Rainbow Nation"[4] of South Africa, the new Language-in-Education Policy encourages additive multilingualism (aim 4.3.2) and multiculturalism. Through multilingualism and multiculturalism, people are encouraged to respect, appreciate and learn about one another's languages and cultures. But it is disappointing to notice that despite all the efforts done to accommodate linguistic and cultural diversity, some South African languages and ethnic groups are still marginalized in education.

It is worth mentioning that there are efforts made to develop the previously disadvantaged languages in the media and other sectors of life (health, justice, etc.) through the establishment of the Pan South African Language Board (PanSALB) and the Provincial Language Committees (PLCs). These language committees are trying to redress the imbalances of the past despite certain language attitudes associated with the history of our country. The only problem lies with the implementation of the new language policies on the ground. The reality is that English still occupies the highest status in South African education. African languages do not have high prestige educationally, and this is in contradiction to Aim 4.3.3 of the new Language-in-Education policy – "to promote and develop all official languages" (National Department of Education: Language-in-Education Policy, 1997:4).

[4] The Rainbow Nation refers to the South African nation which is diverse in terms of race, language, culture and religion. It is an inclusive term that was coined after 1994.

There has also been transformation in education with the introduction of the new curriculum (Curriculum 2005 and Outcomes-Based Education and its revised form, the Revised National Curriculum Statement – RNCS, 2002). The introduction of outcomes-based education (OBE) aimed at providing quality education to all South African children, irrespective of race. All these developments can be seen as wonderful opportunities towards the spirit of "Education for all" and "African Renaissance[5]".

Although the RSA Constitution (1996:11) states: "everyone has the right to receive education in the official language or languages of their choice in public educational institutions where that education is reasonably practicable", there seem to be negative attitudes towards the use of African languages as languages of learning and teaching in schools. The current attitudes towards African languages can be attributed to a number of factors that have to do with the inequalities of the apartheid system. One of the factors is related to the high status that was given to English and Afrikaans as languages of socio-economic mobility during the apartheid regime.

Secondly, the implementation of Bantu education[6] by the apartheid government which aimed at providing low quality education to African learners created an impression for many African people that learning through their languages was a means of blocking their access to socio-economic advancement (Cluver, 1992; Benjamin, 1994; Maake, 1994; Verhoef, 1998). As Bantu Education was associated with poor or inferior education, the use of African languages in education is also perceived as providing low quality education. That is, mother tongue education was and still is not perceived as a valuable democratic asset by the majority of African people, but as a means of denying them access to social, economic and international advancement (De Klerk, 2000:199). English is still perceived as the only language for good education and socio-economic mobility.

[5] With the birth of democracy in 1994, the government tried to redress the imbalances of the past so that all South African learners could get equal access to education, and schools were opened to everyone irrespective of race or religion. The new democracy also came with a spirit of regaining pride in things African – African Rennaissance

[6] Bantu Education perpetuated racial inequality, and it was aimed at providing African learners with poor quality education. However, one of the positive aspects of Bantu Education was providing mother tongue education for the first years of schooling. Bantu Education is discussed in more detail in Chapter 2.

Hence the majority of middle class African parents who can afford high fees often send their children to schools where they are taught through the English medium.

It appears that the hegemony of English prevails throughout the world, especially in so called Anglophone African countries. In Tanzania, for instance, Mazrui (2002:269) has noted that despite the country's progress in using Kiswahili in primary schools, there is still a reluctance to proceed further with Kiswahili at secondary school level and beyond. Mushi (1996:136) claims that English is not used by Tanzanians in their daily activities, but it is learned for academic and business advancement. Likewise, Banda (1996:111) points out that English enjoys high status in Zambia, and it was declared a medium of instruction in the late 1960s. As a result, some Zambian languages that were used as languages of learning and teaching then were given a lower status, and were made optional subjects in some schools' curricula. In South Africa, although the new language policy elevated the nine African languages by giving them official status, English still dominates in official domains such as education.

Research conducted in many countries shows that non-native speakers of English (both teachers and learners) experience problems in the English classroom such as the following:

1) Few teachers are trained well enough in English to help students master the language.
2) There is little or no reinforcement of English outside of school.
3) Students are unable to understand the language of instruction if it is English.
4) Dropout rates and failure rates are high (Holmarsdottir, 2005; Galabawa & Lwaitama, 2005; O-saki, 2005).

Research studies conducted in South Africa, in particular, also show that African learners are disadvantaged educationally as they struggle to learn through the medium of a second language (English). Due to insufficient exposure to English and support from home, these learners struggle to grasp the content of subjects taught through the English medium, and this affects their academic performance adversely (Heugh, 2003; Desai,

2001; McKay & Chick, 2001; Webb, 1999; Adams, 1996; De Klerk, 1996; Sentson, 1994). The results of such practices usually manifest themselves in Grade 12 results where Afrikaans and English medium schools usually obtain better results than African schools where the learners are not educated in their mother tongue. For example, the Grade 12 results of 2005 and 2006 in the Western Cape reflect that the first top twenty schools are ex-model C[7] schools where the medium of instruction is either English or Afrikaans (Western Cape Department of Education; Cape Argus, 30 December, 2005).

Based on the findings of research studies on the performance of children in foreign languages (e.g. English), many linguists have suggested that mother tongue education in African languages is not only a means of developing these languages, but also a means of helping the children learn better in languages they know well, thus serving as a foundation for bilingualism (Duquette, 1995; Kamwangamalu, 1998; Skutnabb-Kangas & Garcia, 1995). There are, however, lots of objections to mother tongue education by those who favour foreign languages like English and French. The following are the most common arguments put forward against the use of African languages in education, even in South Africa:

1) Languages like English (and French) are international languages that can relate to the whole world.
2) National unity would be best achieved through the use of foreign languages like English as it is a neutral language.
3) African languages do not have adequate vocabulary.
4) Western technology and scientific knowledge can be acquired through English and technological thought can be expressed adequately through English.
5) It is expensive to produce educational materials and train teachers to undertake education in African languages (Chumbow, 1990; McLaughlin, 1997).

It is interesting to note that all the above arguments support the use of foreign languages only such as English and French in education. The majority of the above arguments are

[7] Model C schools refer to schools which admitted white learners only during the apartheid system and were funded better than African, Coloured and Indian schools. They also had better facilities and resources.

not convincing at all. Firstly, there is no doubt that English is a global language, but it can be learnt successfully as a subject. Some people often think that a language is learnt better if it is used as a medium of instruction at schools, than when it is learnt as a subject. Many developed countries like Norway, the Netherlands, and many others have shown that people can learn through their home languages and learn English effectively as a foreign language. Brock-Utne (2005:170), a Norwegian by birth, supports the view of maintaining one's mother tongue as a medium of instruction while learning English as a subject. She says:

> …we are just four million people but would not dream of not using our own language as a language of instruction. This does not mean that we do not learn English. We learn English quite well, but as a subject, as a foreign language – which it is to us …

Another example of a developed country that makes use of its own language in formal education is Iceland. Iceland is a small country (300 000 inhabitants) with modern technology that is acquired through the local language, Icelandic (Holmarsdottir, 2005).

Secondly, the fact that national unity can be attained through English is a myth. For a multilingual and multicultural country like South Africa, the use of many languages can play a big role in nation building as people recognize and respect one another's languages. For instance, the notion of the "Rainbow Nation and National Unity" in South Africa shows that there is recognition and acknowledgement of unity in diversity.

It is also worth mentioning that the majority of African people in developing countries are not proficient in English. So to talk of English as the only language of national unity among Africans is not practical. Instead English as the only language of national unity can lead to exclusion of the majority of people who cannot speak English from national activities. As people learn to speak different languages, individual multilingualism may result and cross-cultural communication can be developed. In other words, different nations can unite through languages.

Thirdly, in response to the point that African languages lack scientific and technological terminology, Brock-Utne (2005:171) argues that any language can be the language of science and technology if education occurs through a language that people know well.

The implication is that the lack of adequate vocabulary for science and technology should not be put forward to deny African learners access to mother tongue education. African languages can develop their vocabulary, like other languages. This is possible through borrowing from other languages and terminology development for disciplines like Science and Mathematics. English as a language has also borrowed terms from other languages like Latin. China and Japan have advanced technologically, through their own languages (Mazrui, 2002). Technological advancement is also possible with African languages, especially if people can change their mindsets of thinking that everything better is mainly through English.

Financial constraints are always put forward in the implementation of mother tongue education in African languages. That is, many opponents of mother tongue education feel that it is expensive to translate or produce new materials in African languages. Of course, it is true that most of the African states are poor, and such work can cost large amounts of money. But one would think that prioritizing education would be a life investment for such developing countries. If African children can be empowered with knowledge and skills through the language they understand well, it is likely that such skills can be ploughed back to the communities to improve people's lives. As a counter argument to the high costs involved in producing learning materials in African languages, I would like to quote Brock-Utne (2005:179) who says:

> To the argument that it might be expensive to translate or write new learning materials in African languages, one first has to ask about the costs involved in having millions of children going to school and hardly learning anything because the language of instruction is a barrier to acquiring knowledge. What are the costs involved in children dropping out of school, children repeating grade after grade, children sitting passively in class, learning to copy notes but hardly anything else?

In favour of mother tongue education, Pattanayak (1986) connects mother tongue education with socio-cultural benefits for the child, hence he claims that it is a right and a need for every child. In socio-cultural terms, a mother tongue expresses the identity of a human being, and the child is socialized into a system of beliefs and values through the mother tongue (Pattanayak, 1986). Through the mother tongue the child is able to express

her[8] ideas clearly about herself and about the world in which she lives. Mother tongue education, therefore, ensures that the child's educational experiences are rooted and linked with her cultural identity. The implication is that the child's education starts informally at home through exposure to the mother tongue or home language which is rich in cultural values.

In South Africa, efforts are currently being made to redress the linguistic inequalities within the education system. For example, the National Minister of Education, Naledi Pandor (2004), in her budget speech for education mentioned the need to promote South African indigenous languages in schools, thus:

> Language can and has been used as a tool of exclusion in our schools…. Language in education cannot be seen solely as being about English or Afrikaans. The previously marginalized languages of our country require attention and affirmation… This must not be read as an intention to neglect the relevance of acquiring competence in English…. Our endeavour must be to ensure that the future history of indigenous languages, those spoken by the majority of black people in South Africa, those previously neglected and underdeveloped, move from the margins into centre stage in education (Pandor, 2004:9).

Pandor's vision is relevant and appropriate as a means of elevating the status of African languages in South Africa. Although the RSA Constitution elevated the status of nine African languages by making them official languages, the reality is that they are still treated as low status languages in formal education. Not one of the nine African languages is used as a medium of instruction beyond Grade 3, whereas English and Afrikaans are used as languages of learning and teaching from Grade 1 to tertiary education. There is a need to develop the African languages by making them languages of instruction beyond Grade 3, and it can be a fair practice if they are made compulsory additional languages for primary and secondary school learners who are speakers of other languages like English and Afrikaans. Probably, that could lead to their improved status and their development in terms of resources as well. It may be made a prerequisite for acquiring any public office that one commands an African language.

[8] The terms "she/her/herself" are used to refer to both male and female genders in this study in order to maintain gender neutrality and consistency.

Actually, the new South African Language-in-Education Policy promotes additive bi-/multilingualism, which in reality is not achieved because of the current practices that promote English over other languages, especially African languages. As mentioned in the above sections, many African people opt for English medium schools, and neglect their mother tongues. Such a practice usually results in subtractive bilingualism instead of additive bilingualism as the children neglect their home languages when they learn an additional language. For Afrikaans and English speakers, additive bilingualism in African languages is also possible if they can maintain their languages while learning one of the dominant African languages in their respective communities. Therefore, in support of Pandor's statement, African languages need to play a major role as languages of instruction in education in order to develop their status in the formal sectors such as economy, education, law, and others.

1.4 Contextualizing the problem

In the South African context, English is mostly used in urban areas, especially in city centres, for economic purposes. This kind of situation is influenced by the fact that many businesses are still owned by white people who are either English or Afrikaans speakers. Also, the growing informal black market is dominated by immigrants from other African countries (Somalia, Uganda, Nigeria, etc.) who do not know local African languages. So communication occurs mostly in English. But for people living in the townships and rural areas, exposure to English is limited because the majority of people communicate with each other in local languages. In the context of this study, the teachers and learners reside in the townships where communication occurs mostly in isiXhosa. The schools are also located in isiXhosa-speaking communities, and teachers and learners are only exposed to English in the classroom environment.

Lemmer (1996:330) is concerned about the pupils' lack of proficiency in English in South African black schools, especially those who are at the transition phase from mother tongue instruction (Foundation Phase: Grades 1 - 3) to English medium of instruction (start of the Intermediate Phase Grade 4). The accompanying problem in this case is that pupils start five new learning areas in addition to the three learning areas of the

Foundation Phase (Languages, Numeracy and Life Orientation). In addition, the content of seven learning areas (out of eight) is offered in English. At the Foundation Phase the children's English proficiency is still very limited in terms of vocabulary and the transition to English medium of instruction occurs abruptly, since the learners are expected to master the content of seven subjects in English.

The early shift from mother tongue instruction to English in this case, has implications for academic success or failure as reflected in Cummins (1981). According to Cummins (1981) it takes about two years for a child to acquire basic interpersonal communication skills (BICS) that are needed for informal communication or conversation. But it takes about five to seven years to acquire sufficient cognitive academic language proficiency (CALP) i.e. sophisticated language required for academic success (Cummins, 1981). Proficiency in the mother tongue helps in acquiring the second language. This implies that if the child has high levels of proficiency in the mother tongue, such language skills can influence the child's academic progress (Cummins, 1979; Lemmer, 1996).

So, when (African) children shift to English medium of instruction at Grade 4, one may argue that their BICS is not developed enough (due to lack of exposure to English and the quality of input they get in the classroom). Their challenge is to acquire CALP in English in order to master academic content without a strong base of BICS in English. The assumption is that such children may struggle to grasp the content of subjects taught in English. Lemmer (1996:333) is of the view that the early shift to English medium of instruction with inadequate or low developed language skills in the mother tongue may lead to semilingualism (i.e. literacy in neither languages).

On the basis of the brief background given above, it appears that the use of African languages as languages of instruction is a very controversial issue in South Africa. Some people, especially the African middle class, do not see the need for using African languages as media of instruction. These are the people with good jobs who can afford high education costs for their children in private or English medium schools. They can speak and understand English well and are able to support their children in their school work that is done in English. For instance, De Klerk's (2000) study that was conducted

in the Eastern Cape reveals that a small number (19%) of isiXhosa-speaking parents (middle class) were not enthusiastic about the maintenance of isiXhosa in schools. They claimed that their children knew how to speak isiXhosa, so there was no need to learn to read or write the language. According to the results of the study many parents showed strong positive attitudes towards English as a medium of instruction for economic and academic or educational reasons. They were attracted to English medium schools by the availability of resources and many other facilities, the low pupil-teacher ratio, and many other benefits that are not available in African schools.

In the light of the above, it should be noted that the African middle class is a minority group in comparison to the masses or working class groups whose children are in township or rural schools. My own observation as someone who grew up and studied in rural areas is that the majority of the black working class parents have low levels of education or are completely illiterate in English, (especially in rural areas). Some have very low competence in English, and others have no competence at all in English. My assumption, therefore, is that the use of English as a medium of instruction makes it very difficult for them to give support to their children as many subjects are taught in English from Grade 4. This state of affairs has a negative impact on children's learning as they do not get adequate support from their parents to cope with schoolwork. As a result, some of the learners resort to rote learning (memorizing without understanding) in order to cope in English medium lessons. This situation relates to Bunyi (1997:53) who claims that educational failure is also common among working class children in North America and Europe where the learners are taught through English as a second language.

In the South African context, most of the African teachers too are second language speakers of English, and many of them have limited proficiency in the language. As a consequence, because the teachers themselves are not competent and confident enough to teach English, code-mixing and code-switching in the teachers' and learners' mother tongue occurs frequently in the classrooms. It is to be expected that learners' proficiency in English would be negatively affected if they have insufficient exposure to the language they learn, and if the teachers themselves do not have a good command of the language.

The learner's home language is important as a vehicle of thinking, reasoning and forming mental images (O-saki, 2005:52). In other words, the home language, rather than a second or additional language, enables the learner to make meaning or sense of what is being taught. The implication is that if the learner has a strong foundation in his home language, there are better chances for that learner to cope with an additional language. Conversely, in situations where the learner is introduced to a second language with limited proficiency in his home language, it is likely that the learner will have difficulties in mastering the additional language.

Most of the teachers are the products of an education system that made use of a second language (English or Afrikaans) as a medium of instruction. It is likely that under such conditions of teaching and learning rote learning would take place (i.e. memorization without understanding). Therefore, one would suspect that the teachers would teach their learners in the same way they were taught (i.e. making use of approaches that encourage rote learning). Of course, with the introduction of outcomes-based education (OBE), the teachers have been involved in a number of workshops to prepare them to cope with the new curriculum changes, and to be able to confront other challenges they encounter in their classrooms. Pandor (2004:3), in her speech as the National Minister of Education acknowledged the importance of quality education and she promised to provide intensive training of teachers in preparation for the curriculum. This might, however, not help if a foreign language (English) continues to be the medium of instruction for African learners.

In the 21st century, technology is highly advanced. The school curriculum should prepare learners to meet the challenges of the new millennium. The learners should be encouraged to do Mathematics and Science (including computer literacy) that will help them to cope with the changing world of technology. In the past, especially in African schools, Mathematics and Science were reserved for clever students, but the new South African curriculum requires all learners to do Mathematical and Science literacy at school. This is one of the challenges that teachers face in the classrooms as some of them have little or basic knowledge in these subjects (Mathematics and Science).

In the context of this study, it is important to prepare all the learners for the future by providing them with quality education This could be possible if the teachers are committed and confident in their teaching and if they use innovative teaching styles that are learner-centred. This is hardly possible if the language of instruction is one that teachers and learners do not command well. Also, if the interaction or communication in the classroom occurs in a language that both the teachers and the learners know well, it seems likely that the learners' academic performance would improve.

Many researchers and organizations believe that mother tongue education is also the key to the development of African languages (Desai 1999; Pan South African Language Board (PanSALB), 2000; Sentson 1994). Desai (1999), in particular, argues that it is only by using African languages as media of instruction that a culture of writing is going to flourish in African languages. The implication is that it is possible to develop materials when the language is used in teaching and learning. For example, when mother tongue education was implemented in Ethiopia in 1992, teachers were trained to develop materials and were orientated on how to use the materials and the new mother tongue curricula (Boothe and Walker, 1997:7). Likewise, to implement isiXhosa medium of instruction in the Western Cape (South Africa), it has been necessary to develop Science materials by translating existing (English) materials into isiXhosa.

Against this background, it was assumed that the learners' introduction to Natural Sciences at Grade 4 level, accompanied with a shift to English medium of instruction poses a threat to the academic performance and confidence of learners in this subject. It is thus envisaged that retaining isiXhosa as a medium of instruction in science for another three years will improve the learners' level of understanding and confidence in science.

It was also envisaged that through this undertaking of teaching science through the medium of isiXhosa, African parents would be able to help their children in their schoolwork in the language that they all understand. It was also assumed that learning through the isiXhosa medium would not only improve the African learners' conceptual development and academic performance in science, but would also improve their self-esteem (affective development) and strengthen the link between their language and

cultural identity as well. The learners' mother tongue is the basis for the acquisition and development of their second language and other languages (Alexander, 2005; Prah, 2003; Skutnabb-Kangas & Garcia, 1995). By acquiring basic language skills in the mother tongue (isiXhosa) first, it was assumed that the learners would be able to learn other languages easily. The other assumption was that teachers would be more effective in teaching science through the medium of isiXhosa which is more accessible to them and to their learners.

In the context of this study, the use of isiXhosa as a medium of instruction beyond Grade 3 should be seen as a move not only towards its development, but also as an education right for all the learners who are mother tongue speakers of this language. It is also a means of redressing the imbalances that resulted from the previous education system that did not recognize the status of African languages in education. Consequently, only whites and a few black elites benefited from that system in terms of economic benefits and upward social mobility as they could express themselves in the language(s) of the rulers, Afrikaans and English.

In short, the actual problem which underpinned this study was to investigate how learners cope and perform in Science when they are taught science through the medium of English or isiXhosa. In other words, the study sought to find out the kind of classroom interaction and discourse which occurs between teachers and learners when using either English or isiXhosa as a medium of instruction in science. It also looks at the role played by parents in response to the two languages as media of instruction.

1.5 Rationale for the study

This study sets out to compare the teaching and learning of science through the medium of isiXhosa and English in the Intermediate Phase (Grades 4 – 6). In other words, the research study explores the effects of the use of learners' mother tongue (isiXhosa) and second language (English) as languages of instruction in science in the Intermediate Phase.

Firstly, my involvement in the LOITASA Project stimulated my curiosity in finding out about what happens in the science classroom taught through the medium of isiXhosa. I also wanted to see if there would be any differences and similarities between children who were taught science through the medium of isiXhosa and English in South Africa in terms of academic achievement and in the way they interacted with their teachers. My interest was also triggered by the fact that the study would be the first one in Cape Town to follow teacher and learner interaction in science in isiXhosa for three years through an experimental design. Pilot studies on science teaching through the dual medium of isiXhosa and English have been conducted by organizations such as the Project for the Study of Alternative Education in South Africa (PRAESA) in Cape Town (Mbude-Shale, Wababa & Pluddeman, 2004).

Following the Constitution of the Republic of South Africa (1996) and the Language-in-Education Policy (1997) that recognize linguistic equality and additive bilingualism, this study was chosen not only as a means of strengthening language policy implementation, but also as a step towards the elevation of the status of isiXhosa in education. The main challenge of using isiXhosa as a medium of instruction in science was the lack of reading materials in this language. The means of addressing this challenge are discussed in 1.5 below. The start of the Intermediate Phase (i.e. Grade 4) was targeted as a transition phase where the shift from the use of mother tongue (isiXhosa) to English occurs.

Focusing on teaching and learning was chosen in order to investigate how teachers and learners interacted in science lessons. Given the fact that OBE requires learners to take an active role in their learning, the present study was initiated to identify teaching and learning strategies that were used by both the teachers and learners in the science classroom. That is, the study was driven by the new outcomes-based curriculum in order to find out whether the teaching and learning strategies matched the needs of the new curriculum. In fact, through the support that was provided to the teachers in the form of workshops, it was envisaged that teachers would improve their teaching skills in science, while the provision of learner support materials in isiXhosa was a means of assisting learners to acquire science knowledge in a language that they understood better.

As many teachers did not get professional training in the use of African languages as media of instruction, it would be a mistake to assume that all teachers are ready to implement mother tongue education in African languages. Although one can argue that teachers often switch from English to isiXhosa in the classrooms, such a practice is not official and it is not carried out in a systematic way. Through this study it was envisaged that teachers who taught the experimental groups would also acquire skills related to mother tongue instruction in an African language, specifically in science.

The other challenge was driven by literature I consulted on arguments that support and oppose mother tongue education in African languages (Bamgbose, 2005; Mazrui, 2002; Brock-Utne, 2001; Hameso, 1997; Chumbow, 1990). The opposing arguments perceive science as a subject that cannot be taught through the medium of African languages due to the lack of scientific terminology in these languages. It was for this reason that science was then chosen as the focus area in this study. As explained in 1.2 above, undertaking this study aimed at developing appropriate vocabulary for science in isiXhosa through translations.

In short, the study is based on four comparative pillars:

1) the use of two languages (isiXhosa and English) in science teaching,

2) the interaction of teachers and learners in science lessons taught in English and isiXhosa,

3) the role played by learners in science lessons and

4) the parents' views about the use of the two languages of instruction and their support in teaching and learning.

The study addresses the following main research question: "What are the effects of English and isiXhosa as languages of instruction on the teaching and learning of science in the Intermediate Phase?" Underlying the main research question were the following sub-questions:

1. What approaches or methods do teachers use in teaching science through the medium of English or isiXhosa in the Intermediate Phase?
2. What learning strategies do learners use when they are taught science through the medium of English or isiXhosa?
3. How do learners cope and perform in science taught through the medium of English or isiXhosa?
4. What kind of support do parents provide to teachers and learners?
5. To what extent are the teachers and parents aware of the South African Language-in-Education Policy that guides teaching and learning in schools?

1.6 Objectives of the study

In relation to the research question(s) stated above, the study objectives were as follows:

1. To observe and compare how the teachers interact with their learners in the science classroom when they use English or isiXhosa as a medium of instruction.

2. To investigate and compare how the learners respond academically to the two media of instruction (English or isiXhosa).

3. To investigate the kind of support that parents give to teachers and learners.

1.7 Research Methodology

This study is underpinned by the interpretivist or phenomenologist research paradigm which puts emphasis on the construction of knowledge through observable phenomena. The interpretivist paradigm takes into account how people understand and make meanings of different situations by describing their intentions, beliefs, values and reasons (De Vos, Strydom & Fouche, 2005; Henning et al. 2004; Babbie & Mouton, 2003). Interpretivist inquiry often implies research methods that occur in natural settings, and it often makes use of unstructured observations, interviews and other qualitative research techniques. Data is analyzed as descriptions of experiences within a certain context (De Vos, et al., 2005; Henning, et al, 2004; Woods, 1986).

Informed by the interpretivist research paradigm, my main approach to the research has been a qualitative and ethnographic one. According to Mouton (2002:156) ethnography is characterized by triangulation (i.e. use of a variety of data collection strategies). Following the ethnographic or qualitative research approach, data that informs this study were collected by means of classroom observations, interviews, analysis of learners' workbooks and informal conversations.

The qualitative research methods that were employed for the purpose of this research correspond with the interpretivist paradigm as they aimed at gaining a better understanding of how teachers and learners interacted in science when taught in English or in isiXhosa, as well as their perceptions regarding the two media of instruction. Observations were conducted in the teachers' natural settings, the classrooms. Qualitative data analysis by means of interactionist analysis led me to a deeper understanding of the causes of such behaviour by teachers, learners and parents. Details of research methodology and data analysis are discussed in Chapters 5 and 6.

1.8 Significance of the study

As the study compares the teaching and learning of science through the medium of English and isiXhosa, it should be of significance to the National Department of Education and the Western Cape Education Department (WCED) in particular, curriculum developers and advisors, language practitioners, teachers, learners, parents and other stakeholders as it should inform them of the advantages and problems associated with mother tongue education and second language medium of instruction in a concrete way. It is envisaged that through this study, new developments towards mother tongue education in other African languages might emerge. Hopefully, the study might improve people's general understanding of the language policy issues and help to change their mindsets and attitudes towards the use of African languages as languages of learning and teaching. The results of this research, hopefully will also contribute to better implementation of the Language-in Education Policy in South African schools.

1.9 Organization of the study

The study has been organized into eight chapters. The first chapter gives an overview of the study by giving a brief background of how the study was conceived, the research problem, the rationale for the study and the research theory that underpins the study. It also highlights the main research question that is driven by the problem under study.

To contextualize the study, the second chapter describes language policies and language-in education policies within the South African context. Linked to the problem stated in the first chapter, Chapter 2 explores and analyzes language policies in relation to the current Language-in-Education Policy in South Africa. It highlights current debates and discussions about the use of African languages in education.

The literature on which the study is based is sub-divided into two sections. The first section which is organized as Chapter 3 reviews literature related to mother tongue education theories and second language acquisition theories. This chapter also focuses on the different models of bilingualism in developed countries and their benefits in children's education.

The fourth chapter forms the second section of the literature review. It deals with literature related to science teaching and learning in particular, with approaches that support science teaching through the learners' mother tongue and through a foreign language. It touches on language proficiency as a means of determining attainment of scientific literacy or science knowledge construction.

Chapter 5 discusses research methodology. It gives a detailed account of all the subjects, tools and instruments that were used in collecting data for this study. It links with the research background given in the first chapter and data analysis that informs the findings and recommendations of this study in Chapters 7 and 8.

In Chapter 6 the empirical data that have been gathered is presented. That is, all the key aspects and details of classroom observations, interviews, and other forms of data collection are described explicitly.

Chapter 7 focuses on the analysis of data. The data presented in Chapter 6 is categorized, discussed and interpreted in order to arrive at the findings of the study.

Chapter 8 provides a summary of the findings, conclusions and recommendations that are derived from the analyzed and interpreted data.

In short, Chapter 1 is an introductory chapter that sheds light on what the study aims at achieving. It gives a brief background that foreshadows the study, as well as the objectives and rationale for the study. The problem of investigation is stated in this chapter with a brief citation of literature and research methodology that has been used to collect data. In the next chapter literature which highlights language problems as they emerge from language-in-education policies of developing countries is discussed in relation to current language-in-education policies that are supposed to guide teaching and learning.

CHAPTER 2

LANGUAGE POLICIES IN EDUCATION

2.1 Introduction

In the first chapter the problem underlying this study, the aims and rationale of the study were presented. The problem highlighted in the previous chapter has partly to do with languages of learning and teaching or media of instruction in schools. In this chapter my discussion draws a connection between the research problem stated in the first chapter and the language policies used in education within the South African context. In other words, I am relating the research problem with the past language policies (colonial and apartheid) and with the current language-in-education policy in order to establish whether there is any progress with regard to language policy implementation in South African schools thus far. The current South African language-in education policy is analyzed within the context of transformation and democracy in this country.

Firstly, this chapter gives a brief description of the concept of language planning as it relates to power, transformation and democracy. The rationale for this description is to give a broader understanding of the activities that underpin language policy planning and how these activities depict the issues of political power and economic relations as explained by many linguistic scholars (Alidou, 2004; Tollefson & Tsui, 2004; Webb, 2004; Heugh, 2003; Desai, 2001; Cooper, 1992; Bamgbose, 1991; Corson, 1990, Chumbow, 1987). This description also sheds light on how language policy design influences language policy implementation or practices in the classroom.

Secondly, the various language policies (colonial, apartheid and the current language policy) that have had an influence on education in South Africa are discussed. The discussion aims at identifying similarities and differences in the three language policies in order to arrive at a conclusion of whether the new language policy is in any way influenced by the previous policies. Actually, the discussion focuses on the features of

the different language-in-education policies (also referred to as medium-of-instruction policies) and their implementation in education.

Finally, globalization as a key factor in economic and political development in the world is discussed within the context of post-colonial education in Africa. Specifically, it is discussed in relation to media of instruction, and how it affects linguistic and cultural freedom in Africa. The notion of dependency on European languages and cultural values is the main focus that relates not only to globalization, but to the previous and current medium of instruction policies that are followed by many countries in Africa.

2.2 Language Policy Planning

As the study has to do partly with language policy implementation in South African schools, it is necessary to have an overall understanding of the concept of language policy within language planning. Below, a separate definition of the two concepts "language and policy" is given. Firstly, language, as defined by Hartshone (1995) is:

> used by people to… express their deepest feelings – to pray, to swear, make love and to communicate with others. It is the repository and means of articulation of values, beliefs, prejudices, traditions and past achievements… it is at the heart of the culture of people; it is what makes people see themselves as different; and it is related to issues of identity, position and power.

According to Hameso (1997:3) language is a means of communication, expression and conceptualization. He also claims that language can be used as a means of domination and discrimination (Hameso, 1997:3). Elugbe (1990:12) links language with culture and people's history (i.e. the history of people can be traced through their language). In simple terms, language is an aspect of human behaviour that involves the use of vocal sounds in meaningful patterns to form, express and communicate thoughts and feelings. Pattanayak's (1986:5) definition of language is based on its use in education, and it seems to incorporate almost all the factors that are mentioned above. He defines language as:

> …a factor providing or withholding access to education and therefore to human resource development, as a key to knowledge information and communication, … as a major element in elite formation and alienation, as a barrier to or equalizer of social, political and economic opportunities, language plays a role in the modernization and development of the country.

The common thread running through the above definitions of language is that language has to do with communication (verbal and non-verbal), expression of feelings and thoughts and conceptualization. Language reflects one's understanding (conceptualization) of certain issues and it also mirrors the culture of its speakers. Whilst language can unite people through communication, it can also divide them if one of the languages becomes dominant over others. In other words, language can bring people together, especially when those people communicate in a language that is understood by all of them. At the same time, language can result in social stratification (elites and masses) if a language dominates over other languages in a particular community. The dominant language is usually used in many (formal) domains such as education and business. People who cannot speak the dominant language are usually excluded from the community's formal activities such as the formal economy and education.

Concerning language policy, there are many definitions related to this term. Many linguists, for instance, define a policy within a broader perspective of language planning. Language planning is concerned with solutions to language problems or challenges (Corson, 1990; Rubin, 1984, Cooper, 1984). A policy then is a plan or document that defines the scope of operation and programmes in response to language challenges at national level (Rubin, 1984; Cooper, 1984). The policy is purpose-driven and it gives direction of action. It is future oriented, and it may change over time in order to keep abreast of economic, technological and social changes (Dye, 2001:3). In other words, policy formation involves management of change that involves proper planning for effective implementation. It allows provisions for follow-up, monitoring and revision if there is a need for some changes.

Broadly, a language policy can be defined as any overall plan or course of action adopted by a government, political party or business organization as a solution to language

problems. It is designed to influence long-term decisions or actions. It arises out of proper and careful language planning by the government, with the aim of guiding the medium of communication among speech communities. Language policy activities are decided at the highest level of the government, and they often reflect the political infrastructure, and are usually a top-down process (Dye, 2004; Heugh, 2003; Corson, 1990).

In most cases the top-down policy model reflects the values and interests of the 'governing or national elite' (Alidou, 2004; Dye, 2001:3). In other words, the top-down approach in language policy formulation does not usually take into account the needs of the majority of the masses, especially minority groups with less power and authority in the government. As a result, depending on the decisons of the 'governing elite', a language policy may favour or discourage the use of a particular language or languages in certain domains. In many countries language policies have been used to promote one official language at the expense of others. For example, in many African countries the language policies promote the use of ex-colonial languages such as English, French, Portuguese or Spanish in education at the expense of local languages (Alidou, 2004; Tollefson & Tsui, 2004; Heugh, 2003; Prah, 2003; Mazrui, 1990).

Apart from political influence, language policy formulation tends to be influenced by the economy of the country. For instance, the Western economy seems to exert influence on language policies of many developing countries. Consequently, many African states still depend on European languages such as English and French for economic exchange. Such influence often leads to their dependency on the Western countries for economic and military aid. Dependency and linguicism in African countries are discussed at length in Section 2.4 below.

Language policies can also control access to employment of people who are not speakers of the dominant language(s). In order to qualify for jobs, language groups that speak the non-prestigious languages or languages with lower status have to be proficient in the dominant language(s). In South Africa, in particular, the two European languages,

English and Afrikaans used to be the only official languages in the previous apartheid regime, but within the democratic government of today, they still determine one's placement in certain jobs. Although there are now nine African languages with official status, job advertisements and interviews are conducted either in English or Afrikaans, and such practice tends to be a disadvantage to candidates who are not proficient in these two languages. Subsequently, many black people are not in a position to compete with English and Afrikaans speakers in the job market. Hence the majority of black people aspire for English as the language of socio-economic advancement, confusing learning a language with learning in a language.

In language policy formulation, different laws are often followed. The laws often respond to the needs of the population(s) for which the language policy is designed. That is, different kinds of policies are designed to serve different needs of the populations they are designed for. For example, assimilationist, exclusivist, bilingual, multilingual or mixed language policies are the different types of language policies that have an impact on the various linguistic communities of the world (Wikipedia, 2006; Heugh, 2003; Alidou & Mazrui, 1999). In other words, a language policy can offer good opportunities for some members of the population, while, at the same time excluding or marginalizing other groups of the same population in terms of education, law, work, government, etc. Hence language is regarded as a powerful tool of domination and discrimination (Hameso, 1997:3). More will be said about these types of language policies in the following section.

In relation to the above, Bamgbose (1991:25) distinguishes between three types of language policy, namely, official, educational and general language policies. The official language policy refers to languages recognized by the government, while the educational language policy relates to language(s) recognized by education authorities for use as media of instruction and subjects of study. The general language policy covers either unofficial government functions or languages used in mass communication, in business and in contact with foreigners (Bamgbose, 1991:25). The implication is that the government has a big control over language policy issues. Not surprisingly, language

policies often reflect the vision of the few in power. That is, language policy and planning decisions are power related (NEPI, 1993).

Corson (1990:19) defines language planning in terms of four dimensions, namely, selection of a norm, codification of a norm, implementation of function, and elaboration of function. By selecting a norm, a particular language is chosen to be the main language of communication and such a language is codified by deciding what styles of language can be used within a certain domain or environment and people. For purposes of wider communication, the language selected as a norm is spread in various ways such as business, education, media, etc. The language continues to be used to meet the needs of the linguistic communities.

The above language planning dimensions can be associated with the three main activities of language planning namely, status planning, corpus planning and acquisition planning (Cooper, 1989:99). Firstly, status planning refers to efforts in assigning certain languages specific functions such as "official language(s) or media of instruction. In other words, the use of a language in the society changes, and the change usually affects its status (Corson, 1990:19). There is usually a language with a higher status, with other languages having a lower status in the community.

As mentioned above, the higher status languages are usually used in government, business and education, while the low status languages are often used in informal domains for communication purposes. In the democratic South Africa, for instance, status planning has been executed by the new government by elevating the status of the nine African languages to official status (i.e. placing them on par with English and Afrikaans which used to be the only official languages in the apartheid government). By elevating the status of the previously marginalized languages, the language policy is promoting linguistic equality by recognizing the linguistic rights of South African citizens (Webb, 2004; Heugh, 2003; Reagan, 2001:60). The recognition and development of South African Sign Language, and the promotion of additive bilingualism/multilingualism in schools form part of the status planning process.

In addition to status planning, corpus planning is concerned with the structure of a language such as spelling, pronunciation, grammar and vocabulary (Corson, 1990:19). That is, corpus planning refers to the codification and standardization of the language according to lexicon and orthography. In the case of South Africa, all the official languages are written languages. The only problem lies with the fact that the two European languages, English and Afrikaans are well developed with lots of teaching and learning materials or resources because of the support they received as official languages during the colonial and apartheid era. On the other hand, there is a serious lack of educational materials and publications in African languages, although they were used, and are still used as media of instruction in lower grades, and are taught as subjects in black schools. From Grade 4 materials in African languages are very limited. The only available materials are grammar or language textbooks and different literature genres (novels, drama, short stories, etc.) that are prescribed for different grades. There are no textbooks in African languages for the different subjects like science, history, biology, etc. in these subjects. This state of affairs can be attributed to the unequal distribution of resources along racial lines during apartheid, and to the fact that African languages are not used as languages of teaching and learning after Grade 3.

Contemporary corpus planning activities in South Africa include the development of African languages through the creation of scientific and technological terms in these languages. For instance, currently, there are committees and projects that are working on terminology development for science and technology in African languages. The Department of Arts, Culture, Science and Technology (DACST) has funded some of these projects. Alidou (2004) associates the general lack of resources or literate environments in African languages with the lack or underdevelopment of literacy skills of African children in their national or home languages. The lack of literacy skills in the home language may be a barrier in learning a foreign language (Alidou, 2004:209).

Acquisition planning is concerned with the distribution of languages among speech communities, i.e. it determines who learns or has to learn particular languages (Cooper,

1989; NEPI, 1993:10). Acquisition planning has to do with the spread of language(s) that have been selected as official languages. In other words, it looks at ways or opportunities of teaching or learning other languages. In the South African context, for example, the notion of bi/multilingualism encourages individuals to learn other languages other than their home languages. Hence there is provision for learning of languages as first or second additional languages[9]. Acquisition planning, therefore, seeks to implement the language policy according to the plan.

According to King & Benson (2004:246), medium-of-instruction policies (i.e. language-in-education policies) are a form of acquisition planning which incorporate both status planning and corpus planning. In other words, as part of acquisition planning, medium-of instruction policies usually create opportunities to learn other languages by targeting certain areas of the communities such as education or schools, mass media, etc. Corpus planning and status planning are achieved through a standardization process that usually has implications for language status and language maintenance. For instance, the language with the highest status is usually used in education and in other formal domains.

Given the linguistic history of South Africa, it may be assumed that some people, especially black people, have negative attitudes towards Afrikaans because it was used as a language of oppression by the apartheid government, and that led to the tragic incidents of 1976 (Heugh, 2003, Hartshone, 1991). But with the new language policy that recognizes linguistic diversity, Afrikaans is one of the official languages, and many black people still continue to learn Afrikaans despite its perceived oppressive functions and effects on the lives of black people.

Webb (2004:218) is of the view that language planning in South Africa can be effective if it occurs within the framework of national ideals, macro-economic policies of the government and language stipulations of the constitution of South Africa. With regard to

[9] First additional language is used to refer to a language that a child learns first in addition to his/her home language, i.e. a second language (L2), while a second additional language refers to any language that is learnt after a child has competence in two languages i.e. the L1 and the L2. A second additional language used to be referred to as a third language.

national ideals, he suggests that the vision of the country should be expressed in the following national ideals: establishing democracy; promoting equality and human rights; developing national unity and promoting mutual tolerance and respect among the different cultural, linguistic, religious, racial, and socio-political groups; developing the people of the country; administering the country effectively; implementing affirmative action; and retaining the country's cultural diversity (Webb, 2004, 218).

Secondly, language planning should occur within the Reconstruction and Development Programme (RDP) of 1994 which aims at developing South Africa's human, natural and financial resources (Webb, 2004:219). The RDP sought to create employment opportunities for all South Africans, irrespective of colour, race or religion. However, the RDP was replaced by the Growth and Development Strategy to eradicate poverty, foster economic growth and to narrow the gap between the rich and the poor. The Growth, Employment and Redistribution (GEAR) is the government's strategy or policy to implement the aims of the RDP and of the Growth and Development Strategy. Webb (2004:219) emphasizes the importance of language, (particularly in education for employment), for the success of these programmes (RDP and GEAR). Heugh (2003:8), however, is of the view that the GEAR encourages assimilation into English, and strengthens the marginalization of other language groups in the economy of the country.

Lastly, Webb's (2004) language planning framework is discussed alongside the stipulations of the constitution of South Africa. The Bill of Rights, for example, focuses on equality in all spheres of life such as race, education, religion, language, etc. As stated in the Constitution of the Republic of South Africa (1996:11): "everyone has the right to receive education in the official language or languages of their choice in public educational institutions where that education is reasonably practicable." The RSA constitution acknowledges the importance of language in education.

In line with the above proposed framework, the vision of South Africa in terms of its constitution and language policies is a good one because it recognizes linguistic and cultural diversity as assets in this country. What lag behind are implementation strategies

to effect the vision. For example, with the notion of multilingualism as a key objective of the country towards democracy, one would expect to see many South Africans (including English and Afrikaans speakers) learning the South African official languages. But that is not the case currently, instead multilingualism is more visible among the previously oppressed groups (blacks) of South Africa the majority of whom are proficient in more than one African language, and in English, and Afrikaans (Heugh, 2003). The challenge is that South Africans need to change their attitudes towards certain languages, especially African languages as languages of learning and teaching. As noted by Bamgbose (2005:233) some African language speakers themselves have developed negative attitudes towards their languages as a result of their marginalization in the economy and education of many African countries.

Following the discussion of language policy planning, in the following section I discuss the different language policies that have influenced education in South Africa. My starting point is the discussion of the colonial language policy and its impact on South African education, particularly in black schools. Secondly, I discuss apartheid language policy in order to map the need for language planning (innovations) in democratic South Africa. Finally, I explore the medium-of-instruction policies in relation to colonialism, apartheid and globalization.

2.3 Language-in-education policies of South Africa

Makalela (2005:149) traces the South African language question from seven historical events, namely, (i) pre-colonial South Africa, (ii) the arrival of the Dutch settlers in 1652, (iii) the invasion of English colonizers in 1795, (iv) the Dutch-English bilingual system from 1910 to 1925, (v) the rise of Afrikaans with apartheid policies in 1948, (vi) the 1976 Soweto students' uprisings, and (vii) the multilingual policy provisions of 1996. The discusion that follows incorporates all of these eras in an integrated manner that relates to education.

Regarding the pre-colonial era, it is unfortunate that there is nothing written that can be linked to the question of media of instruction in Africa. This failure is attributed to Western anthropologists and ethnologists who believed that Africans were not at an educational level that could produce written records of important events (Makalela, 2005). However, nowadays African history can be seen from folklore, art and rock paintings, trade marks, individualization of properties like cattle, etc. The indigenous people used language varieties that were understood across a wide spectrum of the ethnic groups that came in contact with each other, e.g. the Khoi and San communities who were hunter-gatherers. All these forms of communication provide evidence that Africans had their ways of communication (e.g. pictographs) when they came in contact with the Europeans (Makalela, 2005).

Likewise, Alidou (2004:197) asserts that African ethnolinguistic groups used their own languages to educate their children before colonialism. In this regard, the parents played a significant role in choosing appropriate strategies of socializing and initiating the children into adulthood linguistically and culturally. Alidou (2004) further explains that there was no medium-of-instruction problem as she says: "no child attended a "classroom" where the language of instruction was foreign". With the introduction of Western education by the colonizers who were accompanied by missionaries, the problems of medium-of-instruction in Africa arose. African children were then forced to get basic education in the language(s) of the colonizers, e.g. Dutch, English, French, Portuguese, etc. (Alidou, 2004:199).

The second period of language history in South Africa ranges between 1652 and 1795. During this period South Africa was under British and Dutch colonial rule. British rule exercised its powers by imposing its own languages and cultural values, that later impacted on the education system of South Africa. At the end of colonialism, apartheid took over until 1994. The apartheid system also had its own language policy in education that was changed by the new democratic government in 1994. In the following discussion I focus on the language-in-education or medium-of-instruction policies of the three political eras: colonialism, apartheid and democracy.

2.3.1 Colonial language policy

As shown above, linguistic inequality in Africa can be traced as far back as the 17th century when Africa was under colonial rule (Alexander, 1989). The African continent was under the colonial rule of European countries like Great Britain, France, Holland, Portugal and others for more than three centuries. South Africa, for example, was colonized by Holland and Great Britain during the 17th, 18th and 19th centuries (Alexander, 1989:12). When the Dutch East India Company (D.E.I.C.) occupied the Cape in 1652, the indigenous peoples (Autshomoa, Krotoa, Doman) of the Cape were using their own languages, and the D.E.I.C. influenced them to learn their language, Dutch, without any attempt to learn the local languages. As a result, by the end of the 17th century most inhabitants of the Cape colony (Dutch, Africans and Malay people) spoke a creole that later became a lingua franca, Afrikaans, in 1925 (Makalela, 2005; Alexander, 1989:15; Bernstein, 2001:221).

Dutch rule was interrupted by the invasion of the British for the first time in 1795, and later in 1806. The British engaged in the "anglicization' of Africa by introducing English while phasing out the Dutch language. So the two languages competed with each other, and the linguistic competition led to the Anglo-Boer War of 1889 – 1902. The two policies, Dutch and British had one thing in common: "de-Africanisation through displacement of African languages" (Makalela, 2005:151).

The colonial language policy followed the assimilationist, transitional and exclusivist models (Alidou & Mazrui, 1999:110; Alidou, 2004). For example, French colonialism enforced the use of French in education while the African languages of the colonized were not given any support or recognition in education. In fact, African people who could not speak French were labelled as "barbarians" (Alidou & Mazrui, 1999:110). Under such conditions, the Africans were assimilated into the French culture.

> In order to "civilize" and assimilate African students into French culture, the schools required children to learn the French language. Coercive measures included physical

> punishment and public shaming of children who spoke their mother tongue in the schoolyard or their own neighbourhood. Upward mobility in school and access to jobs in the colonial administration were strictly tied to mastery of French (Alidou, 2004:199).

Germany, on the other hand, practised an exclusivist language policy. All the countries that were colonized by Germany were denied access to the German language because Germany wanted to monopolize its own language for technological advancement (Alidou & Mazrui, 1999:111). For example, the exclusivist model led to the consolidation of Kiswahili in Tanzania as a national lingua franca (Alidou, 2004).

As mentioned earlier, South Africa was colonized by the British. Unlike Germany, Britain allowed the Africans limited access to the English language. English was introduced as a medium of instruction from the fourth grade up to secondary education (Alidou, 2004). That is, African languages were used as media of instruction for the first three grades of children's schooling. African languages were used as transition to English medium of instruction in higher grades. According to this model, the Africans were exposed to their home languages and English for a limited time. This policy perpetuated segregation in the sense that only a few African elites could get access to English through formal education, the masses without formal education were alienated by the use of foreign languages in certain sectors of their communities (e.g. business or economy and education). Another negative impact of colonialism was the creation of social and gender divisions. Alidou (2004:200), for instance, claims that the majority of people who attended colonial schools were males, the majority of whom were from royal families.

Colonization of African countries did not affect only their economic, political and socio-cultural lives, but also extended to language policies of the affected countries. When the British occupied the Cape in the 19th century, the struggle between Afrikaans and English arose. The British authorities enforced the use of English in various sectors such as education, law, government, media, and so forth, and speakers of Afrikaans tried very hard to put their language on par with English (Bernstein, 2001:221). English then

became the language of public discourse while Afrikaans/Dutch was used in private and religious domains. The extension of the colonial language policy in South Africa is reflected in the Bantu Education Act of 1953 which is discussed at length in the following section. With regard to the colonial language policy in South Africa, Alidou & Mazrui (1999) say:

> … the African was allowed a somewhat regulated access to the English language. This meant regulated acculturation, on the one hand, and regulated induction into spheres of western knowledge on the other. Both doses were to be just sufficient to render the African functional in British-introduced administrative institutions, while limiting exposure to the kind of knowledge that had subversive potential.

The missionaries, however, played an active role in developing the African languages during British rule in the 19th century. Their work, though, followed two directions: strengthening the British interests by spreading English to a few Africans who became teachers and preachers; and putting African languages into writing in order to spread the gospel (Alexander, 1989:18). They developed and standardized orthographies of African languages in order to assist Africans to read and write the Bible. In other words, Africans had to learn English in schools, while they were also exposed to the orthography of their own languages.

History reveals that isiXhosa was the first African language to be put into writing by missionaries (Mahlasela, 1973:3). According to Jafta (1971:6) the two Scottish missionaries, John Bennie and John Ross played a big role in developing isiXhosa literature in 1823. John Bennie, in particular, devised an alphabet and orthography in isiXhosa, and the first book titled "*Incwadi yokuqala ekuteteni ngokwamaXhosa eTyhume*" (The first book in the language of amaXhosa at Tyhume - Lovedale) was printed through his efforts in 1824 (Jafta, 1971:7; Mahlasela, 1973:4). In other words, the evangelical mission of the missionaries was to promote reading and writing among Africans so that they could spread the gospel.

Unlike the British colonizers, the missionaries learned the local languages of the African people, built schools so that they could develop the Africans educationally. As indicated

earlier, colonial education strengthened the use of English in schools and also developed African languages through standardization. The use and mastery of English led to social division among Africans themselves (Brock-Utne & Hopson, 2005:3).

The British language policy continued throughout Southern Africa until the Afrikaner National Party took power in 1948 in South Africa. The Afrikaner National Party tried to change the policy by substituting English with Afrikaans as a dominant language, and where it was not possible, English and Afrikaans had to be used on a fifty-fifty basis. The policy aimed at giving Afrikaans equal status with English as a medium of instruction in schools. This policy came with oppressive and racial attitudes towards African or black people (e.g. the Bantu Education Act) during apartheid in South Africa. The apartheid language policy is discussed in 2.3.2 below.

The above colonial language policy shows that the colonizers aimed at promoting the languages of the colonizers at the expense of the indigenous African languages, and to serve European economic and political interests (Alidou, 2004). The languages were promoted through education, where Africans were taught through the languages of their colonizers. As a result, Africans began to think that everything that was valuable and worthy in life would only be attained through the use of colonial languages (English, French, Dutch and Portuguese). Tollefson (1991: 207) refers to the colonial language policies as unnatural, anti-human and anti-cultural. This implies that as the colonized people learn foreign languages, they also learn a foreign culture that often shifts them away from their traditional cultures.

As discussed earlier in this chapter, the dominant language groups often hold power and enjoy economic and political advantages while the minority language groups are denied access to some of the privileges. Many scholars, for example, perceive colonial languages such as English, French and Portuguese as barriers to the development of Africa because only a few elites can access and participate actively in the economic and political spheres of their countries (Kamwangamalu, 1998; Brock-Utne & Hopson, 2005;

Matsinhe, 2005). In many African countries masses of people who have had little or no opportunity to go to school and learn English are excluded from socio-economic activities in their own countries (Prah, 2003).

2.3.2 Apartheid language policy

The apartheid language policy started in 1948. It did not differ much from the colonial language policy in terms of discrimination in that it recognized the two official languages in education, namely, English and Afrikaans. According to this language policy, black children had to be educated in English or Afrikaans from the fourth grade, while the white children learned through their mother tongue(s) (English or Afrikaans) throughout their education lives. White children who received better education also had better opportunities to better jobs than black children because the economic system was also controlled by the white government. The apartheid policy did not only deny black students entry to white schools and universities that were well resourced, but denied them an opportunity to get education through their mother tongue(s) up to tertiary level like their white counterparts.

The apartheid language policy in South Africa was designed to encourage ethnic division between Whites, Coloureds and Indians on the one hand, and blacks on the other hand (Benjamin, 1994:99). Educationally, the Whites who, in most cases, are mother tongue speakers of English or Afrikaans, enjoyed more privileges than Coloureds, Indians and Africans. For example, they received education through their mother tongue and their schools had more and better resources than schools in the African communities, or Indian and Coloured schools. As stated by Bernstein (2001:222), the annual state expenditure on education by 1965 was R158 per white student, while it was R12 per black student. The disparity in funding ensured that whites were getting better education than Indians, Coloureds and Africans.

Although the Indian and Coloured schools were not on par with white schools in terms of facilities and funding, they were, at least, better funded and resourced than African schools (McKay and Chick, 2001:396). As a result, when the new government took over and established a single educational system, many African students moved into former White, Indian and Coloured schools as they were seen to be providing "better education" than black schools.

The discriminatory policies of apartheid in South Africa also reinforced "ethnic grouping" of African or black people according to different languages. The Group Areas Act perpetuated this kind of ethnic and linguistic segregation. For example, people were grouped into homelands according to their languages; the Xhosa-speaking groups were confined to the Ciskei and Transkei homelands (currently referred to as the Eastern Cape Province), while the Zulu speakers occupied Zululand, part of the KwaZulu-Natal Province, and Bophuthatswana was a home of Setswana and SeSotho speakers, while the Venda homeland was occupied by speakers of Tshivenda. The social segregation did not encourage linguistic and social integration among Africans themselves, but it fostered discrimination and conflicts, which in some instances have led to blood shed among blacks. The Group Areas Act was a strategy of the white government to divide and rule the African people.

The introduction of the Bantu Education Act of 1953 strengthened racial inequality in South African education (Hartshone, 1995). The Bantu Education Act forced the use of the mother tongue as the medium of instruction to the end of primary phase (Grade 1 – 8) for all African learners. It came out of recommendations of the Eiselen Commission that was established in 1949. According to the recommendations, black children had to learn through both English and Afrikaans as media of instruction from Grade 9, on a 50:50 basis (Heugh, 2003; Hartshone, 1995). This was a strategy of the apartheid government to retain Afrikaans as a medium of instruction in schools. In 1959 the first Std 6 (equivalent to Grade 8) examinations were written in the home languages of African children under the Department of Bantu Education (Hartshone, 1995).

The former President of South Africa, Nelson Rholihlahla Mandela (1957) highlights the rationale behind the establishment of the Bantu Education Act that was announced by Dr H.F. Verwoerd in September 1953 as follows:

> He (Verwoerd) declared that racial relations could not improve if the wrong type of education was given to Africans. They could not improve if the result of African education was the creation of a frustrated people who, as a result of the education they received, had expectations in life which circumstances in South Africa did not allow to be fulfilled; when it created people who were trained for professions not open to them; when there were people amongst them who had received a form of cultural training which strengthened their desire for white-collar occupations. Above all, good racial relations could not exist when the education was given under the control of people who believed in racial equality (Mandela, 1957:1).

In the light of the above, it can be implied that African learners were only educated to serve the interests of the whites as their education did not prepare them for the same kinds of jobs that white children aspired for. Black children had to remain inferior to white children in terms of education and economic mobility. Hence De Klerk (2000:199) contends that Bantu Education was a way to subject blacks to a confined and isolated semi-literate labour force. The aim of Bantu Education, as stated by Verwoed (1954) was: "not to educate the 'Bantu' above the level of certain forms of labour" (Benjamin, 1994).

Although it may be argued that the Bantu Education Act recognized the importance of the child's mother tongue in education, it was accompanied with lots of disadvantages that could not enhance the black child's academic advancement. The white government did not show any interest in black education, instead signs of impoverishing the children's education became apparent. For example, English mother tongue teachers were removed from black schools, including mission schools; black children were denied entry to white schools and universities, and black schools lacked funding and resources (Heugh, 2003; De Klerk, 2000). So black children had to be taught English by black teachers, who were second language speakers of English, and who were not very competent in the language of instruction as they were also products of the same system that perpetuated inequality. A clear description of Bantu Education is given by Heugh (2003:7) as follows:

> The mother-tongue principle for schooling was a convenient ploy for the NP and it was clearly part of a divide and rule strategy. When applied to black education, it was coupled with inequity in the form of unequal financial resources an an attempt to limit access to English through the insistence on dual medium (Afrikaans-English) in secondary school at the very time it was phasing out dual-medium education for Afrikaans and English speaking pupils. The double standards and reverse logic would not go unnoticed. Obviously, African parents would view Bantu Education with greatest suspicion… African-language speaking parents…assumed that the mother-tongue principle would, in fact, prevent access to knowledge.

Although black schools followed the same syllabus with white schools until 1975, mother tongue education in African languages was associated with inferior education by African parents (Heugh, 2003; De Klerk, 2000). It aimed at producing citizens who could not compete academically, socially and economically with their white counterparts.

Ironically, it is alleged that matriculation results of African students improved during the time of Bantu Education, and reached a peak of 83,7% in 1976 (Prah, 2005; Heugh, 2002). Bantu Education was implemented for negative reasons as discussed above, but the better academic results can be associated with the delayed switch to the second language (English) medium of instruction. The eight years of home or mother tongue education prepared the children well for the switch at the ninth grade (Heugh, 2002:186).

The following table shows the matriculation results during the apartheid education system in South Africa. As mentioned above, after 1976 there was a decline in the pass rate of African or black students. The table does not reflect racial statistics for 1997 and 1998 because after 1994 matriculation results were not published according to racial groups (Heugh, 2002).

Year	African language speaking students	% pass rate	Overall total number of candidates, plus % pass rate)
1955	595	43,5	
1976	9 595	83,7	
1979	14 574	73,5	82 276 (87%)
1980	29 973	53,2	109 807 (75%)
1982	70 241	48,4	139 488 (69%)
1992	342 038	44	448 491 (56%)
1994	392 434	49	495 408 (58%)
1997			559 233 (47,4%)
1998			552 862 (49%)

Adapted from Heugh (2003: 187) – Statistics from SAIRR – Topical briefing (1984); South African Survey, (1995/6, 101 and 1999/2000, 113)

In 1972 the Bantu Education Advisory Board recommended that mother tongue education should be used for the first six years of schooling (up to Std 4), and thereafter English or Afrikaans should be the medium of instruction (Hartshone, 1995). It was later decided that a dual medium of instruction in English and Afrikaans should be followed from the seventh grade (Std 5). This was not well received by the African teachers and learners who had limited proficiency in the two languages, and this led to the 1976 Soweto boycotts and strikes that led to the tragic 16th day of June in 1976 when many African learners like Hector Peterson lost their lives.

The Soweto uprisings of 1976 marked the climax of apartheid education history. African students resisted and protested against the dual medium policy (English and Afrikaans) as they were feeling the strain of having to learn through the medium of two

foreign languages. The National Party government was not prepared to compromise Afrikaans because of the fear that if learners had to choose between the two languages, it would be English. After the Soweto uprisings, which, according to Alexander (1989:25) drew a line across the historical and political map of South Africa, Afrikaans was perceived as a language of oppression and many black people developed negative attitudes towards it, while English became a symbol of liberation or empowerment. The high failure rate of African learners after 1976 can be attributed to the reduction in the number of years of mother tongue education (from eight to four), following the 1976 Soweto uprisings.

The economy of South Africa had been under the control of whites for decades during the apartheid era, and as discussed above, the apartheid education system did not prepare black children to participate in the economy of their country. It created a hierarchy where the whites occupied the top position, followed by Indians and Coloureds, while the blacks were at the lowest level of the hierarchy. Socially, black people were perceived as being capable of playing a master-servant role to whites. In relation to the linguistic and material deprivation of blacks, Cluver (1992:114) comments thus:

> Most South Africans had to attend school, work, and communicate with the government in a second language. Those South Africans who did not know English and Afrikaans could not participate on an equal basis in the administrative or economic affairs of the country (Cluver, 1992:114).

In the following section I discuss the current South African language-in-education policy. The discussion builds on the previous language policies of South Africa (i.e. colonial and apartheid) in order to show progress made thus far, as well as challenges in respect of the new language policy.

2.3.3 Democratic language policy

Haynes (2001: 149) mentions three stages of democracy in South Africa: (i) collapse of apartheid rule, (ii) democratic transition, and (iii) democratic consolidation. The first two

stages aimed at fighting apartheid rule by engaging in negotiations and reforms directed at achieving democracy. They involved negotiations and decisions that demanded cooperation between the white ruling class of apartheid, the National Party (NP), and the major black ruling party, the ANC to effect changes in the new governemt (Haynes, 2001:150). The third stage (democratic consolidation) is marked by the first black rule of the ANC which commenced in 1994, and which came with new changes that had to be effected by the government for democratic progress.

The new government led by the African National Congress (ANC) set out to redress the imbalances of the apartheid system in South Africa. Given the fact that the previous governments (colonial and apartheid) enforced inferior and unequal education for blacks, the new education policy committed itself to achieving "Lifelong Learning" or "Education for All" (Chisholm & Motala, 199:45). The notion of "Education for All" claims that education is the basic human right of every child and it is necessary for self-reliance. The ANC established the Policy Framework for Education and Training, as well as the Reconstruction and Development Programme (RDP) which considered 10 years of quality basic education for all South African children (Chisholm & Motala, 2001:45).

When one reflects on the apartheid language policy that encouraged racial and linguistic inequality between blacks and whites, the new language policy is a very progressive one. It appreciates and accommodates cultural and linguistic diversity and attempts to address all the disadvantages that were suffered by those who were not in power during the apartheid regime (e.g. the exclusion of minority groups from economic participation, linguistic inequality, unequal opportunities of access to education, etc).

South Africa has to be applauded for some achievements in the first decade of democracy. As mentioned in the first chapter, there has been transformation in education with the introduction of the new curriculum (Curriculum 2005 and Outcomes-Based Education) that sees children as active learners who should be empowered with knowledge, skills and values in order to participate meaningfully in their out of school

lives. It is worth mentioning that there are also efforts made to develop the previously disadvantaged languages in the media and other sectors of life (health, justice, etc.) through the establishment of the Pan South African Language Board (PanSALB) and the Provincial Language committees. These language committees are trying to redress the imbalances of the past (e.g. promoting additive bilingualism) despite certain language attitudes associated with the history of our country.

However, there is no clear guidance and follow-up by the government regarding the implementation of multilingualism in schools and public places, hence English is still the dominant language in formal domains such as school and business. Despite the advocated multilingual and multicultural policy in South Africa, African languages are still marginalized in education because they are not used for learning and teaching after Grade 3. Regarding the choice of media of instruction in schools, the government leaves that role to the School Governing Bodies:

> … in determining the language policy of the school, the governing body must stipulate how the school will promote multilingualism through using more than one language of learning and teaching, and/or by offering additional languages as fully-fledged subjects, and/or applying special immersion or language maintenance programmes. (National Department of Education, 1997:8)

Although this clause shows consideration in terms of democracy and parental involvement (school governing bodies), the actual outcomes that the government envisages may be affected by a number of factors. Firstly, for the few elite black parents, decisions with regard to the medium of instruction in African languages do not concern them because they send their children to English medium schools as discussed in the above section. But for the ordinary working class black parents, whose children are adversely affected by the use of English as a medium of instruction, choosing an African language as a language of learning and teaching may also be difficult.

Although it is not explicitly stated in the policy that after Grade 3 learners should be taught in English, it is taken for granted that African learners should switch to English medium of instruction. It is logical that in a country whose history points to the survival of English or Afrikaans speakers in terms of socio-economic advancement, everyone would like to be proficient in the language(s) of economy. Thus many parents or School Governing Bodies choose English as a medium of instruction for their children. Unfortunately, the hegemony of English affects the previously disadvantaged groups only (i.e. the blacks), who are in the majority in terms of population numbers in South Africa. Thus Makalela (2005:155) cautions: "it would be inappropriate to link the preference for English both in the post-1976 Soweto Uprising and the post-apartheid era as a genuine sign of any dislike for learning through African languages."

Indirectly, the current language-in education policy of this country strengthens the existing power relationships by not encouraging other groups (Whites, Coloureds and Indians) to learn African languages. As suggested by Granville et al. (1998:264) all South Africans (non-mother tongue speakers of African languages) should leave school with at least an adequate bilingual competence in at least one African language, and either English or Afrikaans for African learners. This would be a fair practice for all learners, black and white, and the status of African languages could improve. Currently, the native speakers of English and Afrikaans are still placed at an advantage educationally by the present policy. Regarding the implementation of additive multilingualism as suggested by the new language policy, the government has followed a laissez-faire approach in this regard (Webb, 2004; Heugh, 2003). That is, it has failed to put the multilingual policy into practice. The government could advertise that jobs in the state section will only be open to people, who, in addition to English or Afrikaans, also command one of the African languages.

There is a general belief that English opens all doors of life. People who believe in this myth forget that there are successful individuals in the world who do not utter a word of English. There are also people proficient in English who are failures in life. For example, all countries in Europe use their own languages in education. It is surprising

that these people speak better English compared to many black South Africans who are taught in English for more than eight years of their education. Also, they are very advanced in Science and technology. So, it can be argued that English is not the only determiner of ones success or advancement in life. Science and technology can be acquired through ones mother tongue and not only through English as is the case with developed countries like Japan and others (Mazrui, 1990).

Concerning the teaching and learning of all languages for religious and communication purposes, much still needs to be done to achieve this goal. At present, deaf and blind people are still marginalized, especially in education and in the media. Although there are moves to redress this situation through the introduction of inclusive education, the teachers and other service providers should be trained in order to be proficient in the South African Sign language (SASL).

Economically, democracy has led to a wide gap between the majority of poor South Africans, and the minority of black elites and whites. For example, by the end of the 1990s, the richest 20% of blacks accounted for about two-thirds of the total income brought in by black workers (Haynes, 2001:148). The justification by the government for this disparity is that South Africa should compete globally in terms of attracting foreign investors for economic benefits. As argued above, there are many countries who participate very well in the global world with their languages as media of instruction. In these countries English is taught successfully as a subject without losing the mother tongue (e.g. Norway, France, Sweden, Japan, and many others). So the fact that African countries use foreign languages in education for purposes of globalization is not convincing. A lesson can be learnt from the developed countries.

From the above discussion, it may be deduced that whilst language is a good means of communication, it can also promote social and economic inequality. The current Language-in-Education Policy of South Africa aims at redressing the linguistic imbalances of the past, but the reality is that it is still to the advantage of the non-mother tongue speakers of African languages (Afrikaans and English speakers). English and Afrikaans are well-developed and have been the main official languages of South Africa

in the past. Presently, they are still regarded with prestige in official domains like education, especially English. So, the shift of medium of instruction from the fourth year of schooling does not affect English and Afrikaans children as their languages are used as languages of learning and teaching from the first year of their schooling up to and through tertiary education. As a result, many speakers of these languages do not see a need to learn African languages because their languages can offer them socio-economic benefits that African languages do not carry. The African children, on the other hand, are indirectly forced to learn through the medium of English from Grade 4 and throughout their tertiary education. Thus Maake (1994) comments:

> Whites of all political and ideological persuasions have been so comfortable with the privileges that apartheid offered them in the form of cheap labour that they found no need to learn African languages… they were in a situation which never demanded that they associate with the African working class as equals at any time.

For African languages to develop like English and Afrikaans, efforts should be made to encourage and extend their use as languages of learning and teaching (Desai, 2001). The different linguistic and cultural groups of South Africa should be encouraged to learn each other's languages in order to achieve multilingualism. The implementation of multilingualism should be seriously considered along the lines of linguistic equality and national unity. Additive multilingualism is possible if the learners' home languages are used in education, or are not replaced by foreign languages. The following discussion focuses on the importance of mother tongue education.

2.4 Mother tongue education policy

Prah (2003:16) describes the language or medium of instruction as the language in which basic skills and knowledge are imparted to learners. He goes on to say that where the medium of instruction is the same as the mother tongue, it affirms the developmental capacity as a language of culture, science and technology. It also gives confidence to people as a symbol of their history and culture as echoed by Gxilishe (1996) and Gfeller

& Robinson (1998). People become more creative and innovative in their own mother tongues (Prah, 2003:16).

It is generally accepted and has been proven empirically that the mother tongue has psychological and socio-cultural benefits for the child as it enhances continuity in the child's learning process (Bamgbose, 2005; Chumbow, 1990; Hameso, 1997; Elugbe, 1990; Duquette, 1995; Skutnabb-Kangas, 1999; Mazrui, 2002). For example, Chumbow (1990:63) emphasizes the psychological and socio-cultural importance of the child's mother tongue. He links the child's mother tongue to conceptualization and thinking. In other words, the child learns better and develops faster cognitively if s/he receives education in his/her mother tongue. Likewise, the child is socialized in his cultural environment through his mother tongue. That is, it is through the mother tongue that the child is able to express his ideas and feelings clearly and meaningfully.

The psychological benefit of mother tongue education is that it moulds the child's early concepts, i.e. it is the means by which the child conceptualizes and thinks. In other words, it is needed for the cognitive development of the child (Chumbow 1990:63; Skutnabb-Kangas, 1999:58). As the mother tongue is usually transmitted from parents to the child, it corresponds with the life experiences of the child and it enhances continuity in the child's learning process and encourages the child's intellectual development. Duquette (1995:38) is of the view that mother tongue education is meaningful and relevant to the child, and it also facilitates the transfer of first language skills to the outside environment. Hence it is associated with better educational achievement (Bunyi, 1997:54; Hameso, 1997:6).

In the first chapter, the Six Year Primary Project (SYPP) was mentioned briefly. The SYPP which was conducted in Nigeria in the 1970s was an effort to implement mother tongue education. In this project, Yoruba was used as the medium of instruction for the first six years of schooling. The secondary aims of this project were to enrich the curriculum and to develop materials in Yoruba. The teaching of English was also improved by hiring English specialist teachers to serve as good models for the experimental class. "With exposure to a good model of English, it was expected that there

would be considerable improvement in the pupils' mastery of English language" (Bamgbose, 2005:243). The results of this project showed that children who were taught through the medium of Yoruba outperformed their counterparts (in Yoruba, English and Mathematics) who were taught through the medium of English (Bamgbose, 2005; Bunyi, 1997:53). It is interesting to note that the learners who were taught in Yoruba did very well also in English. Thus it can be concluded that the learner's mother tongue is not only beneficial in understanding academic concepts better, but it is also a good foundation for second language learning. Thus Bamgbose (2005: 245) says:

> The outcomes from the SYPP provide strong support for the use of a child's mother tongue for learning and teaching in the primary school. Because this first language is already familiar, learning to read and write in it is easier, and information and understanding of concepts in the mother tongue also facilitate the learning process.

Nevertheless, mother tongue education among African communities is still a very sensitive issue that is not very easy to address. Many African people, especially in South Africa, associate it with inferior education that was enforced by the apartheid government. Since African people were denied access to certain privileges that were enjoyed by whites only, (speakers of English and Afrikaans), they began to believe that the only way to climb the socio-economic ladder was through English. So many parents believe that if their children are taught in English, they will be in a better position to get the better jobs now enjoyed by whites. They seem not to be aware of the psychological and cognitive benefits of mother tongue education.

Hameso (1997) stresses the importance of indigenous languages in education thus:

> Indigenous languages reflect learners' backgrounds or address their needs while positively influencing their educational achievement…They are relevant, practical and necessary for the revival of Africa's institutions… (Hameso, 1997:12).

However, the reality is that almost all the colonized countries in Africa still use the language of their former colonizers. As most of these countries were colonized by either British or French colonials, English and French are still widely used as languages of

teaching and learning in many African countries. Some of the colonized countries have made efforts to reverse the situation by recognizing their indigenous languages in education. Tanzania, Nigeria and Ethiopia are some of the countries that have attempted to use their indigenous languages in education (Bamgbose, 2005).

About 95 – 99% of the Tanzanian population speaks Kiswahili which is a national language. Kiswahili is used as a medium of instruction in primary schools (seven years) and English is taught as a subject. In secondary schools and universities English is used as the medium of instruction. Brock-Utne (2005:51) mentions that Kiswahili is used as a medium of instruction in the Kiswahili Department and the Institute for Kiswahili at the University of Dar es Salaam, and meetings are held in Kiswahili. This is an indication that Kiswahili is not only a unifying national language, but it is used in formal domains at the highest academic levels such as education and research.

Although Tanzania has been among the first African countries to implement mother tongue education, the government objects to the extension of the use of Kiswahili as the medium of instruction beyond primary schooling. The main claim of the objection is that English is a language of research and international communication (NEPI, 1992:53). But my visit to a private primary school in Tanzania (in 2004) where the medium of instruction is English left me with many unanswered questions. Although the school is offering tuition in English, the teachers and learners use textbooks written in Kiswahili. Is English the medium of instruction in reality? Why and how do they use the Kiswahili textbooks in teaching English texts?

Ethiopia, like Tanzania uses an indigenous language, Amharic as a medium of instruction in primary education. The main aim of mother tongue education in this country is to provide access to primary education, and to develop all people in order to eliminate poverty (Boothe & Walker, 1997:2). As a starting point, existing primary school (Grades 1 – 6) textbooks and teachers' guides were translated into nine national languages of Ethiopia, including Amharic. This work was done in 1992 with the help of teachers, communities, donors and non-govermental organizations (NGOs). This initiative

developed positive attitudes of parents, teachers and students towards the use of the mother tongue in education (Boothe & Walker, 1997:13).

In support of mother tongue-based bilingual education in the Western Cape, Alexander (2005:9) suggests that a market value should be created in isiXhosa, which is the marginalized and less developed language in terms of material resources in the Western Cape. In this way, isiXhosa as a medium of instruction will be taken seriously by schools. He also suggests that the translation of existing textbooks into isiXhosa will make a difference, and publishers should be guaranteed of a market to sell these books.

Based on Bamgbose's (2005:249 - 254) observation and experience of mother tongue education in Nigeria, (i.e. the SYPP), the following summary can be drawn:

1) Primary education is more meaningful when conducted in the child's first language.
2) Mother tongue education does not preclude effective education in more than one language.
3) Language education may entail curriculum reform.
4) Terminology need not be an obstacle to mother tongue education.
5) Co-operative effort is required for materials development and terminology creation.
6) Mother-tongue education will lead to a reduction of educational failure.
7) Teaching and research at university level may provide the impetus for improvements in mother-tongue medium education.

The above summary provides a guide that other African countries can explore if they want to implement mother tongue education in African languages. For instance, points 4,

5 and 7 were taken into account as indicated in the previous chapter[10]. In the following section I look at foreign language instruction policy as opposed to mother tongue education policy.

2.5 Foreign language instruction policy

The use of foreign languages (e.g. English, French, Portuguese, etc.) as languages of instruction is a common practice in many African states. This practice can be attributed to a number of factors such as the colonial period that imposed a one-language model for administration, the continuation of the colonial policy in post-colonial education, the obsession of African leaders about economic development through foreign languages, the myth that African languages cannot be used for science and technology, and negative attitudes displayed by African language speakers towards their own languages (Bamgbose, 2005:232). The irony is that medium of instruction policies of many African countries advocate multilingualism, and many African people speak more than one African language, yet multilingualism is seen from the European language perspective. That is, for Africans to attain multilingualism, they should add European or foreign languages to their linguistic repertoire. An African is only called a bilingual if one of the languages s/he speaks is a European language, not if s/he commands two African languages (Brock-Utne, 2006).

There are assumptions underlying the teaching of foreign languages such as English in African schools. The first one is that all primary school teachers can teach in English, and can use it effectively as a medium of instruction. Secondly, children are ready to shift to English medium of instruction from the fourth grade. The third assumption is that the earlier the English medium of instruction, the better the results in terms of proficiency (Bamgbose, 2005:237). These assumptions are not true, instead they lead to educational failure by learners.

[10] As the study forms part of the LOITASA Project, the initiative was taken by three universities, Dar es Salaam, Oslo and the Western Cape. In order to develop science materials in isiXhosa, existing English materials were translated.

With regard to teaching through the medium of English, not all African teachers are competent in English. Some are poor models of both spoken and written English, so the learners' exposure to that kind of environment often leads to poor results or lack of competence in English (Bamgbose, 2005; Heugh, 2003). This kind of situation also leads to regular code-switching and mixing in the classroom in order to explain lesson concepts in the learner's or teacher's mother tongue.

Also, the "earlier-the-better" approach to second language learning is a myth (Bamgbose, 2005; Heugh, 2003). What should be considered is that in most cases African children get very little exposure to English because they are usually taught by teachers who speak their home languages to them (through code-switching). Except for the middle class black elites, the majority of black parents and learners communicate in their home languages at home. So switching over to English at the fourth grade does not in any way help the learners to develop maximum proficiency in English.

Whilst teachers resort to code-switching and code-mixing, the learners are expected to write their examinations in English. Holmardottir's observations in Cape Town schools show that isiXhosa was used for most of the time when the teachers interacted with their learners. After explaining everything in isiXhosa, sentences were written in English on the board (Brock-Utne & Holmarsdottir, 2003:91). That alone confuses the learners as they have to start forming a connection between the verbal statements in their mother tongue, and the statements written in English. Although many teachers make use of code-switching to facilitate learning in their classrooms, they also feel bad about it because they think that it is a "bad practice" that shows their lack of proficiency in the prestigious language. Concerning the teachers' code-switching in the classroom, McLaughlin (1997:2) makes the following remark:

> Most community school teachers…do not speak English well enough to be able to teach the language effectively. So across much of the country there is a situation where teachers lacking in knowledge are expected to do something that they cannot do. The result is that teachers are avoiding the use of English much of the time, or are teaching it badly.

From the above quotation, it can be implied that teachers would resort to code-switching in order to get the message across to the learners. As stated above, this could be attributed to teachers' limited proficiency in English. This often results in producing students with low competence in English. In some cases, the same students are sent back to teach English, probably in the same way. No one would expect good results under such conditions, instead "unofficial" code-switching and mixing in teaching and learning becomes the order of the day.

Learning through the medium of English does not always guarantee proficiency in it. For instance, the majority of African children, especially those that are schooling in the Black township schools and in the rural areas, leave school at Grade 12 (after nine years of immersion in English medium classes) with little proficiency in English, and are unemployable in formal sectors. In the light of this, Granville et al. (1998:257) comment thus: "Students have left school with a less than full competence in English (the language of power) and an inflated view of its importance and value." In other words, in spite of the fact that learners are taught through the medium of English early in their schooling lives, they do not acquire full competence in English. This affects their achievement or performance in subjects taught through the medium of English. In other words, although English is treated with high regard, many learners do not attain full competence in it. This raises a question: Which direction to take – an early or delayed immersion in second language (English) medium?

The other contributing factor to children's limited proficiency in English is that some of the parents cannot understand or speak English, and therefore are unable to support or help their children with their schoolwork. Due to the lack of support from home and school, some of these children become victims of educational failure. Perhaps, the fact that top students in Grade 12 examinations (especially in the Western Cape) are always from ex-white schools where the medium of instruction is either English or Afrikaans (which are home languages of white children), explains the fact that learners learn better in their mother tongue.

Research shows that even the English-medium schools do not give enough academic support to children who are not mother tongue speakers of English. For example, De Klerk's (2000) study on Xhosa-speaking children schooling in an English medium school in Grahamstown shows that some of the children experienced psycho-social problems that affected their performance and behaviour at school. Some of the parents (10%) involved in De Klerk's study revealed that teachers tended to focus on children who are already fluent in English, thus neglecting those who are not yet fluent in this language. As a result, these children become reserved and shy. About 16% of the parents indicated regret in sending their children to these schools, while 60% of the parents expressed fears of losing isiXhosa language and culture.

It is interesting to note that 81% of the parents in De Klerk's (2000) study believed in the maintenance of mother tongue, but needed English for political, economic and educational reasons. The results of this study show that Xhosa speakers are still loyal to their language, but because of the past policies and the economic and political climate of this country, they send their children to schools where they can get better education. Unfortunately, these "well resourced" (ex-white) schools that benefited through the apartheid system do not recognize the linguistic assets that these children bring to school; instead they alienate the children from their languages and culture. That is, the learner's mother tongue is seen as a handicap rather than a resource (McKay & Chick, 2001:401).

Regarding economic development in South Africa, Maake (1994:119) asserts that there would have been an enormous increase if the African language speakers' skills in various fields such as engineering had been met half-way, and their mother tongues utilized in a variety of vocational fields. This means that African languages could be of great use in the future development of South Africa.

In the light of the above discussion, if Africans (including South Africans) are really serious about African Renaissance and "education for all", the following comment by Tollefson (1991:211) should be carefully considered: "A commitment to democracy means that the use of the mother tongue in school is a fundamental human right" (Tollefson, 1991:211).

Education will only be accessible to all learners (education for all) if they are educated in the language they know very well, i.e. their mother tongue. Skutnabb-Kangas & Garcia (1995:234) take this even further by mentioning the principles of 'effective education for all' that include informed parents, enlightened politicians and school administrators, and well educated and committed teachers; as well as well-structured and inclusive educational policies and teaching strategies, rich and diverse materials and fair educational assessment. The relevance of some of these principles will be discussed in Chapters 7 and 8.

Although most African countries opt for early exposure to English medium of instruction, Mazrui (2002) cites claims of "falling standards" in English in educational institutions and in societies as one of the reasons for introducing English earlier. Mazrui (2002:271) cites the media and the National Examination Boards of Uganda and Kenya which complain about the drop in standards in English. He extracted this comment from the 1993 report of the Kenya National Examination Council: "Students cannot follow basic instructions in English and they end up giving irrelevant answers in examinations" (Daily Nation, 1993, August, 14 as cited by Mazrui, 2002). This problem continues up to tertiary level as shown in the following comment by Professor J. Kiptoon of Egerton University (Kenya) who is also quoted by Mazrui (2002:271):

> A good number of employers have complained that many graduates cannot communicate effectively in English which is the official medium of instruction right from the primary to university level.

The above comments about falling standards in English are also true for South Africa. Does early immersion then promote effective learning of English? Does learning occur effectively if learners do not understand the language used in teaching? Is teaching effective if teachers cannot express themselves well in the language of teaching? These questions are addressed in Chapters 7 and 8 of this thesis. Though it appears that in spite of the high status of English in education and learners' early exposure to it, there are many problems underpinning its use as a medium of instruction.

2.6 Post-colonial education and medium-of instruction policies

> Forces which favour the retaining and promotion of English in African education seem to be triumphant. English has continued to serve as the medium of instruction and to enjoy tremendous support in terms of human and material resources…Professional Japanese scientists or social scientists can organize a conference or convention and discuss professional matters almost entirely in Japanese. But a conference of African scientists devoted to scientific matters in an African language is not yet possible (Mazrui, 2002: 269 – 275).

While African countries got their independence from the colonists, many of them retained the colonial languages (English, French or Portuguese) as official languages in government and administration, education, science and technology, and international relations (Molosiwa, 2005:177, Alidou, 2004; Prah, 2003). In many African countries, the retention and promotion of colonial languages (English, French, Portuguese, and others) as media of instruction is still dominant. The global view is that these languages are "major economic languages" with linguistic capital value (Brock-Utne & Hopson, 2005:13). These languages are protected by elites who perceive them as neutral, natural, and beneficial (Prah, 2005:44; Hopson, 2005:94). Prah (2003) and Brock-Utne (2000) refer to this situation where colonial languages are still dominating in the education of African children in post colonialism as the "colonization of the minds of Africans". Mazrui (2002:268) mentions Tanzania and South Africa, in particular, as countries that still support English in education despite their current language policies that aim at developing African languages. He says:

> Even Tanzania, which made major strides to phase out English from its educational system, is now showing signs of back-peddling and reluctance to proceed any further with its Swahilization programme… In spite of South Africa's new language policy to demote both English and Afrikaans and give greater prominence to several African languages, English has gained new ground in this country (Mazrui, 2002:269).

Another factor that influenced the retention of colonial languages in the African education system was the lack of corpus planning in some of the African languages. Because some of the African languages were not used as media of instruction in colonialism, many of them are not developed, and some do not have orthographies

(Alidou, 2004):202). Therefore, this kind of situation encourages the use of colonial languages as media of instruction.

During colonialism, languages of learning and teaching were imposed on Africans (unilateral approach), and very few African languages were used in education. Moreover, there were also few Africans who had access to colonial languages as is explained in Section 2.3.1 of this chapter. In the post-colonial era, language policy problems started in Africa as a result of tensions between different ethnolinguistic groups on the choice of medium of instruction. The colonial languages (English, French, Portuguese, Spanish, etc.) were retained because these languages were perceived as neutral or unifying languages of communication between different language groups (Alidou, 2004).

In relation to the dominance of European languages in education, Tollefson & Tsui (2004:284) view medium-of-instruction policies as ideological and discursive constructs. As ideological constructs, medium-of-instruction policies reflect the interests of the powerful groups in order to expand their political control. The powerful groups usually possess economic power. Such policies often result in linguistic inequality. Medium-of-instruction policies, as discursive constructs, have something to do with social issues among ethnolinguistic groups such as social class, political and economic power (Tollefson & Tsui, 2004:285). The issue of political and economic power is discussed in Section 2.2 above. In the struggle between the more powerful who usually possess economic power, and the powerless, the policy is usually designed to serve the interests of the more powerful groups (Alidou & Mazrui, 1999; Cooper, 1991; Corson, 1990).

In addition to ideological and discursive aspects, medium-of-instruction policies usually reflect a gap between the stated aims and practice (Tollefson & Tsui, 2004:286). The gap is often created by problems of implementation of the policy which relate to social, economic and political power. For instance, the medium-of-instruction policy of South Africa advocates democracy and multilingualism (plural discourse), but the practices strengthen inequality and hegemony of English (monolingual practice) (Webb 2004,

Prah, 2003; Heugh, 2003; Desai, 2001, De Klerk, 2000). The mismatch between policy and practice is a common phenomenon in ex-colonal countries such as India, New Zealand, sub-Saharan Africa, and others (Tollefson & Tsui, 2004). Lack of proper implementation of the initial goals of the language policy usually blocks access of certain ethnolinguistic groups, especially minority groups, to education and employment opportunities.

Medium-of-instruction policies are influenced by lack of resources, especially in ex-colonial African countries. As a consequence, there is always a need for external aid. Alidou (2004), for instance, mentions the role of the World Bank in controlling the medium-of-instruction decisions in sub-Saharan Africa. Actually, Alidou (2004) and Mazrui (2002) allege that the World Bank is reluctant to support programmes that promote the use of national African languages in the former colonies. Many bilingual programmes that have been implemented in sub-Saharan Africa remain experimental projects that are not sustainable due to lack of financial support. This state of affairs encourages the predominance of French and English languages as media of instruction in African schools (Alidou, 2004:204).

Many African scholars recognize the negative effects of colonialism on African education (Alidou, 2004; Webb, 2004; Heugh, 2003, Prah, 2003; Mazrui, 2002; Alexander, 1999, Chumbow, 1997, Hameso, 1997). Some of the negative effects of colonialism include the poor academic achievement of learners taught in colonial languages, high drop out rate and class repetition (Alidou, 2004; Bamgbose, 1991). Referring to a UNESCO study (2000) conducted in two of the Francophone countries (Burkino Faso and Mali), in particular, Alidou (2004:202) voices her concern about the use of French as a medium of instruction:

> Indeed, sub-Saharan African countries that have maintained colonial languages in education continue to be among the poorest, most illiterate, and most poorly educated countries in the world. Countries such as Burkino Faso, Mali, and Niger face both access-and quality-of-education issues, with more than 70% illiteracy among the adult population and only 30% of school-aged children with access to basic education. Those children who attend school face serious educational problems due to their lack of mastery of the medium of instruction. For example, the dropout rate between fifth and sixth grade

> is more than 30% of all students. In addition, there is a high rate of class repetition. According to UNESCO's annual evaluations, more than 35% of all students repeat a class or two before they finish the 6 years of compulsory education. (Alidou, 2004:202)

With regard to the use of English as a medium of instruction for African learners in South Africa, Webb (2004) notes many disadvantages. For instance, he claims that many black South Africans know some English for basic interpersonal communication (in urban areas), but they lack English proficiency for formal learning. He mentions the results of a large survey that was conducted in 1996 in 20 ex-Department of Education and Training (DET) rural schools in the following provinces: Western Cape, Eastern Cape, KwaZulu-Natal, Free State, Northern Cape, and Gauteng. The results of this study show that the learners lacked adequate reading and writing skills as follows:

(a) Only 33.6% of the Grade 5 learners were found to possess "average" reading skills, with 38.5% of the Grade 6 learners and 45.5% of the Grade 7 learners;
(b) Only 7.5% of the Grade 5 learners were found to possess "average" writing skills, with 12.6% of the Grade 6 learners and 19.3% of the Grade 7 learners (Webb, 2004:230).

Heugh (2003) is also concerned with the current language practices in South Africa that tend to have negative effects on the education of African learners. She reflects on the past policies of colonialism and apartheid which marginalized African languages as minority languages with low status in education. Her concern is that the current language-in-education policy perpetuates inequality between English and Afrikaaans on the one hand, and African languages on the other hand. Given the fact that the speakers of African languages constitute about 74,6% of the total South African population, while English and Afrikaans speakers total up to 24,05 % of the population, it is ironic to see that the majority of South Africans are not taught in their languages. Emphasizing the extent of linguistic inequality in the democratic South Africa, she writes:

> Despite the antipathy towards apartheid by the current government, inequality continues to permeate current activities of the state. Just as economic disparity increases, the current practice of linguistic exclusion via education not only reproduces the last 25 years of education under apartheid, but it does so more effectively than under the previous

> government. Catastrophic failure cannot be reversed if the former practices remain in place,… (Heugh, 2003:42).

In the light of the above quotation, linguistic inequality or linguistic imperialism occurs in many African countries. Linguistic imperialism or linguicism perpetuates the dominance of one language over others. English is usually seen as the only key to the economic world while other languages are stigmatized. Regarding the dominance of English in the Third World countries, Phillipson, (1996:341) comments thus:

> The elites in the Third World countries owe their position in part to their proficiency in English, and therefore accord a high priority to the learning of English. Even those not proficient in the language can see what it does for those who are…

Linguicism can be overt or covert (Phillipson, 1996: 341). Overt linguicism refers to a situation where a given language is prohibited in certain environmental settings such as schools. Covert linguicism refers to languages that are not used in formal domains such as education although they are not directly prohibited. The former scenario is common among African schools where learners are prohibited to speak their own languages in the classrooms or in the school premises. Such a situation normally results in "silence" as the learners cannot communicate in a foreign language. In the teaching-learning process, the learners remain passive or silent, regardless of whether they understand or not, because they cannot express their feelings or views due to limited proficiency in the required language which is usually English. Covert linguicism can be associated with the current status of African languages, especially in South Africa, that have official status but are not used in official domains such as schools as languages of instruction.

The theory of linguistic imperialism mirrors the hegemony of English in former colonial states in Africa and abroad (e.g. India). To promote the dominance of English worldwide in the neo-colonial phase, English Language Teaching (ELT) courses are offered for immigrants and minority groups e.g. in Britain and America (Phillipson, 1996:348). Reacting to the dominance of English, Imam (2005:472) comments thus:

> English is considered as a global language and thus both the west and east have become equally busy promoting this language. However, it is time for the developing countries to

> think seriously about who is being most benefited in this language promotion. Why are millions of dollars being invested in language programmes like English Language Teaching (ELT) and Teaching of English to speakers of Other Languages (TESOL)? Is it just for the sake of development? What has English to do with development? Why does one need to adopt someone else's language/identity in order to achieve 'development'?

Imam's (2005) concern above has to do with globalization that reinforces the promotion of English worldwide at the expense of local languages and people's identity. Given the status of English globally, many countries, especially the developed countries depend on it for economic development. Dependency as a syndrome that resulted from colonialism is discussed in Section 2.7.2 below within the context of colonial education policies.

2.7 Globalization and dependency

2.7.1 Globalization

In many countries globalization has led to the introduction of new technologies, access to new markets and the establishment of new industries. Globalization is seen as a means of international trade worldwide. It has given people in developing countries access to knowledge that is beyond their reach, e.g. internet communication, foreign aid and investment, etc. (Stiglitz, 2002; Kennedy, 2000). That is, through globalization people became connected to the whole world by means of technology such as the internet. Also, through globalization the developing countries get opportunities of interaction or collaboration with developed countries (Tsui & Tollefson, 2004:6). The collaboration is often facilitated through the use of language, which in most cases is the language of the more powerful state(s) e.g. the use of European languages in Africa. English, for example, has become the lingua franca of the internet or globalization, and it threatens the use of local languages in education. Thus Tsui & Tollefson (2004:6 - 7) have the following comment about globalization:

> The effect of globalization that leads to linguistic and cultural assimilation is particularly evident in smaller states, whose national languages are not among the major languages, and in developing countries, which are keen to remain competitive and play an active role in the international economy… Although globalization can bring about more

> collaboration amongst countries, it also brings about assimilation of the powerless toward the powerful.

Globalization is driven by the values and rules of economic development. It also affects the politics of the less powerful countries through the media. Global activities need "more educated and multiskilled labour" because they make use of computer technology (Webb, 2004: 224). So education should empower people with knowledge and skills that will enable them to participate effectively in global activities. Concerning the use of foreign language(s) in education in many developing countries, the question is whether these languages empower the citizens with such knowledge and skills, or whether they block them from participating globally.

The three main institutions that govern globalization, namely, the International Monetory Fund (IMF), the World Bank and the World Trade Organization (WTO) have opened opportunities of trade and free market to developing countries (Alidou, 2004; Heugh, 2003; Stiglitz, 2002; Kennedy, 2000; Calvert & Calvert, 1996). The primary aim of the IMF, for instance, is to promote economic growth in the Third World or poor countries. But the relationship between the IMF and the Third World countries is not a good one (Calvert & Calvert, 1996:100). The poor countries do not see their influence on the IMF, and they perceive the IMF as an imposing structure that doesn't serve their economic interests because of the conditions attached to its loans, i.e. short term loans and repayments, among other restricting conditions (Calvert & Calvert, 1996:101). The World Bank is perceived as the main source of funding for poor countries. Although the World Bank is criticized by Alidou (2004) in terms of its reluctance to fund projects that promote the use of African languages in education, it has, however, given loans to many projects in Third World countries.

Globalization widens the gap between the rich and the poor African countries (Stiglitz, 2000). Looking at the different language-in-education policies of South Africa discussed above (colonial, apartheid, democracy), the issue of human capital and economic development and participation in the global market become areas of concern. For example, education is one of the key aspects of economic development in globalization.

In relation to the previous policies and the current South African language policy discussed earlier, it appears that all the policies (past and present) benefited, and are still benefiting the speakers of English and Afrikaans only, and a very small percentage of African elites. In the context of globalization, only these latter groups are capable of participating or competing meaningfully in the economic and global world. The limiting factor for the majority of black South Africans is the European language used in education and in the global market, which is not well understood by the majority of South Africans, especially in rural areas.

For active participation in global activities, there is a need to invest in people (or human capital) by providing food, health and education (Kennedy, 2000:25). Kennedy (2000:25) goes on to say that countries which neglect the development of human capital become losers in globalization. The problem with the development of human capital in many African states is that many people are blocked with respect to economic participation by their language backgrounds. The influence of colonialism in the above case is apparent. Many African countries are still using the languages of their colonizers. In the following discussion colonialism and globalization are discussed within the context of dependency and linguicism.

2.7.2 Dependency

> … large masses of people, and especially peasants, simply accept the social system under which they live without concern about any balance of benefits and pains, certainly without the least thought of whether a better one might be possible, unless and until something happens to threaten and destroy their daily routine (Adam & Moodley, 1986:142)

Pennycook (1994:46) describes the concept of "dependency" within the context of economy, education, communication and culture. In economic terms, he sees dependency as the causal relationship between the development of the metropolitan (urban) areas and underdevelopment of the satellite (rural) areas. He also refers to economic dependency as a relationship between capital and labour which is often

characterized by problems of modernization, exploitation and inequality (Pennycook, 1994:46).

Educationally, dependency in the Third World countries reflects neocolonialism and imperialism as it serves the interests of the former colonizers. Western education results in social and cultural inequalities and is "part of a massive deskilling process of the Third World populations in terms of indigenous systems of language, symbols, art, folklore, music, and knowledge itself" (Pennycook, 1994:49). In terms of communication, Pennycook (1994:49) claims that Third World countries depend largely on the industrialized countries for communication equipment, technology and skills. He sees a problem in this situation as the industrialized benefit financially from the communication networks with the developing countries, while such networks pose a threat to indigenous cultures and to development (Pennycook, 1994:50).

According to Mazrui (1990) dependency involves two forms of relationships between the colonizer and the colonized: the relationships of surplus need and deficit control. In the case of surplus need, the relationship arose as a result of economic needs of the colonizers. That is, before colonization, the colonizers regarded the colonized countries as rich sources of raw materials and labour, while they were also seen as recipients of surplus European populations. On the other hand, the deficit control relationships emerged as a result of the economic demands of the colonized countries on their colonizers i.e. the colonizers were seen as sources of wealth by the colonized countries (Mazrui, 1990). The above scenarios show some kind of mutual dependency between the colonizers and the colonized states. The dependency relationship is driven by politics, and has to do with power relations. That is, the powerless party in the relationship remains dependent on the more powerful party. Such kind of a relationship perpetuates inequality.

In describing dependency, Mazrui (1990) makes reference to the North (Europe) and South (Africa). He mentions a big gap between North and South in terms of technological skills and techniques, in financial income, in military power and in cultural

values and attitudes. Dependency is then sub-divided into economic, military, and cultural spheres (Mazrui, 1990).

In terms of the economy, the developed countries in the North are modernized and are technologically advanced. They have financial and material resources that enable them to do well in the economic market. Unlike African states, they conduct their economic affairs in their local languages, e.g. English, French, or Dutch (NEPI, 1993). On the other hand, African states are underdeveloped, and do not use their languages in education and economic activities. Thay are rated high in terms of illiteracy, hunger, HIV/AIDS, and unemployment. Thus they depend on developed countries of which some were their former colonizers, for economic support and development. Sacrificing their national languages for European languages becomes part of the process of development and modernization.

Economically there was at least a reciprocal exchange between European countries and Africa because the exchange involves export and importing material goods between the concerned countries. But culturally there were no mutual benefits between Europe and Africa. In other words, European countries never had any intention of importing African culture (Mazrui, 1990). Western culture was transmitted through education to the African continent. Consequently, Africans became assimilated to European or Western culture as a result of colonialism. In the process of assimilation or acculturation to Western culture, Africans began to lose their traditional values, including their religion and languages. The loss of African culture was in exchange for Western or European economic riches (Mazrui, 1990). Thus the Africans became economically and culturally dependent on their ex-colonizers.

> Whatever African culture has penetrated Europe has been due far less to organized European policies than to the activities of individual scholars, artists and antiquarians, and to the cultural impact of African slaves imported in the western world…Europe was only prepared to offer its religion, languages and culture to Africans – but only in exchange for land, mines, labour, energy and other economic riches of Africa (Mazrui, 1990:6).

According to the Dependency Theory, many African states are still dependent on the former colonial languages in education, namely English, French, Portuguese, Spanish, Dutch (Vuzo, 2005:60). Linked to dependency, Mazrui (2002) is concerned with the fact that education in Africa seems to be influenced by the Western values at the expense of African educational values and culture. He specifically mentions science and technology as modern packages that "reproduce Africa in the image of the West," and he defines such dependency as "a denial of innovation" (Mazrui, 2002:273). In other words, Africans become assimilated in the Western culture and knowledge, at the expense of their own languages. Prah (2003:7) also contends that cultural dependency accords inferior status to the culture and language of the masses. Hence a medium of instruction that is a colonial language causes social stratification and division among the Africans.

As mentioned above, social divisons are influenced by assimilation of Africans to the Western values. Cultural or linguistic assimilation is normally associated with the black elites who are usually more educated than the masses. These are the people who are usually in power positions, and who have access to economic and technological facilities. They are able to form global networks because they can understand and use the language(s) of the white people. So culture, like economy can be associated with power relations. Prah (2003) claims that cultural and economic freedom will never be attained if the medium of instruction is different from the language(s) that people use in their daily lives.

In the educational context, Alidou & Mazrui (1999) mention intellectual and linguistic dependency which tends to have negative effects on students' learning. They claim that intellectual dependency of African students or scholars occurs as a result of the (foreign) language in which they are taught. That is, the foreign language which is used in the education of many Africans is the source of intellectual dependency. Because of the influence of European languages that are used as media of instruction in Africa, many Africans acquire Western knowledge, and become assimilated in the Western culture at the expense of their own languages (Alidou & Mazrui, 1999). In other words, the intellectual capacity of Africans comprises Western or foreign knowledge which is

imparted in a foreign language. Unlike the developed countries such as China, Japan, and others, which can discuss intellectual matters and conduct economic and technological activities in their own languages, Africa depends on foreign languages to conduct such formal discussions.

> Africa-centred knowledge has become a problem partly because of the foreign origins of the modern educational institutions. The African university, for example, is so uncompromisingly alien in the African context and has been more culturally alienating than it might have been. A whole generation of African graduates has grown up despising its own ancestry and scrambling to imitate others (Alidou & Mazrui, 1999:113).

What becomes clear from this discussion is that dependency is one of the effects of colonialism and globalization on African countries. The current language-in-education policies of many African states strengthen dependency by making use of European languages in teaching and learning. Social and linguistic inequalities are partly the result of the hegemony of European languages in Africa. The following discussion makes a connection between dependency and linguicism.

From the above discussion it can be implied that although the constitution of South Africa advocates national unity, the language policy runs parallel to this vision. Instead of strengthening unity among the different language groups, the language policy continues to divide European language (English and Afrikaans) speakers and African language speakers. In fact, the few black elites enjoy more or less similar status with English and Afrikaans speakers as some of them can access better education and economic structures through European languages, particularly English. This kind of linguistic discrimination in South Africa is now hidden under the cover of democracy, while the acts of segregation and discrimination were open in the previous government of apartheid.

Many linguists maintain that the present democracy in South Africa retains many features of apartheid (Webb, 2004; Heugh, 2003, Prah, 2003; Haynes, 2001, Webb, 1998). The only difference, according to Haynes (2001), is that: “what had formerly been the political and economic domination of a small *white* elite changed to be controlled by a

numerically small group of powerful *black* elites linked to the ANC." As a result problems of democratic stability and consolidation arise because the majority of black South Africans remain excluded from economic affairs. In addition to politics, the influence of globalization also plays a role in the education systems of many countries. Thus it can be argued that colonialism and globalization have an impact on the choice of language(s) of learning and teaching in general.

2.8 Summary

From the foregoing discussion it is apparent that foreign languages like English, French and Portuguese are still dominant as languages of learning and teaching in the African continent. In other words, the effects of colonialism are still prevailing in Africa despite its colonial independence. Globalization appears to be perpetuating the hegemony of these foreign languages in Africa as languages of development in the economy and political power. As a result, access to socio-economic benefits is usually determined by one's proficiency in foreign languages because communication in the global world is mainly through foreign languages. This kind of situation leads to social stratification between elite people who are literate in foreign languages and the masses who lack proficiency in these languages.

In the South African context, English is dominant over African languages despite the fact that the African languages too have official status. The hegemony of English has implications for the implementation of the current progressive language-in-education policy. Educationally, the dominance of English over African languages seems to have a negative impact on the teaching-learning process where the teachers and learners are not native speakers of English. In the following chapter, I look at language acquisition theories in order to understand the relationship between language and learners' cognitive abilities, and how the language of instruction influences interaction between the teacher and learners in the classroom.

CHAPTER 3

LANGUAGE ACQUISITION THEORIES AND CLASSROOM INTERACTION

3.1 Introduction

As discussed in the previous chapter, learning in a foreign language appears to be a disadvantage to many learners in Africa. In this chapter I look at the process of language acquisition (first and second languages) in order to explain the role played by first and second languages in facilitating classroom interaction. The discussion in this chapter also explores various factors which influence language learning, which in turn influence knowledge construction in the teaching-learning process. In short, it looks at how the first (L1) and second (L2) languages are acquired, and how the acquired knowledge is used to facilitate meaningful interaction or communication in the classroom.

In this chapter I focus on theories on classroom interaction and language acquisition. Following McLaughlin's (1987:7) description of the functions of theories, namely, understanding, transformation and prediction, the discussion in this chapter aims at understanding how teacher-learner interaction occurs when there is a mismatch between the learners' L1 and the medium of instruction; and also when the medium of instruction is the learners' L1 and teacher's L1. Thus it discusses language acquisition theories on the basis of teacher-learner interaction in order to predict data-driven findings which are discussed in Chapter 8. In relation to theories, Gopnik (1999:305) emphasizes the interpretive effects of theories i.e. theories lead to interpretations or sometimes interpretations of evidence. This study, as mentioned in Chapter 1 is guided by the interepretivist paradigm which seeks to make meaningful interpretations of the collected data. So theories discussed in this chapter aim at paving ways towards data analysis and interpretation which are discussed in Chapter 7.

Both interaction and language acquisition theories emphasize the importance of language competence in classroom communication or interaction (Shrum & Glisan, 2000; Gleason, 1989:187). That is, the two theories assume that if a person has acquired sufficient competence in the language being learned, it is likely that s/he can understand what is being said to him. Conversely, his/her speech can be understood by others in the process of interaction. In support of the importance of language competence in interaction, Bohannon & Warren-Leubeker (1989:188) believe that what children know about language (competence) can be measured through what they say and understand (performance) within the context of interaction. In this study, data that denote learners' language competence and classroom interaction are presented in detail in Chapter 6.

In explaining how learners get input from the environment, and how language input is processed into output, I have made reference to Krashen's (1981) Monitor Model. The Monitor Model gives a clue on how children acquire or learn a language, and how they produce or control their speech utterances. The Monitor Model is used in order to understand and interpret learners' and teachers' utterances which are reflected in Chapter 6.

The interactionist theory incorporates Vygotsky's (1978) sociocultural theory. Vygotsky's sociocultural theory is used to explain how language is used by teachers and learners to mediate learning. At the centre of mediation is language (input). In other words, the sociocultural aspect features in this study in terms of clarifying how language input is processed through social interaction (between teachers and learners, and between learners themselves) to produce meaningful outputs. In a nutshell, the sociocultural theory highlights the roles of the different participants (teacher and learners) in classroom interaction. To illustrate the status and the role of the learners' L1 and the L2 in classroom interaction, models of bilingual education are discussed within the South African context.

In all, this chapter discusses the theoretical framework which underpins data analysis in this research. The key theory which forms the backbone of this study is interactionist theory which is within the interpretivist research paradigm as explained in the first

chapter. The interactionist theory takes into account how language is used to construct knowledge in teaching-learning, and therefore, it is discussed in relation to other theories such as socio-cultural and constructivist theories.

3.2 Interactionist theory

The interactionist theory claims that learning occurs as a result of interaction between the linguistic environment and the learner's internal or innate environment (Ellis, 1997:44). That is, learning is seen as an interrelationship between internal (innate) and external (environmental) factors. Thus Freeman & Freeman (1994:103) describe interactionist theory as the theory of "nature and nurture." In terms of "nature", the theory assumes that children have to reach a certain level of cognitive development in order to acquire a language, while "nurture" refers to the importance of the experience that the learner gets from the environment (Bohannon & Warren-Leubeker, 1989:187).

Interactionist theory builds on Nativist theory which believes that all humans have a Language Acquisition Device (LAD) which is a kind of built-in language ability (Freeman & Freeman, 1994:85). The LAD is a mental structure which is associated with assimilation and accommodation processes that are core aspects of Piaget's theory of cognitive development. Relating to assimilation and accommodation, the learner adjusts hi/her internalized system to make it fit the new input. Similarly, for learning to take place, according to Piaget, the learner has to internalize or assimilate new knowledge and adjust or change existing knowledge as she adds new input (Ellis, 1985:254). In this process, the learner constructs her knowledge, building on previous experiences. That is, an interplay or interaction occurs between existing and new knowledge (Leach & Scott, 2000:43).

Linked to language acquisition, interactionist theory holds that learning or acquiring a language is both a cognitive and social process. In other words, language is acquired by means of mental or cognitive structures (e.g. the LAD). Cognitive learning processes imply that children select relevant information, elaborate and organize the information in a coherent manner, and integrate the new information with existing information. Learning

also takes place in a social situation where people interact with each other (Ohta, 2000:53; Cook, 1993:128).

Language is used as a tool to express information and ideas in different forms (e.g. discussions and arguments, narrations and descriptions, natural language, etc.). Science involves coming to understand, talk and think about scientific concepts (Leach & Scott, 2000; Philip, 2000). It has a unique or specialized language that is used to develop scientific knowledge e.g. graphs, charts, mathematical symbols and equations, etc. (Jones, 2000:88). It is therefore important that the teacher and learners understand the language of science for effective communication in the science classroom. Mutual understanding between the teacher and the learners has to do with the kind of (natural) language used in the classroom, i.e. whether both parties (teacher and learners) have proficiency in the language of interaction. If one of the people involved in the interaction is not proficient or has low level of proficiency in the language of interaction, communication breakdowns may result. Thus it is important to understand the processes involved in effective communication in the classroom. I now move on to discuss the process of language acquisition.

3.3 Language Acquisition

Following Krashen's Monitor Model of language acquisition, I make a distinction between acquisition and learning. Referring to second language acquisition (SLA), Krashen's Monitor Model assumes that language is acquired and learned. Acquired knowledge is gained naturally in informal situations while learning occurs through formal instruction. Language acquisition then occurs subconsciously through natural communication or exposure to the Target Language (TL), while learning occurs consciously as the learner studies the linguistic rules of the TL (Cook, 1993:126; Ellis, 1985:261, Klein, 1986:28; Towell & Hawkins, 1994:26). Acquired knowledge is referred to as implicit knowledge (knowledge of the language), and learnt knowledge is known as explicit knowledge (knowledge about the language). Acquisition leads to spontaneous, unplanned communication, while learning involves knowing the rules of the

language, being aware of them, and being able to talk about them (Shrim & Glisan, 2000:3; Gas & Selinker, 1994:144).

In relation to the interactionist theory underpinning this study, the above distinction between acquisition and learning as processes of SLA shows that both acquisition and learning involve interaction between two or more individuals. Although it is claimed that acquisition is natural and informal, in the process of acquisition the learner must interact with the natural environment e.g. family, parents, friends, etc. Likewise, for learning to take place through formal instruction, the learner should interact with the person or tutor who will teach him the structure and grammatical rules of the TL. In summary, language acquisition and learning involve interaction, irrespective of what language one learns (i.e. whether it is the L1 or the L2).

3.3.1 First and Second Language Acquisition (FLA and SLA)

Based on the above description of acquisition and learning, first language acquisition (FLA) can be associated with 'acquisition' (natural or subconscious process) and second language acquisition (SLA) can be associated with "learning' (conscious process). If acquired knowledge is gained subconsciously or naturally, then the child's L1 should be acquired rather than learnt because the child's L1 is always used in his immediate environment for him to pick it up quickly and subconsciously. Thus linguists claim that the first language (L1) is acquired by any normal child and its acquisition is guaranteed during the first few years of life unless the child has physiological defects such as deafness (Shrum & Glisan, 2000:3; Le Roux, 1994:24; Klein, 1986:3). As explained in Section 3.1 above, the LAD facilitates L1 acquisition by providing the child with a mental grammar or Universal Grammar (UG) of the language being acquired. The child is able to acquire the L1 without formal instruction because of the innate ability (LAD) for language acquisition.

Second Language Acquisition (SLA), on the other hand, can be defined as a process by which a language other than the mother tongue is learnt inside or outside of a classroom (Ellis, 1997:3; 1985:6). SLA can occur naturally (subconsciously) through exposure to

the second language (L2) input, or it can take place in a tutored setting or formal instruction (consciously). So it appears that all L1 knowledge is acquired knowledge while some of L2 knowledge is acquired and learned. Thus le Roux (1994:24) claims that FLA is guaranteed while SLA cannot be guaranteed because FLA occurs naturally and effectively (under normal conditions) as the child interacts with the family, while SLA may be hindered by certain external factors such as the quality and amount of exposure to the TL, and many others. SLA involves the acquisition of various aspects of the target language (TL) such as phonology, lexicon, grammar and pragmatics in a more conscious way than is the case with FLA (Ellis, 1985:6, Towell & Hawkins, 1994:26).

As mentioned above, the other determining factor in language acquisition is exposure to the language being learned, i.e. the target language (TL). The child has greater exposure to the L1 than the L2 because the L1 is normally used or heard from immediate surroundings such as family and friends. It should be noted, however, that it is possible that in some cases a learner can be more exposed to the L2 than his L1, depending on a number of factors such as the language used in his neighbourhood, the role of the L2 in the community, etc. For example, an immigrant child whose language is not spoken in the country can get more exposure to the TL, thus leading to faster acquisition of the TL.

The other difference between FLA and SLA lies in linguistic rules. In FLA the rules of the language or language elements (e.g. vocabulary, phonology, morphology, syntax, etc.) develop unconsciously. The children manage to construct mental grammar on the basis of what they hear in their immediate environment. As stated above, the children have innate capacity to acquire knowledge, the Language Acquisition Device (LAD). The Language Acquisition Device (LAD) is responsible for the child's effortless acquisition of the first language. The LAD is associated with the learner's Universal Grammar (UG) which forms a background against which any language process occurs (Towell & Hawkins, 1994:246; Cook, 1993:116; Klein, 1986:7). Hence children are able to produce grammatically correct utterances without any formal training or teaching (Freeman & Freeman, 1994:67; Klein, 1986:6). In the language acquisition process, especially with the L1, the UG principles are triggered by the input the child receives. That is, there is an

interaction between the mental processes (LAD) and external processes (input). Thus FLA is associated with cognitive development (Klein, 1993).

In SLA the learner develops an interlanguage which influences her comprehension and production of the TL. The interlanguage (IL) is a unique abstract linguistic system of grammatical rules that is different from the learner's L1 and the TL (Ellis, 1997:33). Second language learners usually make use of learning strategies to develop their interlanguages (e.g. paraphrasing, coining, L1 transfer and avoidance). Linguistic errors such as omissions of certain linguistic structures, overuse, overgeneralization, sociolinguistic errors and transfer indicate that learners create their own rules of the language as they learn an L2. These errors show gaps in the learner's L2 knowledge (Ellis, 1985:20). The grammatical errors can fossilize in SLA (i.e. they become a permanent part of the way a person speaks or writes a language). Incorrect linguistic usage does not fossilize in FLA (Ellis, 1997:34). As a result, fossilization and foreign accent usually characterize SLA, while there is no foreign accent in a child's L1.

FLA is also associated with social development and it is linked to social identity (Klein, 1986:6). It plays an important role in social development as it enables the child to express her feelings, ideas, wishes, etc. in a socially accepted manner through interaction with others. In order for the learner to communicate fluently in the language, she should have grammatical, pragmatic and communicative competence. That is, she should be able to use the grammar of the language correctly (grammatical competence), and at the same time she should use the language appropriately in different situations (e.g. apologizing, requesting, being polite, etc). In FLA, it is possible for the child to acquire the three different competences naturally as discussed in the above sections. But for SLA, the learner may not be able to acquire all the types of language competence. That is, the L2 learner's utterances may sometimes be marked by inappropriate phrases or incorrect words (e.g. pronouns, prepositions, etc.) in an attempt to communicate or to convey a message.

The distinction between FLA and SLA enables me to understand the teachers' and learners' oral and written discourse as presented in Chapter 6. As the participants

(teachers and learners) of the study are L2 speakers of English, I could analyze interaction between the teachers and learners on the basis of my understanding of FLA and SLA. For instance, Ellis (1985:37) claims that the learner's L1 is a resource in learning additional languages as L1 knowledge can be transferred to L2.

> …when learners experience difficulty in communicating an idea because they lack the necessary target language resources, they will resort to their first language (L1) to make up the insufficiency. This explains why the L1 is relied on more at the beginning of the learning process… (Ellis, 1985:37)

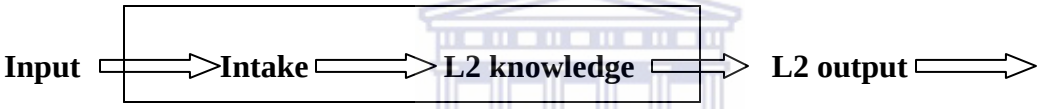
Given the fact that science understanding is enhanced by using a specialized language of science (Jones, 2000:95), the language in which science is taught to learners is crucial (i.e. the input). The influence of the L1 and L2 in science teaching and learning is discussed at length in Chapter 4. In the following section I look at language input as a source of L2 knowledge.

3.3.2 Language Input and Output

The Input Hypothesis of Krashen's Monitor Model looks at the kind of language input received by the learner during the learning process. The input (i) refers to the language that is heard or read by the learner (Gas & Selinker, 1994:146). The input stimulates the innate structure of language acquisition (LAD). For effective language learning the input should be comprehensible in that it should be a little higher than the learner's current grammatical knowledge (i + 1). The formula (i + 1) denotes input (i) which must be beyond or a little higher than (+1) the current competence of the learner. If the input contains what the learner already knows, or if it is at a very high level of the learner's current knowledge, it will not be useful to the learner. That is, the input must be at the right level (i + 1) for effective acquisition and learning (Gas & Selinker, 1994; Ellis, 1985). By implication, for effective language acquisition, the input should not be too easy or too difficult. It should be simple so that it can be understood easily by everyone, especially second-language learners.

In relation to interactionist theory, the Input Hypothesis requires an interaction between a more capable individual and a less capable person in the teaching-learning setting. The

fact that the input should be at a higher level (i + 1) indicates that the person mediating learning should be more knowledgeable than the learner, so that the learner can be scaffolded to reach a higher level of development (i.e. the Zone of Proximal Development - ZPD) as discussed in Section 3.4 below. The input should be comprehensible for learning to take place effectively. Thus the Input Hypothesis of Krashen's Monitor Model can also be associated with Vygotsky's sociocultural theory which focuses on language development from childhood through adulthood (Donato, 2000:45). The language is developed socially as teachers and learners interact with each other through mediation and scaffolding. The following sketch shows how the learner receives input from the environment (external), and how the mental (internal) structures interact with the input to produce L2 utterances (output).



Source: (Ellis, 1997:35)

Exposure to the input occurs in a social context where the learner interacts with the social environment. The box represents the child's mind where the input is transformed into intake which is processed into short term memory. The processed input is stored in the long term memory as L2 knowledge that can be produced verbally or in written form as an output (Ellis, 1997:35). This explanation of input processing supports the interaction theory as a theory of 'nature' and 'nurture' (i.e. a theory that looks at the mental and social aspects of interaction).

As shown in the above sketch (Ellis, 1997:35), the interaction between the outside or external input and internal or mental structures results in the production of utterances or speech. The speech is monitored or controlled for correctness. According to the Monitor Hypothesis of Krashen's Model, the monitor is a device used by the learners, especially L2 learners to modify, check or edit their language use or performance (Shrim & Glisan, 2000:3; Ellis, 1985:262). That is, the learner can monitor or control his output in the form of self-correction when necessary. But the monitor cannot be used all the time (Gas

& Selinker, 1994:145). The learner usually uses learned knowledge to modify utterances (e.g. correcting grammar, word order, etc.). Monitoring one's utterances can be effective in communication if there is enough time to do it; if the speaker focuses on the correctness of the speech production; and if the speaker knows the correct rules relating to the speech form (Shrum & Glisan, 2000:3; Ellis, 1985:262; Klein, 1986:28). Monitored speech usually focuses on form rather than meaning. Following interaction data analysis, the data on teacher-learner interaction presented in Chapter 6 captures some aspects of monitored speech.

Skehan (1998:16) perceives output as a means of generating better input or efficient learning through feedback. In other words, in the process of communication, the utterances one produces can be modified according to the feedback one receives from the listener. Similarly, the listener makes use of his language knowledge to produce utterances. The output helps to develop an individual's automaticity, discourse skills and personal voice (Skehan, 1998:18 – 19). That is, it enables the speaker to link together the various components of utterances to create meaning and to express his views openly.

The Affective Filter Hypothesis explains why not everyone is successful in learning the L2 (i.e. it accounts for individual differences in SLA). The amount of input that is changed into intake is controlled in the learner's mind depending on whether or not it is comprehensible to the learner. Gas & Selinker (1994:147) explain the filter as follows:

> If the filter is up, input is prevented from passing through; if input is prevented from passing through, there can be no acquisition. On the other hand, if the filter is down or low, and if the input is comprehensible, the input will reach the acquisition device and acquisition will take place (Gas & Selinker, 1994:147)

The control of input is also affected by factors such as the learner's motivation, self confidence or anxiety. For instance, learners with high motivation and self confidence are seen to be having low filters, and they can obtain or allow more input in. They learn better and faster than learners with high filters. On the other hand, learners who are less motivated, with little self confidence have high filters. They receive little input and allow less in (le Roux, 1994; Ellis, 1985:263). So, acquisition appears to be controlled by two

factors: comprehensible input that is at the right level of the learner (i + 1), and the affective filter (low or high) to control the amount of input.

A common thread between Krashen's Monitor Model and the interactionist theory is that interaction occurs between an individual's innate and external structures in SLA. As mentioned earlier, comprehensible input is important for meaningful output. The interaction between the internal and external factors has pedagogical implications. For example, the kind and quality of input that learners receive in the classroom is important because it influences the kind of outputs they will produce at the end. For example, if learners are exposed to poor input, it is likely that they will have poor outputs too. In the case of language learning, if the teacher has low competence in the TL, the learners will be exposed to input of poor quality, and the likelihood is poor output by the learners. Conversely, if the teacher is proficient in the TL, the children will be exposed to an input of good quality, and the output may be of good quality too.

The situation becomes worse if the language in which both the teacher and learners have low proficiency is the medium of instruction. Such a situation can lead to communication breakdowns, misunderstanding and frustration. In the teaching-learning process, the learners have to grasp language skills in the TL as well as academic content of the subject, which is likely not to happen if the learners are exposed to poor input. Thus Freeman & Freeman (1994:168) have this to say about learning in an L2:

> … we cannot learn what we do not understand. If demonstrations are in English, nonnative speakers may not understand what they are seeing or hearing and won't choose to engage in the activity. Non-participation in the classroom may convince the learners that they can't learn.

Freeman & Freeman (1994:168) are of the view that L1 instruction has more benefits than L2 instruction. The L1 provides the learner with comprehensible input to develop linguistic and academic proficiencies. They claim that language and thinking are interrelated. So a learner who learns through her L1 can develop concepts and negotiate meaning better than in an L2.

According to the RNCS Statement for Languages (2002:4), which is in line with the South African Language-in-Education Policy, the home, first additional and second additional languages are approached differently in schools:

- The home language assessment standards assume that learners come to school able to understand and speak the language. They support the development of this competence, especially with regard to various types of literacy (reading, writing, visual, and critical literacies). They provide a strong curriculum to support the language of learning and teaching.
- The first additional language assumes that learners do not necessarily have any knowledge when they arrive at school. The curriculum starts by developing learners' ability to understand and speak the language. On this foundation, it builds literacies. Learners are able to transfer the literacies they have acquired in their home language to their first additional language. The curriculum provides strong support for those learners who will use their first additional language as a language of learning and teaching…

Although many researchers on SLA agree that young children acquire an L2 faster and better than old learners (Towell & Hawkins, 1994; Klein, 1986; Ellis, 1985), such an advantage could not be guaranteed with these learners because of their limited exposure to English. Actually, the interaction analysis and discussion in Chapter 7 touches on the issue of academic proficiency and L2 proficiency.

Linguistic distance between the learners' L1 and L2 is another factor that influences SLA. For instance, in the case of isiXhosa (L1) and English (L2), the linguistic distance is wide between the two languages. IsiXhosa belongs to the Bantu language family which is not cognate with European languages. Moreover, isiXhosa is characterized by an agglutinating morphological structure. Unlike English, isiXhosa has no auxiliary verb system in asking questions, nor does it distinguish between masculine and feminine forms, to mention but a few differences (Gxilishe, 1996). So it is not easy for an isiXhosa (L1) speaker to associate some of the aspects of the L1 with English, especially morphological and grammatical structures.

The above discussion shows that it is possible for an individual to learn another additional language as an L2 after he has acquired the L1. Of importance in SLA is the interaction between cognitive processes and environmental factors to produce meaningful utterances (output). Krashen's Monitor Model of SLA has been used to illustrate some of

the processes of SLA and how they relate to interactionist theory. It is apparent that the interactionist theory is supported by other theories that explain how learning is mediated in the classroom (e.g. Vygotsky's sociocultural theory). The role of the L1 as a symbol of cultural identity and as a resource in SLA is also another point of importance in SLA. In the following section, I look at the role of language as a mediator in classroom interaction.

3.4 Classroom interaction

Ellis (1992:2) describes classroom interaction as the "fundamental fact of pedagogy" which provides opportunities for negotiating comprehensible input. Comprehensible input refers to input that can be understood by other people involved in the communication process. For effective interaction and learning in the classroom in a foreign language, Shrum & Glisan (2000:14-15) suggest that learners should be provided with the following:

- comprehensible input in the TL.
- an interactive environment that models and presents a variety of social, linguistic and cognitive tools for structuring and interpreting participation in talk.
- opportunities for learners to negotiate meaning in the TL, with assistance from the teacher and one another.
- opportunities for learners to interact communicatively with one another in the TL.
- conversations and tasks that are purposeful and meaningful to the learner.
- a non-threatening environment that encourages self-expression.

Firstly, classroom interaction is guided by a certain goal or purpose. Ellis (1985:148; 1992:2) mentions three basic pedagogic goals of interaction in the L2 classroom: (i) core goals, (ii) framework goals and (iii) social goals. The core goal relates to the actual purpose of the lesson e.g. teaching a specific aspect of the lesson while framework goals are concerned with the necessary requirements to organize the lesson (e.g. giving out materials or classroom management). Social goals refer to the use of language for personal purposes such as greeting, apologizing, etc. All these goals influence the kind

of communication or interaction in the language classroom because the language (TL) can be used as a medium of instruction or as a means of managing lessons (Shrum & Glisan, 2000:7).

In line with the goals of language learning, Ellis (1992:2) mentions the setting as another factor that may influence SLA. For instance, the language used by learners differs according to settings such as the classroom, playground, recess, etc. In some cases learners tend to use formal language, e.g. in the classrooms while they may use informal language in the playground or with friends.

In an L2 classroom there are many challenges that confront both teachers and learners in terms of accessing comprehensible input. Firstly, if the teacher is the native speaker of the TL, she may encounter problems communicating effectively and negotiating meaning if the learners are not native speakers of the TL. There may be communication breakdowns that may have negative effects on the learning process. Secondly, the learners may be anxious about making mistakes and remain silent or passive in the classroom. Anxiety is one of the factors that have a negative influence on L2 learning. It often occurs because learners have fears of communicating in a language in which they are not fluent; hence anxiety and silence are common among L2 learners who have low proficiency in the L2. It must be noted, however, that silence in the class may be due to language learning anxiety, rather than incompetence in learning the subject matter. For instance, Tsui (1996:154) makes the following comments about her observation of English L2 students in Hong Kong:

> Most students in Hong Kong will not ask the teacher even if they do not understand what the teacher is saying, especially if the students have to ask in English. When the students remain silent, the teacher has no way of knowing what the problem is. Hence no remedial measures are taken. This leads to further incomprehension, resulting in further silence.

Likewise, if both the teachers and learners are non-native speakers of the TL more problems in terms of language interaction may be expected. The teachers themselves may find it difficult to communicate in the medium of the L2, while the learners may not understand lessons in the L2. The input that the learners get is likely to be

incomprehensible (e.g. incorrect utterances, vague questions, etc.). In such a situation both the teachers and learners resort to the L1 as a communicative resort through code-switching. Adendorff (1996:389) describes code-switching as a spontaneous and functional communicative resource that assists the teacher and students to accomplish educational objectives.

As stated above, the learning of science involves learning the language of science such as grammatical metaphors or condensation of words to explain cause and effect such as "photosynthesis, polymerization, etc." (Keys, 1999:1046; Monk & Dillon, 1995:95). The language of science also involves pictures, graphs, tables, unfamiliar vocabulary, etc. Classroom communication often involves speaking, reading and writing (literacy) to convey meaning. Urquhart & Weir (1998) refer to literacy as reading, writing, numeracy and document processing. A minimal level of literacy is needed to enable one to read and write simple messages, but functional literacy is necessary for sophisticated functions such as comprehension, interacting and interpreting written data (Urquhart & Weir, 1998:20). In most cases the learners are functionally literate in the L1, and may have a minimal level of literacy in the L2. According to Keys (1999), writing fosters the generation of knowledge in science, and written language encourages learners to make connections between concepts, to discover and extend their knowledge. Given the fact that science has a special language as stated above, and it is a subject that demands learners to investigate, observe experiments, and interpret data, learners may experience difficulties in performing these functions effectively if they have limited literacy in the language used in learning.

Classroom interaction is also influenced by the three phases of discourse exchange, namely, initiate-respond-feedback (IRF) (Ellis, 1992:2). IRF reflects the three types of address in communication: the speaker, the listener and the hearer. IRF exchange restricts the learners to perform the language acts as they have to respond to roles assigned to them (Ellis, 1990:2). In IRF exchange, the pupils normally respond to the teacher's questions and such kind of interaction does not equip the learners for communication outside the classroom. This kind of interaction is associated with

transmission or traditional mode of teaching where the teacher takes control of the lesson content and management. In the science classroom, particularly, it inhibits learners from working out relationships and meanings of scientific concepts (Jones, 2000; Ellis, 1985:147).

In relation to IRF exchange in classroom interaction, Tsui (1996:149), in her study of factors that caused reticence and anxiety among L2 learners in Hong Kong noted that English L2 students showed less confidence in initiating questions or providing answers due to their low English proficiency. The students were not willing to take risks, and they only answered when they were asked by the teacher. He also noticed that there was an uneven allocation of turns to students in terms of answering questions. In other words, the teachers tended to ask brighter students more often. They used this strategy to get the correct answers and to avoid not getting responses from other students (Tsui, 1996:154). In cases where there were no responses from students, the teachers provided the answers themselves instead of showing patience by giving more time for students to think. In relation to this study, an analysis of classroom interaction is discussed at length in Chapter 7. In the next section, I present the actual classroom interactions that may be employed to enhance teaching and learning. The interactions are discussed from the sociocultural perspective based on Vygotsky's (1987) sociocultural theory.

3.5 Sociocultural theory and classroom interaction

At the centre of interactionist theory is Vygotsky's (1978) sociocultural theory. Socicultural theory perceives language as a tool for developing thoughts, and it believes that all learning is social (Freeman & Freeman, 1994:57). It takes into consideration the role of social interaction in learning and development. That is, sociocultural theory sees learning and development as cognitive and social processes that occur as a result of interaction between 'experts' (more capable) and 'novices' (less capable) (Shrum & Glisan, 2000:7). In the context of this study, the experts are teachers while the novices are the learners who have to be assisted to get to a higher level of development by means

of interaction through language. For effective learning to take place, collaborative interaction is necessary.

There are three concepts that are involved in learning within the sociocultural theory, namely, the Zone of Proximal Development (ZPD), mediation and scaffolding and scientific concepts (Freeman & Freeman, 1994:57; Shrum & Glisan, 2000).

3.5.1 Zone of Proximal Development (ZPD)

Vygotsky's (1978) Zone of Proximal Development (ZPD) assumes that the learner brings two levels of development to the learning task: (i) what the learner can do or the actual developmental level, (ii) what the learner should be able to do in the future or potential devopmental level. As the learner interacts with others, she progresses from the actual developmental level to the potential developmental level. The distance between these two developmental levels is referred to as the Zone of Proximal Development (Lantolf, 2000; Shrum & Glisan, 2000; Ohta, 2000; Freeman & Freeman, 1994).

For learning to take place, instruction must occur in the learner's ZPD (Freeman & Freeman, 1994:57). In other words, the learner must be guided by an adult (teacher in this case) to reach his potential developmental level. The interaction between the learner and the teacher is scaffolding. Scaffolding is a collaborative process which enhances learning by providing assistance to one another (Ohta, 2000:52). In the process of scaffolding, the expert (teacher or more capable peer) supports the learner until he reaches a stage when he can do the tasks without the teacher's or expert's support. Thus Freeman & Freeman (1994:59) perceive a scaffold as a temporary framework for a building or construction because it supports a building during its construction, and then it is taken down once the building is finished. In this case, construction refers to knowledge construction or meaning making.

The ZPD or learner's attainment of his potential level has implications for the teaching approaches that the teacher employs in the lessons, as well as the kind of interactions that

occur in the classroom between the teacher and the learner, and between the learner and his peers. Problem-solving under the teacher's guidance (or a parent or a more capable peer) is seen as one of the effective strategies of achieving the ZPD (Shrum & Glisan, 2000:8). Collaborative or interactive learning in the form of group work is also essential as children learn from each other. Effectiveness in the ZPD depends on a number of factors such as the expertise of the helper, the nature of the task, the goal of the task, and the developmental level of the learner (Ohta, 2000:52). For instance, if the helper is not more knowledgeable than the learner (e.g. i + 1), or the task is too easy, or there is too much assistance, the development of the learner may be negatively affected.

The learner's level of actual development can be seen when the learner is performing a task without assistance from a more knowledgeable person. But when he is able to do the learning tasks under the guidance of a more capable individual, he is working on his potential level of development. The ZPD is only reached when the learner can do the task without assistance. The ZPD level then becomes the actual level of development for further learning. This shows that performance and assistance in learning complement each other (Shrum & Glisan, 2000:8).

It should be noted, however, that language is very crucial as a tool of interaction in the achievement of the ZPD. If there is a mismatch between the languages of the people or parties involved in interaction, it may be difficult for learners to get into a higher or potential level of development. For instance, if there is no mutual understanding between the teacher and the learner, learning can hardly take place. Thus Freeman & Freeman (1994) and Shrum & Glisan (2000) put forward the importance of language in sociocultural theory.

3.5.2 Mediation

Within the sociocultural paradigm, learners make sense of the world around them by means of certain tools. Such tools include the language used in social interaction, visual materials, learning activities, direct instruction or teacher assistance, etc. (Shrum &

Glisan, 2000:11). These tools mediate between the learner and the world. In simple terms, mediation can be defined as a way of assisting the learner to make sense of what is being learned by making use of various tools.

Language is regarded as a tool that enables people to organize and control mental processes such as planning, problem solving and learning (Shrum & Glisan, 2000:11). Through questions and answers, demonstrations and discussions, etc. new knowledge can be mediated with the learners. Collaborative activities such as group work facilitate language learning. The students learn new skills by interacting with each other. That is, more knowledgeable learners can assist others to reach higher levels of understanding through social interaction. This implies that it is not the teacher only who acts as a mediator; learners who have more capability than others can also mediate learning. Language is important as a tool of mediation, whether mediation occurs between teachers and learners or between learners themselves.

Shrum & Glisan (2000:11) mention learner's private speech (i.e. speech of the self or whispering to the self) as another mediating tool. Private speech is described as the convergence of language and thought. It occurs when a learner speaks aloud, and it helps to clarify certain tasks or to seek a solution to a problem. Language play occurs within private speech as learners experiment with language features (e.g. grammar, phonology, lexicon) by imitating other people or repeating their own utterances (Shrum & Glisan, 2000:11). Language play creates a ZPD because the learner makes efforts to do even more than what she is supposed to do at a particular time.

The ZPD and mediation relate to the transactional view of learning which sees the learner as an explorer. The learner is given an opportunity to construct knowledge by posing problems and raising questions to reflect on new experiences (Freeman & Freeman, 1994:59). In line with interactionist and sociocultural theories, Chamot and O'Malley (1994:375) mention cognitive and social strategies which mediate learning. Cognitive strategies involve the following: relating new knowledge with existing knowledge, making inferences, linguistic transfer, imagery, deductions and inductions,

summarizing, etc. These strategies have to do with interacting with materials to be learned. Social strategies, on the other hand, include questioning for clarification, co-operation with teacher or peers and self talk. Both strategies (cognitive and social) have implications for language competence. For instance, the learner may be able to make inferences in a text only if she has comprehended the text. Comprehension has to do with the language used in the text (i.e. whether the learner understands the language or not). Likewise, a learner can be confident enough to ask questions if he is comfortable enough with the language he uses to ask for clarification. As mentioned above, learners may keep silent without understanding if they do not have sufficient proficiency in the language of interaction.

The above discussion shows that language development is through input, output and interaction. The kind of output produced by the learner depends on the input she receives. The (language) input has implications for effective teaching and learning. If the input is incomprehensible, it may not result in effective learning. The determining factor in comprehension is usually the language of communication, i.e. whether it is a familiar or unfamiliar language. In the following section I focus on bilingual education which takes into account the learner's L1 and L2 in education. As a point of departure, I provide a brief description of bilingualism.

3.6 Bilingualism

It is not easy to describe bilingualism without referring to multilingualism because many people around the world speak more than two languages. Hence multilingualism is considered to be a norm among many language groups of the world (Grosjean, 1982). Multilingualism is accelerated by language contact among different groups of people. As people move around the world for various reasons such as business, immigration, studies, etc. they come into contact with other people. People communicate or interact with each other through languages. So when groups of people speaking different languages come into contact, they have to improvise means of communication in order to understand each

other. In cases of language contact, one of the options of facilitating communication or interaction is to learn one another's language/s. That means each group/person learns an additional language/s which could be an L2 or L3 in order to fit within the new situation. Such a situation leads to bilingualism or multilingualism. In the context of this study, however, I will use the term bilingualism to refer to competence in two languages, namely, isiXhosa (L1) and English (L2).

The relationship between the groups coming in contact determines who learns whose language. For instance, in cases of minority groups, perhaps in terms of size or of the status of the language they speak, they may be forced to learn the language of the dominant group. This situation may lead to inequalities between people where one of the languages will be dominant (Grosjean, 1982). In other words, attached to bilingualism or multilingualism are aspects of inequality which sometimes have to do with power and politics of the concerned groups of people or languages. In the context of Africa, it is, however, the majority groups that are forced to learn the language of the minority group.

In the South African context, I support Heugh's (2002:188) point that children grow up in bilingual homes or in multilingual homes. Many African language speakers, for instance, usually speak more than two languages, including English. Following the above discussion of SLA in section 3.3, this section will focus on bilingualism as it applies to competence in two languages (L1 and L2). Also, in line with the context of this study, there are two languages involved as languages of learning and teaching, isiXhosa and English. Therefore, I will base this discussion on learners' competence in the two languages.

3.6.1 Defining Bilingualism

There are many definitions of bilingualism, depending on the context of language use. Bilingualism can be described in terms of the purpose of acquisition (of additional language/s), as well as the function of language/s within that particular speech community. For example, there is individual and societal bilingualism (Hoffman,

1991:161; Romaine, 1995:23). Individual bilingualism occurs within an individual (i.e. when a person acquires an additional language for her personal use), while societal bilingualism refers to groups or populations acquiring other languages for specific purposes such as business or acceptance within a particular area.

With regard to societal bilingualism, the acquisition of the additional language could be linked to social factors such as seeking refuge among populations of different languages. In societal bilingualism the more powerful groups usually enforce their language upon the less powerful groups (Hoffman, 1991). As a result, the language of the powerful group becomes a dominant language, while the language of the less powerful group may be marginalized, and can be used only by its speakers when they communicate with each other.

Grosjean's (1994:1656) description of bilingualism has to do with the role of languages within the society and the speakers' competence in the languages concerned. He refers to bilingualism as the ability to produce meaningful utterances in two or more languages for different purposes. If language is used for different purposes, it is implied that it is used differently in different domains and with different people. So if someone is competent in two languages, one of the languages will be used for specific purposes such as education and business, while the other one may be used informally with family and friends only.

Secondly, Grosjean (1994) claims that bilinguals rarely develop equal fluency in their languages. For instance, a bilingual can read and write in one language, and can have low level of fluency in a language which is used with a limited number of people. One would assume that the bilingual would be more fluent in her L1, with less fluency in the L2. The other assumption that one would make is that the L1 would be the language used in formal domains, (e.g. in education, business) and informally (with family and friends who know the language), while the L2 would be used in special or limited domains where the speaker cannot use the L1 (e.g. speaking to someone who doesn't understand the speaker's L1, or learning the L2 as a subject in school). This is the situation in Europe

where people use their own languages in education and for most formal functions and use an L2 for communication with people who do not understand L1.

In the context of this research, however, a different scenario arises. The learners' L1 (isiXhosa), despite its official status and being one of the languages with the highest number of speakers in the country, is not widely used like English in education. Although it serves important communication functions in other domains such as religion and cultural activities, its use is limited in education because it is used as a language of learning and teaching only for the first three years of schooling, as explained in Chapter 1. On the basis of the above description and assumptions, and the benefits of learning through the L1 as discussed in the previous chapters, it would be expected that the learners' L1 should have a higher status in education. The following section on bilingual education will pursue this point further.

Furthermore, Grosjean (1994:1657) mentions two aspects of bilingualism: a monolingual mode and a bilingual mode. In a monolingual mode the bilingual speaks or writes to monolinguals in one of the languages he knows, whereas in a bilingual mode he communicates with other bilinguals who know the same languages. The monolingual mode restricts the speaker to use one language irrespective of the level of fluency in the language of interaction. The possibility is that there could be communication breakdowns or misunderstandings if one of the speakers does not have high levels of competence in the language used. The scope of communication appears wider in the bilingual mode because the people involved in communication or interaction can mix languages through code-switching or borrowing as they are able to understand both languages. In fact, code switching or borrowing could be used to bridge a gap when one of the speakers is struggling to understand the other language. The following reasons usually influence language switches among bilinguals:

- The speaker may feel more competent in handling a topic in a particular language (e.g. having more appropriate vocabulary in that language).
- The other language may not possess the required terms.

- One language may be considered to be better to talk about a particular subject or topic (Hoffman, 1994:178).

As mentioned above, bilinguals who know the same languages usually choose or adopt a language of interaction. The choice of language of interaction is influenced by factors such as: (i) the speakers or interlocutors involved (age, sex, occupation, kinship relation, etc.), (ii) the situation of interaction (formal, intimate, etc.), (iii) the content of discourse (topic, vocabulary, etc.), and (iv) the function of the interaction e.g. to apologize, to request something, to exclude someone, etc. (Grosjean, 1994:1658; Hoffman, 1994:178). For instance, speakers of the same age or sex can use a language that they will both understand (e.g. tsotsitaal[11]), and that may not be used when speaking to a person of a different age (e.g. an adult). Similarly, a language used in the classroom (with teachers), for example, will be different from a language that children use in the playground with friends. In the case of content discourse, one may think of language used in science discourses that may be different from language used in social sciences as it may, for example, include calculations, graphs, formulas, etc. as illustrated in the sections above.

Diglossia is mentioned as another type of bilingualism where the two languages or varieties of the same language (high status and low status varieties) are used in different domains. For instance, the high status language or variety (H) has a well-developed literature, and is used in government and education, while the low status language (L) is spoken by the community and rarely appears in written form at all. The low status language is usually used at home and among family and friends, and in informal and private domains. The high status language is usually used formally in education as a medium of instruction.

The diglossic situation relates to the status of English in South Africa. In Chapter 2 the hegemony of English is discussed at length. English dominates in all formal domains

[11] Tsotsitaal originated from Afrikaans and it is a kind of informal language that is commonly used by young people when they communicate with each other. It is is a mixture of different languages and it is common among urban youth.

such as education and business, while African languages do not have the same prestige, although they all have an official status. English is used as a medium of instruction, and, as Heugh (2003:174) puts it: "At no point is the position of English questioned or threatened".

Ironically, the notion of diglossia within the South African context also describes the variation that occurs within isiXhosa as a language. While English is a high status language worldwide, there are also inequalities within isiXhosa. IsiXhosa is heterogenous in that it has nine mutually intelligible dialects which are not accorded the same status in education. Nomlomo's study (1993) on the impact of isiXhosa varieties on children's learning shows that the non-standardized isiXhosa dialects are stigmatized in the classroom. The stigmatization of these dialects does not only affect the learners' academic performance in the classroom, but also their self concepts (Nomlomo, 1993). Depending on what dialect the learner speaks, he may be disadvantaged educationally in his own language. In addition to that, he may have to face other challenges in the English classroom. Although one may argue that isiXhosa dialects are predominantly used in rural Eastern Cape, particularly in the former Transkei homeland, some of the learners involved in the study grew up in the Eastern Cape, and some still go there during holidays. So the influence of isiXhosa dialects on the learners' speech forms and understanding of lessons cannot be ruled out completely.

In relation to acquisition of an additional language, Letts (1991:352) distinguishes between simultaneous bilingualism and sequential bilingualism. Simultaneous bilingualism is attained when the child has more or less equal exposure to two languages from birth. This usually happens when the parents have different languages, and the two languages are both used to communicate with the child, or when there are two languages that are used equally within the child's immediate environment (not necessarily with parents). The child will learn the two languages at the same time. When the child goes to school at the age of seven, for example, he can communicate fluently in the two languages, and may start learning an additional language at school. In sequential

bilingualism the child is exposed to the other language after he has acquired another language (e.g. SLA).

The latter can be associated with the current situation in South Africa where the majority of children learn an additional language (L2) as a subject from the first year of schooling. The difference lies in the extent of the use of the L2 in the classroom, and the learners' exposure to it. For children who are L1 speakers of either English or Afrikaans, they are always exposed to their languages at home and at school because they are used as media of instruction from the first grade to university. On the other hand, African language speaking children learn in their L1s for the first three years of schooling, and thereafter they switch to an L2, which is English in most cases.

Secondly, Afrikaans and English speakers get enough exposure to the language of learning and teaching because it is used in their immediate environment (home, media, playgrounds) and at school. Thirdly, both English and Afrikaans, as the official languages of the previous apartheid regime, are well developed, and have plenty of resources (e.g. books, magazines, newspapers) which support children's learning of an additional language.

It is my assumption that the majority of Afrikaans and English-speaking parents are usually literate in the two languages, and they are in a good position to assist their children in learning one of the two languages (English or Afrikaans), whereas some African language speaking parents, especially the rural and working class people, have low competence in English and/or Afrikaans. So supporting their children in learning an L2 may not be possible. This has implications for SLA and academic performance in subjects that are taught through the L2. Chapter 7 highlights the effects of learning through the L1 and L2 in science.

Linguistic diversity can either be an advantage or a disadvantage where there are many official languages. Its advantage can be seen in terms of promoting multilingualism, and of uniting linguistically diverse groups by using languages (i.e. multingualism as a

resource for communication purposes). On the other hand, diversity in languages can lead to linguistic inequality in that some of the languages may be accorded higher status, while others are given lower status. In a country like South Africa, for example, which has different ethnic groups who speak different languages, multilingualism is inevitable. In the following section I focus on bilingual education models in order to identify the models that are suitable for the South African context.

3.6.2 Bilingual Education in South Africa

Many countries around the world have bilingual education programmes, e.g. in East Africa, China, India, Canada, and many others (Corson, 1190:162). In support of bilingual education, Skutnabb-Kangas (1999:42) states that a good bilingual educational programme should accomplish the following goals:

1) High levels of multilingualism.
2) A fair chance of achieving academically at school.
3) Positive multilingual and multicultural identity and positive attitudes toward self and others.

The three goals correspond with the new South African Language-in-Education Policy in terms of striving for multilingualism and multiculturalism. They also relate to the new curriculum in terms of promoting success for learners (i.e. seeing learners as achievers) (RNCS, 2002). Achievement is matched with multilingualism which would imply learning additional languages, and/or making use of different languages as media of instruction. In line with the goals of the South African Language-in-Education Policy (1997), the Languages Learning Area Statement also supports an additive approach to bi/multilingualism as follows:

- All learners learn their home language and at least one official language.
- Learners become competent in their additional language, while their home language is maintained and developed.

- All learners learn an African language for a minimum of three years by the end of the General Education and Training Band. In some circumstances, it may be learned as a second language.

The first two goals support an additive approach to bilingualism, while the third one assumes that African language speakers have to switch over to a second language in the fourth grade. The Language-in-Education Policy doesn't clearly specify the language to which learners should switch. As argued by Heugh (2001:12), the underlying assumption is that English should be the medium of instruction from the fourth grade. The other assumption is that non-mother tongue speakers of African languages (English and Afrikaans) do not have to learn African languages. If they learn an African language, it has to be for three years only, whereas their African counterparts have to learn through an L2 from the fourth grade. This kind of approach perpetuates inequality that was started by the apartheid education system. With regard to inequality in the current education system, Heugh (2001:12) comments about mother tongue education (MTE) thus:

> MTE continues uninterrupted throughout the education system, on the other hand, for speakers of English and Afrikaans. This disparity is one of the critical reasons why education for the majority of South Africans remains disastrously inequitable, even after the official end of apartheid.

Many linguists working with minority populations in the North distinguish between two types of bilingualism in education: additive and subtractive (Ellis, 1994; Corson, 1990; Skutnabb-Kangas, 1999, etc.). Additive bilingualism is a phenomenon whereby learners retain their L1, and learn an L2 as an additional language. In most cases, in maintaining additive bilingualism the learners' L1 and L2 are both used as media of instruction. Additive bilingualism is usually influenced by the learner's attitudes towards the TL. For example, when the learner has a positive attitude towards his linguistic and cultural identity, and that of the TL, he can become competent in both languages, and in that way additive bilingualism can be attained (Ellis, 1994:208).

In contrast, subtractive bilingualism occurs when learners replace their L1 with the L2. Subtractive bilingualism normally occurs when the learner's L1 is used for the early

years of schooling, after which the L2 takes over as a medium of instruction. In this case, the L1 is used for transition to the L2 (Corson, 1990:161). Subtractive bilingualism is common among learners who want to assimilate into the TL culture. As a result of subtractive bilingualism, learners sometimes fail to develop full competence in their L2 or lose the L1 competence they already acquired. Lack of L1 and L2 competence usually results in semilingualism (Ellis, 1994:208; Corson, 1990, Skutnabb-Kangas, 1999).

Within the South African context, additive bilingualism seems to benefit only a few individuals. In fact, Afrikaans and English-speaking learners are the only people who can be associated with this kind of bilingualism. As stated above, African language speaking children get tuition in their own languages for the first three years of schooling. By the time they go to the fourth grade they do not have well developed BICS and enough vocabulary to cope with English as a medium of instruction in all the subjects. There are myths that are put forward in preventing African languages, specifically in South Africa, from becoming media of instruction. Heugh (2002:177) mentions the following:

1. There is little or no indigenous South African research.
2. Parents want straight for English.
3. In South Africa English is the only language which has the capacity to deliver quality education to the majority: African languages do not and cannot.
4. African language speaking children are multilingual and therefore do not need mother tongue education.
5. Bilingual or multilingual education is too expensive and we have only one option: English only (or mainly).

Recent research that has been conducted in the different provinces of South Africa shows that African language speaking children do not perform well in subjects taught through the medium of English (Langenhoven, 2005; Desai, 2001; De Klerk, 2000; Webb, 1999; McKay & Chick, 1996, and many others). The results of these studies give enough research evidence, and what needs to be done is to implement the means of reversing the

situation or intervening. This research study, (though at a very small scale), is also a means of extending knowledge of what happens when an African language (isiXhosa) is used beyond Grade 3. In all, attempts in the form of research have been, and are still being made to show that the majority of children suffer educationally due to the question of medium of instruction.

The second myth relating to parents who want their children to be taught in English only needs to be contextualized. With the present economic climate that is conducted through English, all parents would like their children to gain access to English. Secondly, the legacy of apartheid of unequal division of resources and facilities in schools (white and black schools) influences the parents'choice of sending their children to ex-white schools as they are better resourced than black schools. But this choice involves only a few black middle class parents (who can afford the high costs of the ex-white schools) as De Klerk's (2000) study on Xhosa speaking children in Grahamstown ex-white schools shows. The majority of African children who belong to working class homes, especially in the rural areas and townships, are the people who are negatively affected by the use of English as a medium of instruction throughout their schooling years. Research evidence shows that not all African parents want their children to be taught through English only. For example, the NEPI (1992) and the Mark Data/PanSALB (2000) reports indicate that parents want to maintain their home languages as media of instruction, alongside English (L2). This study too gives evidence that some parents would like their children to learn English as a subject, without replacing the home language (isiXhosa) as a medium of instruction. Such evidence is discussed at length in Chapters 6 and 7.

Regarding the third myth that English is the only language which has the capacity to deliver quality education, how is quality attained if there are misunderstandings and communication breakdowns in the classroom due to lack of proficiency by both teachers and learners in the language of instruction (English)? In making this claim of quality education through English only, one must consider the kind of English input that the learners get in the classroom. In fact, as a researcher and supervisor of Post Graduate in Education (PGCE) students who go out on teaching practice, over the eight years that I

have been doing this job, there is very little English used in classrooms with African learners. In fact, I have also noticed that practising teachers with good teaching experience also use very little English in the classroom. My discussion in Chapter 6 dwells much on this issue, i.e. the language used for interaction in the classroom.

Moreover, it has been argued in the above sections that limited exposure to English is another hindering factor to gaining linguistic and academic proficiency in the language. From this kind of situation, one would expect poor performance by learners when compared to their counterparts who are English (L1) or Afrikaans (L1) speakers who learn through their own languages throughout their schooling years. In fact, poor examination results among black learners as opposed to their white, and to a lesser extent coloured counterparts, especially in the Western Cape, could be associated with the language/s used in teaching and learning (Cape Argus, 2005). Heugh's (2002:190 - 191) observation about the use of English by teachers is as follows:

> Most of the primary school teachers with whom PRAESA comes into contact do not themselves have sufficient English to teach through English. They do not teach in English despite the fact that they think they should and the fact that they say they teach through English. We hear teachers code-switching, but more often than they are code-mixing… This is the closest they can get to English medium, but it is not English medium. Pretending that an English only or mainly option is viable under these conditions is not responsible.

The high costs of bilingual or mother tongue education cannot be measured against the costs of having learners fail or dropping out of school due to the fact that they cannot cope with the medium of instruction, as Brock-Utne (2001) argues. The South African Matric (Grade 12) results too show that many African learners fail their examinations, and those who manage to pass get lower grades than their Afrikaans or English speaking counterparts (Cape Argus, 2005). Heugh (2002:190) also claims that only 27% of the South African pupils who begin school exit with a school-leaving certificate after Grade 12. Of interest is what happens to these learners along the way between Grade 1 and Grade 12. Also, who are these learners - Afrikaans/English/African language speakers? Perhaps research in this area will give a better picture or strengthen the language debates in education. In the following section, I discuss bilingualism within the bilingual models

suggested by Skutnabb-Kangas (1999) in order to determine the model that can best fit the South African context.

3.6.3 Bilingual Education Models

Skutnabb-Kangas (1999) mentions educational models (nonmodels, weak models and strong models) that relate to either additive or subtractive bilingualism. These models worked well for minority immigrants in industrialized countries. They may not fit the African situation. The nonmodels, for example, promote one (dominant) language over others, and usually lead to monolingualism. In this case, one would think of the dominance of English over other languages in education in the world (including South Africa).

The weak models lead to assimilation into the TL culture, and they do not promote multilingualism because the learners whose L1 is a low status language, are forced to learn through the medium of the L2. In most cases the teachers do not speak the language of the learners, and subsequently, the children gradually lose their language. The weak models often lead to subtractive bilingualism. They are also associated with submersion or 'sink-or-swim' programmes (Skutnabb-Kangas, 1999:42). In other words, the learner is educated through the medium of the L2 at the expense of the L1. Submersion often results in poor school achievement (Phillipson, Skutnabb-Kangas & Africa, 1986:82). The 'sink-or-swim' programmes are applicable in many African countries where African learners learn through a foreign language that is not properly taught, and in the process of learning the L2, their L1s do not develop (Romaine, 2000; Skutnabb-Kangas, 1999).

The nonmodels and weak models are also associated with "Deficiency Theory" which perceives learners who learn through an L2 as being handicapped (or having no potential). The learners' deficiencies are related to their parents' lack of proficiency in the dominant (L2) language; low socio-economic status of their parents (lack of education, unemployment, etc.) that affects the kind of support that children get at home;

cultural clashes and the learners' lack of competence in their L1 that impacts negatively on the learning of the L2 (Skutnabb-Kangas, 1999:45). The Deficiency Theory makes sense when related to the context of this study. In Chapter 5, the parents' profiles that include their educational qualifications and places of employment are given. The profiles show that the majority of parents have very low levels of education, and many are unemployed. The effects of the low economic status of parents are discussed in Chapter 7.

The strong models, on the other hand, strengthen the use of the learners' L1 in education. They aim at promoting multilingualism and multiculturalism by following the additive bilingual education approach. The strong models can be associated with better academic achievement because the learners' L1 is usually the medium of instruction. They can also be associated with immersion programmes where learners are given greater exposure to the TL. According to Phillipson, Skutnabb-Kangas and Africa (1986:82) the main goal of immersion programmes is linguistic and cultural enrichment. Learners are not stripped of their language and cultural identity, but are helped to develop them.

Immersion programmes often lead to high levels of bilingualism and success at school because both the home language of the learners and the school language are treated equally and the learners are helped to master both languages. Immersion programmes have been used successfully in many developed countries like America, Finland, Sweden, Canada, etc. The Canadian immersion programmes, for example, are mentioned as the most successful programmes where children who are predominantly of English-language background are taught through the French medium (Pattanayak, 1986:82; Romaine, 2000:230). In these programmes the learners are taught by well trained bilingual teachers, and the learners' L1s are not threatened as they are also used in teaching (Skutnabb-Kangas, 1999:49; Pattanayak, 1986; Phillipson, Skutnabb-Kangas & Africa, 1986). This situation does not match the context of this research as the teachers and learners use a foreign language in which they have limited proficiency in the classroom.

Some linguists recommend a delayed switch to the additional or second language (L2). In delayed immersion the learners are first taught through the medium of their first language (L1) in the early years of schooling, and later taught through the medium of a second language. Skutnabb-Kangas (1999:46) refers to this type of programme as the 'transitional programme' which sees the mother tongue as useful only to enhance the knowledge of the dominant language, and thereafter there is a shift to the medium of the dominant language. In this case, the mother tongue is of instrumental value only. This model is followed by many African countries including Botswana, Ghana, Malawi, Nigeria, Seychelles, South Africa, Swaziland, Uganda and Zimbabwe (NEPI, 1992:50). In these countries the mother tongue is used as a medium of instruction for the first few (3-4) years of schooling, and thereafter there is a shift to English (second language).

The Six Year Primary Project (SYPP) of Nigeria on which this study is based as stated in Chapter 1, is a good example of delayed transition. The SYPP resulted in effective use of Yoruba as a language of instruction in Science, Mathematics and Cultural Studies. Teachers were trained in the effective use of the mother tongue as a medium of instruction and many books were published in this language (NEPI 1992:51). The delayed switch to the L2 resulted in better academic achievement of learners, which showed learners' cognitive and linguistic maturity.

If one compares the language situations prevailing in many African countries with the models mentioned above, one will note that most of the African countries follow the submersion model. Many (black) children in the African continent are educated in their L2s from a very early age. With regard to South Africa, in particular, Heugh (2003) raises her concern about how bilingualism is handled currently when she says:

> Bilingual education for each child within a multilingual education policy does not mean a choice between either English or an African language (including Afrikaans). It means developing the first language and adding a second language in the best possible manner to ensure the successful learning of a second language….The country's political, economic and social future depends upon the successful education of its youth. If the majority of the youth continue to be failed, the socio-economic differences which existed during apartheid will not change very much (Heugh, 2003:193).

In the light of this quotation (Heugh, 2003), the concept of additive bilingualism/multilingualism which is at the forefront of the new Language-in-Education Policy still remains a dream for the majority of learners in this country, i.e. black learners. The intention of additive bilingualism is a very good and progressive one, but the problem lies with its implementation in schools. To foster linguistic equality is still a challenge in South Africa, and unfortunately, linguistic inequality that prevails affects the same groups who were adversely affected by the apartheid system.

3.8 Summary

In summary, my discussion in this chapter is based on interactionist theory which deals with internal and external processes involved in language learning. It shows that learning is influenced by the kind of input which learners receive during the learning process. For effective learning to take place, the learner should get comprehensible input from a knowledgeable individual that can be processed into meaningful output. Learning also depends on the kind of exposure and mediation that is available to the learner. Language is seen as the best mediator in learning. If there is a mismatch between the languages of the mediator and that of the learner, learning may not be successful. Similarly, if the learner does not get enough exposure to the language being learnt, learning may not be effective. So the quality of output is determined by the quality of input.

Educationally, the learner's L1 seems to be an advantage not only in understanding academic content, but it also helps the learner in acquiring the L2. SLA may lead to different levels of bilingualism, e.g. additive or subtractive bilingualism. Although having competence in more than one language is an advantage in terms of mutual understanding, it appears that it may also lead to linguistic inequality among different groups. The inequality perpetuates subtractive bilingualism as some people lose their L1 as they learn the L2, especially if the L2 is a dominant language of education or business.

The discussion in this chapter is underpinned by interactionist theory which emphasizes the importance of cognitive and environmental factors in learning. The cognitive

structures refer to mentally controlled processes such as speech, while external factors may refer to the input that the learner receives from home, or from the playground or from school. The implication is that learning is a cognitive and social interaction. Hence the learners' cognitive and social development should be stimulated in any classroom interaction. This interactionist theoretical background forms the basis of discussion for science teaching and learning in the following chapter. It also guides data presentation and analysis in Chapters 6 and 7.

CHAPTER 4

SCIENCE TEACHING AND LEARNING

4.1 Introduction

The previous chapter dealt with the theories of language acquisition and the role of language in mediating learning in the classroom. It focused on the relationship between language and classroom interaction by stressing the importance of comprehensible language input in the learning process. The logic is that if the learner receives sufficient exposure to the TL and comprehensible TL input, s/he can produce meaningful language output. Conversely, insufficient exposure to the TL with inadequate TL input, may lead to the production of poor or meaningless output by the learner.

Firstly, on the basis of the discussions in Chapter 2 which point to colonialism and globalization as factors which have legitimated English as the official medium through which science and technology are best communicated in many developing countries, this chapter focuses on the actual process of teaching and learning science in primary schools. The aim is to highlight the relationship between language and science teaching and learning. As a starting point, this chapter analyzes the concepts of scientific literacy, and teaching and learning as they apply to the Natural Sciences Learning Area[12] of the South African curriculum, the Revised National Curriculum Statement (RNCS).

Secondly, it highlights the key learning outcomes of the Natural Sciences Learning Area and the various teaching and learning approaches that are relevant to the teaching of science in primary schools. In line with the Natural Sciences Learning Area Outcomes, the teaching and learning approaches are discussed in order to illuminate how they can be

[12] Natural Sciences Learning Area is one of the eight Learning Areas that came into being on the introduction of OBE in 1994. This Learning Area encompasses all science subjects such as physical science, biology, etc. In this study, it is used to refer broadly to the cluster under which science for Grades 4, 5 and 6 belongs.

used effectively to promote scientific knowledge construction. In other words, this chapter stresses the constructivist approach as a means of creating meaning in science teaching and learning. Science knowledge construction is discussed in relation to the role of language in enhancing science teaching and learning.

4.2 Conceptualizing teaching and learning

Firstly, it is necessary to understand what "teaching" entails before getting into "creative ways of teaching". Broadly, teaching can be defined as a part of a bigger whole that comprises the teacher, the learner, the disciplinary content, the teaching/learning process, and the evaluation of both the teacher and the learner (National Research Council, 1997:2). Learning, on the other hand, involves the acquisition of knowledge, skills, values or attitudes that can be applied in different domains. Learning, according to Guthrie (1991:156) distinguishes humans from other primates because it enables humans to develop language and tool making. Thus humans, unlike lower animals, are able to communicate and express their thoughts, feelings and emotions through language.

Pedagogically, it is very difficult to separate teaching from learning, because learning is perceived as the product of effective teaching. In other words, teaching is carried out for learning to take place; learning is a goal of teaching. In the context of this study, learning would then refer to the interaction between the teacher, the teaching agent(s) and the learner, and would support the idea that there would be no learning without teaching.

A review of the extant literature reveals at least four basic elements incorporated in teaching and learning, namely: (i) engaging students in the teaching-learning process, (ii) establishing content for exploration, (iii) proposing explanations, (iv) reading and writing for understanding (National Research Council –NRC, 1997: 24-25). This implies that effective teaching and learning is a product of various interactions between the teacher and the learner that involve creativity by the teacher and the learner in terms of teaching and learning strategies. In the case of science teaching and learning, creativity is essential for promoting scientific literacy (Foreman, 2005:111; Roden & Ward, 2005:3). The words of Harlen & Qualter (2004) seem to suggest that the talent of creativity is

there in every individual, but it needs to be stimulated or triggered in certain ways that involve active participation by the learner. They assert that:

> …science is a distinct form of creative human activity which involves one way of seeing, exploring and understanding reality…We all have the capacity to be creative (Harlen & Qualter, 2004:82).

Being creative, on the part of a learner, has to do with constructive learning. That is, the learner should be given an opportunity to play an active role in her learning in order to build up her understanding of the subject content. Creativity goes hand in hand with the development of knowledge process skills and scientific attitudes which form the core of science learning. Harlen & Qualter (2004:84) mention four features of creativity, namely, (1) learners' imagination, (2) executing activities for a purpose, (3) originality and (4) being judgmental. Other features of creativity include curiosity, resourcefulness, desire to discover, critical thinking, insight, ability to synthesize and see new implications, and many others. Of importance is that creativity is inquiry based, and it stimulates learners' critical and reflective thinking skills.

Imagination encourages the learners to think and make sense of the ideas they have made about the world. They have to develop curiosity that will encourage them to observe and question scientific information. This relates to the first Learning Outcome (LO1) of the Natural Sciences Learning Area which requires learners to conduct scientific investigations in order to get a better understanding of science. That is, science investigations are purposeful. By so doing, learners acquire scientific literacy which is discussed in depth in the Section 4.3 below.

As children go on with their science investigations, they generate new ideas as they observe and interpret investigations. Such activities promote learners' originality as they carry out investigations independently, and arrive at conclusions. At the end of an investigation, the learners have to question the validity of their results compared to acceptable scientific standards. In other words, they must reflect critically on the results they have obtained in order to compare them with the initial purpose of the investigation.

On the part of the teacher, creativity has implications for curriculum development, teaching styles and language(s) of learning and teaching. As mentioned earlier, creativity needs co-operation and communication between the teacher and the learner. Both parties should understand each other so that all the activities can be carried out properly. One wonders if creativity can be developed in a case where there is a mismatch between the language used by the teacher and the learners in the teaching-learning process.

To enhance creativity by learners in the classroom, the relationship between the teacher and learners is important. Martin, Sexton & Gervolich (1994:49) mention three types of relationships in science teaching, namely, authoritarian, laissez-faire and democratic teaching relationships. In an authoritarian relationship, the teacher takes control of the classroom, and the teacher is the only active participant in the teaching-learning process. In this relationship, learners remain passive, and their thinking is limited to teacher's decisions. Learning often occurs through recalling and recitation of facts. Therefore, authoritarian teaching can be associated with teacher-centredness which limits learner creativity to a certain extent.

In a laissez-faire relationship learners are left on their own to decide what they want to do and how they want to do it. There is no guidance or leadership by the teacher in a laissez-faire relationship, and it often shows the teacher's poor or lack of leadership skills and planning. This kind of relationship does not encourage a sense of responsibility in learners as there is no meaningful guidance or control by the teacher. Also, it does not encourage active participation by the learners in learning activities, and effective learning in this kind of situation may not be guaranteed.

A democratic relationship, on the other hand, allows the teacher to work cooperatively with learners, while maintaining a reasonable control in the classroom. In this kind of relationship, the classroom atmosphere is flexible and relaxed, and there is always mutual trust and openness between the teacher and learners. This kind of atmosphere usually reduces fear among learners, and encourages learners to express themselves freely in the classroom. The democratic view of science learning and teaching helps learners to

construct their knowledge through collaborative or group learning. Unlike authoritarian teaching, the democratic relationship is learner-centred because the learners are encouraged to play an active role in the classroom activities. Thus it encourages or promotes learner creativity. The following section gives a definition of scientific literacy as one of the major outcomes of science teaching and learning.

In the context of this research, the teaching and learning process can be explained in terms of languages used to teach science. Given the fact that teaching and learning are mutual or interdependent processes, language plays a crucial role in enhancing interaction or communication between the teacher and the learners. In relation to the importance of language input in teaching and learning (e.g. i + 1) and the complexity of science language as explained in the preceding chapter, the language of instruction becomes a crucial factor in determining the effectiveness of the teaching-learning process. That is, if the language used in the classroom is not comprehensible to learners, learning may be adversely affected. In simple terms, if the teachers use English (L2) to communicate scientific instructions to learners who are not proficient in the language, it is likely that learners may not understand the instructions, and that can impact negatively on their creativity and imagination necessary for making sense of what is learnt. Likewise, if teachers have limited proficiency in English (i.e. limited input); it is possible that they may not convey the correct information or instructions to the learners. That may also lead to misunderstandings that can hinder learners' understanding of scientific concepts. In the following section I discuss scientific literacy as a key aspect in science learning.

4.3 Science and Literacy

4.3.1 Literacy

Before discussing scientific literacy, I deem it necessary to give a brief description of the term "literacy" as it applies to human lives. Literacy is a basic human right, despite the fact that many African populations, including children and adults lack adequate literacy skills as a result of different social pressures in their communities. According to the

UNESCO Education For All (EFA) Report (2006), the regions with the lowest literacy rates (around 60%) are sub-Saharan Africa, South and West Asia and the Arab States. Illiteracy is associated with poverty.

Literacy goes beyond reading and writing skills to access to scientific and technological knowledge, legal information and the media. It also includes speaking, listening and media analysis. Literacy is crucial for economic, social and political participation and development, and it is a foundation for further learning (EFA, 2006; Einstein, 2002). In addition, numeracy is regarded as a component of literacy (EFA, 2006:22).

Literacy makes people aware of many opportunities that can empower them or improve their lives such as health, education, political and economic opportunities (EFA, 2006: 19). That is, in many instances literate people can access information which illiterate people may not be able to access because some of the information may be in written form (e.g. use of internet and email systems). So literacy has to do with language competence which determines one's access to knowledge locally and globally. For instance, one may have verbal competence in the L1 but may lack reading and writing skills in the same language. In this case, if the individual lacks literacy skills in the L1, and she may not be able to access information written in her L1. That is, lack of literacy does not necessarily refer to lack of literacy skills in one's L2, but it may occur in any language in which one lacks reading and writing skills.

Furthermore, as literacy has to do with proficiency in a particular language (e.g. L1 or L2) which is used in a particular context (verbal, reading and writing), it is a common phenomenon that many people are illiterate in languages other than their mother tongue, especially in Africa. This kind of situation is usually perpetuated by the historical past of many African countries such as wars which prevented people from attending or sending their children to schools to gain literacy. Secondly, in many African States the traditional African culture did not allow girls to go to school. This was due to the fact that Africans did not see any value in educating girls because they were perceived as future wives who had to bear children and take care of their families. Such care did not require any form of academic education hence the girls were trained in domestic chores such as cooking,

cleaning, taking care of children, and so forth. Thus illiteracy among women in Africa is higher than in men (EFA, 2006).

Thirdly, in many African countries African languages are used as media of instruction for the first three years of schooling only. So many learners, who, for various reasons, do not go beyond the third year of schooling in their education, do not usually get adequate exposure to languages other than their home languages. In fact, such people usually have limited reading and writing (literacy) skills in their home languages as well because of the limited number of schooling years which are not enough for them to gain full literacy in their home languages. Fourthly, the severe lack of reading materials in African languages does not strengthen literacy skills which people have developed in their home languages.

Developing literacy in any society has implications for the language(s) used in the education system. For example, if the education system makes use of language(s) that are not well known by the majority of people, literacy development may occur at a slower pace than when conducted in the language(s) of the majority. Regarding languages used in education, Chapter 2 has shown that the language(s) which are used in Africa for economic and social mobility are usually English and other colonial languages including French, Portuguese, Dutch, and others. Unfortunately, these foreign languages have become measures of literacy in the African continent, as a result of colonialism and globalization. Consequently, many African people become marginalized in social and economic development in their countries as they lack proficiency and literacy in these (foreign) languages. In the present global world of science and technology, African countries take it for granted that if one lacks literacy skills either in English or French (or any of the colonial languages), it may be difficult to access scientific and technological knowledge necessary for socio-economic development. Interestingly, developed countries such as China and Japan do well technologically through their languages.

In terms of social development, literacy in one's home language or mother tongue seems to be advantageous. Wedikkarage's (2006:83) observation regarding mother tongue education in Sri Lanka is that literacy in the mother tongue improved health conditions

and people's lives because as people became literate in their own languages, they could launch awareness campaigns to eradicate dangerous diseases. Regarding the benefits of teaching of science in local languages in Sri Lanka, Wedikkarage (2006:84) says:

> In addition to literacy, the benefits of studying science subjects in local languages have been cited as the crucial factor in determining other human development indicators such as infant mortality rates and the eradication of dangerous diseases and the remarkable control of the spread of the AIDS virus among the people in Sri Lanka… When science is taught in local languages, it can reach everybody in the country and, accordingly, it is much easier to inform people about diseases and health than using a foreign language. The use of local languages has, thus, been able to reach everybody and has been a catalyst for many aspects of present human development in Sri Lanka.

Wedikkarage's (2006) claim is relevant in the context of African countries which have the highest rates of illiteracy, high death rates due to HIV/AIDS and severe cases of poverty and starvation. One may argue that there are many awareness campaigns and reading materials on how to prevent the spread of HIV/AIDS, but the question is whether such information reaches the majority of people who are illiterate in English or any other foreign language. If that is not the case, the affected countries will always be dependent on foreign aid instead of relying on their efforts on issues pertaining to education, health and other areas of development. So literacy is very important in human capital development, and one of the challenges towards development is to improve literacy in local languages so that science and technology necessary for development can be accessible to people in the language(s) they know well. In the following section emphasis is on scientific literacy.

4.3.2 Scientific literacy

In relation to the description of literacy given above, Harlen and Qualter (2004:61) define scientific literacy as the overall aim of learning science which indicates competence in science. They refer to scientific literacy as a level of competence in understanding and using knowledge of science that is needed to be a functional and effective member of the society. In the South African education context which is guided by the RNCS (2002), the three Learning Outcomes of the Natural Sciences Learning Area aim at developing scientific literacy through scientific investigations (that develop the learner's process

skills), science knowledge construction (when learners show their understanding by developing and applying science knowledge) and appreciation of the natural environment (when learners develop an appreciation of the relationships between science, society and the environment) (Langenhoven, 2005:283; RNCS, 2002). In simple terms, scientific literacy refers to the development and use of process skills and competence to apply science knowledge in different situations. Such competence should mirror the learners' understanding of the natural world (i.e. the relationship between science, society and the environment).

According to Harlen & Qualter (2004:64) scientific literacy has four components: concepts or ideas, processes (process skills), attitudes and understanding the nature of scientific knowledge. Firstly, the concepts enable the learners to understand and make sense of new experiences by linking them to their prior knowledge, while the processes that include mental and physical skills are used to obtain and interpret information for better understanding. As defined in the RNCS (2002:13) document, process skills refer to the learner's cognitive activity of creating meaning from new information and experiences. The learners' process skills can be stimulated through tasks that require learners to make observations, measure, record information, classify, interpret, predict, conduct investigations, and many others (RNCS, 2002: 13 – 14). Lastly, attitudes or dispositions determine the learner's willingness and confidence in learning, and all these components assist the learner to gain a better understanding of science and its limitations (Harlen & Qualter, 2004:64).

The achievement of scientific literacy does not depend on the development of the four components mentioned above only, but on a number of other factors such as the curriculum, the teaching and learning process, the language(s) used in science teaching and learning, and others. In relation to the new South African curriculum (RNCS), for instance, the science content (Grade R – 12) must cover these areas: Life and Living, Energy and Change, Planet Earth and Beyond and Matter and Materials (RNCS, 2002:6). The implication is that these areas should be dealt with in the classroom in a manner that will reinforce the learners to use their process skills in order to understand and make meaning of what they are learning. Therefore, the teaching strategies and the language

used by the teachers in the classroom may determine the learners' understanding of science concepts as well as their attitudes towards learning. In other words, if the teachers interact with the learners in an interesting way, and through a language they all understand, it is likely that such an environment can reinforce the learners' positive attitudes towards learning.

In view of the above definitions, Ogunniyi (2005:123) sketches the benefits of scientific literacy in a society. These benefits include society's ability to participate successfully in a world of science and technology; using scientific and technological knowledge to formulate policies and to make informed decisions, solve problems and improve quality of life; coping with rapid changes due to advanced science and technology and using technology and science to achieve cultural revolution. At the centre of scientific literacy is the language of instruction.

As discussed in depth in Chapter 2, many African countries still use foreign languages as media of instruction which may be second or third languages to learners. According to Ogunniyi (2005:132) the "Europeanization phenomenon" has negative implications for science and technology education. He mentions the results of a survey with Grades 7 - 9 learners in South Africa which tested learners' understanding of 22 science concepts taken from the science syllabus. The results of this study revealed that learners had linguistic problems which ranged from grammatical errors, inability to respond to questions correctly, lack of comprehension skills and inability to explain clearly what they knew (Ogunniyi, 2005:133).

To achieve scientific literacy in the first Learning Outcome (LO 1: Scientific investigations), for example, the learners have to investigate relationships in scientific, technological and environmental contexts (RNCS, 2002:16). The learners have to plan and conduct investigations. At the end of the investigations they should evaluate the data and communicate the findings. The specific duties to be performed differ according to grades. For instance, in communicating the findings, Grade 4 learners must "talk about observations and suggest possible connections to other situations." In Grade 5 a learner has to: "report on group's procedure and the results obtained" while a Grade 6 learner is

expected to: “relate observations and responses to the focus question.” (RNCS, 2002:16–17).

From the foregoing discussion, it can be deduced that literacy has to do with education and development. Scientific literacy, in particular, depends on language competence to make meaning of scientific concepts. Actually, Einstein (2002:6) claims that science and language are interdependent.

> Science strengthens literacy skills by infusing them with meaning and purpose, while literacy skills strengthen science learning by giving students the lens of language through which to focus and clarify their ideas, conclusions, inferences, and procedures (Einstein, 2002:6).

This implies that for learners to make meaning and apply what they have learnt, they should have understood the language used to communicate science knowledge. Also, to conduct scientific investigations and communicate their findings effectively, they should have a good proficiency level in the language of communication. The stronger a learner’s literacy skills, the stronger the learner’s grasp of science will be (Einstein, 2002:4).

Of concern in this regard, however, is whether the learning will be effective if the learners communicate through a language they do not know well enough. The question that can be asked is whether scientific literacy can be achieved if the learners are not proficient in the language of instruction. This follows Thornton’s (1986:43) point of view that meaning is embodied in language, and therefore, sophisticated or effective communication is possible between people who share the same language. In relation to the use of a foreign language in science teaching Ogunniyi (2005:133) also raises the same questions:

(i) How does a second/third language learner resolve the conflict created when his /her intuitive and commonsensical language clashes with the complex language of school science/technology?
(ii) How does a second/third language learner perceive the hidden cultural meaning in a text?
(iii) How does she adapt her personal and creative language to the impersonal language of science?

(iv) How can this foreign language be made accessible to her?
(v) How can they acquire this language in such a way that it facilitates rather than retards their thinking? (Ogunniyi, 2005:133).

All these questions are relevant in this study as they trigger answers which will be revealed by data presented in Chapter 6. These questions tie in with science teaching and learning and some of them will be addressed in Chapters 7 and 8. In 4.4 below scientific literacy is discussed as part of the Natural Sciences Learning Area in order to understand the kind of teaching and learning which is envisaged in this Learning Area.

4.4 Natural Sciences Learning Area

The Natural Sciences Learning Area aims at promoting scientific literacy. It involves the development of process skills that may be used in everyday life in different settings. It also deals with the development and application of scientific knowledge that enables one to appreciate the relationship between science, society and the environment (RNCS, 2002:4). The features and scope of the Natural Sciences Learning Area, as outlined in the RNCS (2002) document read as follows:

> The Natural Sciences Learning Area Statement envisages a teaching and learning milieu which recognizes that the people of South Africa operate with a variety of learning styles as well as with culturally-influenced perspectives. It starts from the premise that all learners should have access to meaningful science education, and that arbitrary selection and rejection based on various kinds of biases should be avoided… The Natural Sciences Learning Area must be able to provide a foundation on which learners can build throughout life (RNCS, 2002:5).

What can be deduced from the above statement is that the Natural Sciences Learning Area recognizes diversity of learners within the teaching-learning process, and it attempts to promote equality in terms of access to scientific knowledge. It operates within the scope of the South African Constitutional Manifesto on Values, Education and Democracy (2001) which in turn guides teaching and learning, as well as development and governance: democracy, social justice and equity, equality, non-racism and non-

sexism, ubuntu[13], an open society, accountability, the rule of law, respect and reconciliation.

The Natural Sciences Learning Area seeks to develop the learners' ability to use scientific knowledge by conducting scientific investigations and activities that will lead to science knowledge construction, and by understanding the interrelationship between science and technology, society and the environment (RNCS, 2002:6). That is, all teaching and learning in the Natural Sciences Learning Area should be guided by these outcomes: 1) scientific investigations, 2) construction of science knowledge, and 3) understanding the relationship between science, society and the environment.

The first outcome intends to empower the learner so that s/he could "be able to act confidently on curiosity about natural phenomena, and to investigate relationships and solve problems in scientific, technological and environmental aspects". The second one requires the learner to "know and be able to interpret and apply scientific, technological and environmental knowledge." The third outcome expects the learner to "demonstrate an understanding of the interrelationship between science, technology and the environment" (RNCS, 2002). These learning outcomes aim at promoting scientific literacy. Of importance is the role of the language in the construction of scientific knowledge by the learner and how the teachers interact with the learners to gain science literacy.

The scope of this research is primary school science, particularly the Intermediate Phase (Grades 4 – 6). The following section unpacks the concept of "science" in order to reveal its origin and how it is depicted in the Natural Sciences Learning Area.

[13] "Ubuntu" is a Xhosa term that is used to express how people show their care and love for each other as human beings. It is now a widely used term which refers to communality, relatedness and the good of all.

4.5 Science as a subject

According to the RNCS (2002:4), what today is known as science originated from African, Arabic, Asian, American and European culture, hence it has become part of the cultural heritage of all nations. The word "science", in particular, originated from a Latin word "scientia" which means knowledge (Martin, Jr., Sexton, Wagner, Gerlovich, 1994:5). There are two views underlying the learning of science: historical and modern views. The RNCS (2002:11) refers to the historical view as traditional and indigenous knowledge systems (IKS), while the modern view is referred to as science and technology. The historical or traditional view perceives science as a means to satisfy the needs of the mind, (and not those of the body) in order to gain useful and practical knowledge (RNCS, 2002). This view implies that humans are always curious to learn new things and skills needed to acquire useful knowledge.

According to the RNCS (2002:11) many South Africans hold a world-view that all things have spiritual existence or meaning (i.e. they come from God). They believe that events occur for spiritual and physical reasons hence they connect them to the physical and social environment of the people. Traditional and indigenous knowledge systems evolved out of this school of thought (RNCS, 2002:11).

The modern view of science emphasizes the ability of humans to construct new ways of investigating information. In other words, it stresses the human potential to explore different ways of creating knowledge that is meaningful to them. The modern view of science is influenced by empiricism. Empiricism believes in measurement and observation as a means of explaining why events happen in nature. According to this view, things that cannot be measured and observed are not valid in explaining why events happen. Empiricism is used worldwide in research and science education (RNCS, 2002:11). As the modern view believes in practical knowledge, it encourages humans to develop positive attitudes to learn science. In support of the view, Sanfeliz & Stalzer (2003:64) maintain that interest and attitudes are critical aspects of science learning that motivate people to become scientifically literate. According to Martin Jr. et al. (1994:6), science requires humans to use their curiosity to construct ways of investigating and

processing information. Science consists of meanings and information humans construct for themselves to benefit their everyday living. That is, science encourages human creativity through experimentation.

The two views, however, have something in common. Both views recognize the intellectual (mind) and the emotional aspects of the human being. The emotional aspect focuses on the development of learners' attitudes towards science, while the intellectual aspect emphasizes the development of learners' process skills in the construction of new and useful knowledge that can be applied in everyday life. On the basis of the two perspectives mentioned above, science can be defined as a body of intellectual and social knowledge that is required by the learner to construct meaningful knowledge about the world around him/her. The acquisition of such knowledge in the education context incorporates creative thinking, problem-solving, experimentation and invention which should be employed by learners. In other words, the two views of science have implications for teaching and learning approaches.

Mintzes and Novak (2000:43) describe science as an authoritative intellectual enterprise which does not give equal weight to all points of view. By implication, science is selective and specific in that some concepts and theories are supported while others are rejected. As a result, scientific explanations or theories change over time due to external new evidence or counter-evidence to the theory. An alternative theory is then established, and the new theory may borrow some ideas from the existing theory or get other ideas from different domains (Gopnik, 1999:305). Ogunniyi's (1986) defines science as an attempt by human beings to organize their experiences with nature into meaningful systems of description, explanation and description (Ogunniyi, 1986).

Many scientists mention certain process skills as ways of thinking, measuring, and solving problems in science (De Wayne, 2002; Beisenherz & Dantonio, 1996; Martin, Jr., et.al, 1994; Padilla, Muth & Padilla, 1991). Science process skills can be divided into two: basic skills and integrated skills. The basic skills include observation, classification, communication, measurement, estimation, predictions and inferences. They help the learners to expand their learning through experience. On the other hand, the integrated

skills enable the learner to think at a higher level or to make abstract thoughts. They include the learner's ability to identify and control variables, form hypotheses, perform experiments and interpret data. In other words, they enable the learner to conduct scientific investigations in order to discover new information. The process of science investigation is facilitated by the use of process skills and it involves the construction of knowledge by the learner herself in order to arrive at meaningful conclusions.

At the end of the science learning process the learner is expected to be able to produce information by applying it in new situations. Science products include facts, concepts, principles and theories. In other words, by making use of both basic and integrated skills the learners are able to verify information through observations and measurements to produce facts. To produce concepts, the learner needs to be able to make generalizations based on facts and other experiences. The end products of school science depend on effective teaching and learning which, in turn are influenced by a number of factors such as teaching and learning strategies; medium of instruction; and other factors linked to cognitive development (Fairbrother, 2000).

In relation to the RNCS principles and the Learning Outcomes of the Natural Sciences Learning Area, the above description of "science" has to do with the construction of knowledge that develops scientific literacy. Secondly, scientific literacy is acquired through various means that involve scientific investigations. Thirdly, scientific knowledge can be applied in various situations of our daily lives. So science is part of our daily activities, although we might not be aware of it due to the lack of understanding of the scientific world.

4.6 The role of language in science teaching and learning

Language, as a means of communication, plays a significant role in all teaching and learning. The teaching-learning process involves interaction between the teacher and the learner that occurs through the use of language in many instances. One of the critical outcomes of Outcomes-Based-Education has to do with communication. This outcome

aims at producing learners with the ability to: “communicate effectively using visual, symbolic and/or language skills in various modes.”

Learning science involves learning the language of science which is complex, abstract and highly specialized with grammatical metaphors and lexical density (Jones, 2000:89; Puhl, 2000:6; Monk & Dillon, 1995:95). In addition to words, science incorporates graphs, charts, tables, diagrams and mathematical symbols and equations, etc. to develop learners’ scientific knowledge and understanding. Science, therefore, has a language peculiar to itself and a complex system that is used to convey meaning effectively. Scientific meanings can be conveyed in the form of pictures, tables, graphs, etc.

The science discourse is dynamic, and it can be used in specific contexts to meet specific needs. The dynamic feature of science becomes evident when new scientific discoveries are made, resulting in the emergence of new meanings that challenge the existing scientific meanings. Secondly, as social relations emerge for users of scientific discourse, the language has to be modified to meet the needs of the different audiences. In this way, certain terms are modified and this influences the language of science. The new technologies (e.g. computers) also influence the way knowledge is presented and communicated. They bring about a transformation in the way in which scientists present and produce knowledge and how they communicate the information among themselves to convey acceptable meanings (Jones, 2000:91).

Good communication skills are one of the fundamental skills required in scientific discourse (Erekson, 2002:39). In fact, one of the critical outcomes of teaching and learning in the New Revised Curriculum Statement (RNCS) in South African education requires learners to be able to: “communicate effectively using verbal and visual images”. Language art skills that include reading, writing, speaking listening, presenting and viewing are very important in communication. For example, learners can do the following language related activities in a science classroom: taking notes, reading a textbook, writing laboratory reports, science projects with language components, presentations, etc. In relation to science teaching and learning, learners should be able to use or interpret the verbal and visual language of science effectively.

Learners understand science better when they use the language of science through talking, reading and writing. Talk stimulates thinking, especially when learners use their home language(s). Language can be used for exploratory purposes in cases where learners exchange ideas spontaneously with their teachers or with their peers (e.g. in groups, in performing science experiments). It can also be used for presentational purposes when the learners use the language in a more prepared and formal manner (Britton, 2002:75). Exploratory speech as a spontaneous process can be associated with a language in which both teachers and learners have full proficiency (usually the mother tongue of both parties). Presentational speech is possible in both the learners' L1 or L2, depending on the nature of the science task they are doing. For instance, if the learners are working in groups, they may prepare their work and present it in a formal way irrespective of which language they use (whether they are using their L1s or L2s).

Reading strengthens learners' comprehension in written texts, and encourages learners to be critical thinkers. According to Einstein (2002:39), reading in science enables learners to make accurate interpretations, inferences, conclusions and connections about the text. They can interpret and apply ideas and make connections among concepts if they read with understanding.

Writing encourages learners to think in a structured way, and to express their thoughts freely in order to show their scientific knowledge (Jones, 2000; Garton & Pratt, 1989). Science writing involves three activities, namely, interpretive, knowledge transforming and discursive activities (Jones, 2000). All the three activities stress the importance of language in constructing knowledge. For instance, learners can express meaningful interpretations of science texts and develop critical thinking skills (reasoning, predictions, inferences, make conclusions, etc.). As in speaking, learners can articulate clearly what they know in writing. If the learner cannot explain a concept clearly in writing, it is likely that the learner does not clearly understand that particular concept (Freire, 2002:100). As mentioned above, speaking, reading and writing are language skills which are important in making sense of any learning activity. In science learning, these skills strengthen the learners' scientific process skills (analysis, comparison, synthesis, inference, application, etc.) which play an important role in knowledge construction. It is

logical to assume that learners can make more sense of what they are learning if they understand the language used in the learning process.

The discussion in Chapter 3 stresses that communication can be more effective if the parties involved in the communication process understand each other. In other words, the key factor that determines the effectiveness of the communication process is the language used, as well as the level of proficiency of the speakers in the language of communication. In the classroom context, the language used as a medium of instruction becomes a matter of concern. Owing to the fact that science is taught through the medium of English, (besides the fact that it has a specialized language), one may argue that it is unlikely that learners can be able to communicate their understanding of science discourse effectively in English, especially if they have limited exposure to it. Also, it may be difficult for learners to understand and make meaningful interpretations of visual images used in science discourse if they are not competent in the language of instruction. Data presentation and analysis in Chapters 6 and 7 show how learners communicated with each other and with their teachers in the science classroom.

4.6.1 Home language as a medium of instruction in science

In Chapter 2 a lot has been said about the benefits of mother tongue education. This section seeks to put special emphasis on learning science through the medium of home language. Literature cited in Chapter 2 indicates that many developed countries which are advanced in science and technology make use of their own languages as media of instruction (Mazrui, 2002, Skutnabb-Kangas, 1999; Soepadmo, 1981). The same literature points to the fact that the majority of developing countries still use foreign languages (e.g. English, French or Portuguese) as languages of instruction which sometimes alienates learners in the classroom.

With regard to development in science, Soepadmo (1981:278) claims that the developed countries have made better progress than developing countries because they use their national languages as media of instruction and scientific communication. Hence they are able to invent new ideas and introduce new scientific theories. On the other hand, the

developing countries are faced with problems of scientific terminology and cultural changes because their local languages are not used as vehicles for the expression of science (Suhaimi, 1981:272).

According to Nababan (1981:18) the child's home language lays the foundation of a person's world-view and perception. With regard to mother tongue education in science, O-saki (2005:11) mentions his personal experience of learning science through the medium of his home language in the lower grades, although he had to shift to English from Grade 5. What is interesting about his experience is the fact that as he interacted with his grandparents and the environment, he could gather a rich bank of scientific vocabulary and (cooking) skills that still made sense to him later in his life (e.g. 13 varieties for the English word "banana tree"). Although such indigenous knowledge is usually labeled as being primitive in the classroom, O-saki's experience and his prosperity in life, within the science field in particular, may be an indication that indigenous knowledge that the learners bring to the classroom can form a basis for understanding modern science. Hence he writes thus:

> …by abolishing the vernacular and despising Kiswahili in the schools science and technology are buried alive, as there are several other ideas learned in these languages but which cannot be translated into English…Thus the policy of de-emphasizing African languages in favour of English ruins Africa's chances of being innovative in science and technology, as all indigenous ideas are not available to the younger generation. The younger generation, taught by teachers who themselves have lost most indigenous knowledge and understand little of western science (other than memorized definitions), is lost in a concept mapping that is too foreign to their culture and experience (O-saki, 2005: 51-52).

As indicated in 4.4 above, the different world-views of science touch on the importance of traditional and indigenous knowledge systems in education (RNCS, 2002:11). As indicated in O-saki's statement above, IKS can be better understood in one's mother tongue as it has cultural connotations. This traditional worldview (IKS) can also be associated with the third Learning Outcome (LO 3) of the Natural Sciences: understanding the interrelationships between science and technology, society and the environment. One aspect of LO 3 is based on traditional technologies that may reflect people's wisdom and experience. It reads as follows:

> Indigenous or traditional technologies and practices in South Africa were not just ways of knowing and thinking. Traditional technologies and practices often reflect the wisdom of people who have lived a long time in one place and have a great deal of knowledge about their environment… Much valuable wisdom has been lost in South Africa in the past 300 years, and effort is needed now to rediscover it and to examine its value for the present day (RNCS, 2002:10).

The current situation of integrating school science with Indigenous Knowledge Systems (IKS) in the new South African science curriculum seems to pose a challenge not only to teachers, but also to science educators who seem not to be competent enough to train teachers on the implementation of an integrated science/indigenous curriculum (Ogunniyi, 2005).

In his study with science teachers, Ogunniyi (2005) assessed teachers' understanding of the Nature of Science (NOS) and Indigenous Knowledge Systems (IKS). According to Ogunniyi (2005) one of the initial concerns of the teachers in implementing the science/IKS curriculum was their inability to communicate science in the nine indigenous languages of South Africa. In Ogunniyi's study (2005) the teachers showed their awareness of the link between IKS and learners' home languages where the nine indigenous languages are not used as languages of learning beyond Grade 4. Interestingly, the results of Ogunniyi's (2005) study show that the teachers became "converted" to the notion of IKS as they began to raise concerns about how they were going to convey their knowledge of the IKS to the advantage of their learners, especially those in traditional communities. Their perceptions of the IKS as "superstitions" changed, and they realized the importance of human experience in science. As a result, the teachers called for more training and in-service workshops in the IKS area (Ogunniyi, 2005:18).

Many research studies relate the use of the learners' mother tongue in teaching with better academic performance at school (Galabawa & Lwaitama, 2005; Langenhoven, 2005; Malekela, 2004; Malekela, 2003; Mwinsheikhe, 2003). All theses studies focused on science teaching (including Biology) in Tanzania and South Africa, except Malekela's studies that focused on English Proficiency testing and on students' performance in the Certificate of Secondary Education Examination (CSEE) in Tanzania. Langenhoven's

(2005:287) results, in particular, show a pass rate of 79% by Grade 4 learners who were taught through the medium of isiXhosa in one school, and a pass rate of 37% in the English stream. Other South African studies show similar results, though they focused on History and Mathematics taught in African languages (isiXhosa and Sesotho) and English (conducted in different areas of South Africa) in the 1990s by Sentson (1994) and Mckay & De Klerk (1996).

Prophet and Dow (1994) also conducted a study that focused on the impact of the language of instruction on learners' science concept development in Botswana. The results of the study show that the learners who were taught science through the medium of Setswana, their mother tongue, performed better than their counterparts who were taught through the medium of English. Also, the Setswana group showed better understanding of concepts than those who were taught in English (Prophet & Dow, 1994:214). In their study they concluded that science concept attainment is significantly enhanced when junior secondary school students are allowed to use their mother tongue. When junior secondary school students are taught science in English, there is no significant improvement in their understanding of science concepts (Prophet & Dow, 1994:215). So the learner's mother tongue appears to enhance better understanding of science.

However, there are other challenges with regard to the use of African languages as languages of learning and teaching, especially in science. Some of these challenges are discussed in the first chapter, and they include the following: (i) lack of teaching and learning materials in African languages; (ii) limited scientific vocabulary in African languages (for example, one word may mean several things in science, e.g. power, energy, force, etc.); (iii) learners' underdeveloped literacy skills in their mother tongue, (iv) teaching approaches used by the teachers in the classroom, and many others.

In the context of this study, the experimental group learners were provided with science materials in their mother tongue (isiXhosa), but other challenges such as the lack of science laboratories could not be addressed as part of this study. Therefore, the contribution of this study towards the complex issue of isiXhosa as a medium of

instruction in science occurred on a very small scale considering other challenges which relate to the teaching of science in general. All these factors have a negative impact on the development of African languages as languages of learning and teaching, especially in science. Guided by the research question(s) and objectives underpinning this study, only some of the challenges are addressed.

4.6.2 English as a medium of instruction in science

There is evidence of better learning taking place in the mother tongue as discussed in the section above. Foreign language(s) as language(s) of instruction, on the other hand, seem to be barrier(s) to children's learning. Many scholars have found that learning in a foreign language (English) prevents learners' easy accessing of knowledge (Brock-Utne, 2004; Senkoro, 2004; Mwinsheikhe, 2003). The observations by the scholars mentioned above were made in Tanzania where English is supposed to be the medium of instruction in secondary schools. Mwinsheike (2003), in particular, observed that English was not only a barrier to learning in general, but also to conceptualizing science knowledge.

As discussed in the preceding sections, learners can learn meaningfully through the language they know well, which is usually their mother tongue. That is, the learners' mother tongue is a vehicle of knowledge construction. Brock-Utne (2004:60) refers to English used as a medium of instruction as a language of "destruction" (instead of construction) because it blocks the learners' potential in attaining the intended outcomes of the learning process. In support of the notion of "knowledge destruction" suggested by Brock-Utne (2004), Senkoro (2004:44) writes thus:

> It is next to impossible for one to inherit a philosophical and moral construction of the world, and to be empowered so that one can form and manipulate concepts if all these are delivered through a medium that one has not fully grasped and does not fully understand. For, indeed, one can only define the world through a language most clear to oneself.

Lemmer (1996:336) mentions learners' emotional trauma that surrounds African children, especially those that live in the townships. These children are always exposed to violence in the places where they live. In the classroom environment they experience frustration "from the experience of knowing the answer but not having adequate

vocabulary to express it. Stress can affect children's academic progress negatively, especially their acquisition of English" (Lemmer, 1996:336).

The use of a foreign language in education has implications not for learning only, but also for teaching as well. As mentioned in the previous chapter, it appears that some African teachers who are supposed to teach in foreign languages (e.g. English) have limited proficiency in such languages. Research studies show that due to limited proficiency in English, some teachers resort to coping strategies such as code-switching and direct translation (Mwinsheikhe, 2003, Brock-Utne, 2004; Vuzo, 2005, Holmarsdottir, 2005). Holmarsdottir's (2005) study focuses on three South African schools in Western Cape townships where the majority of teachers and learners are mother tongue speakers of isiXhosa. The other three studies reflect teachers' practices in Tanzania where Kiswahili is widely used as a national language by both teachers and learners (Mwinsheikhe, 2003; Brock-Utne, 2004; Vuzo, 2005). What all these studies imply is that it is not only learners who experience difficulties in learning through English (a foreign language), but that teachers also find it difficult to teach through the medium of English. The question that remains is: to what extent is teaching and learning effective in cases where both the teachers and learners struggle to communicate through the (English) language of instruction?

Lemmer (1996:330) also mentions the teachers' limited proficiency in English for effective teaching in South African black schools in particular. This kind of handicap is attributed to the fact that teacher training does not empower (African) teachers with principles of language acquisition. As a result, teachers often lack the ability to support English language learning or to teach literacy skills across the curriculum (Lemmer, 1996:330).

It is, however, imperative to acknowledge that teachers and learners can also experience problems in science while using a common language, i.e. a language which is the mother tongue of both the teacher and the learner. For instance, English L1 speakers can encounter problems in communicating science knowledge to English L1 learners depending on the concepts being taught, the teacher's and learners' level of

understanding of the concepts, or how complex the concepts or vocabulary are, and the context in which those concepts are used. By implication, communication breakdowns are not necessarily due to a mismatch between the learners' or teacher's home language and the language of instruction, but may arise from other factors such as unfamiliar vocabulary or concepts used, or as a result of dialectal variation.

In the context of this research, English appears to be a barrier to teaching and learning. Therefore, for effective teaching and learning, it is imperative that teachers should be empowered with appropriate skills to teach in the learners' mother tongue, as well as in English. This calls for change and reflection in teaching styles, with an underpinning knowledge of approaches that can promote scientific literacy. The following section focuses on some approaches that may encourage creativity in the science classroom, without, of course, ignoring the underlying problem of the language used to teach science.

4.7 Approaches to creative teaching and learning in science

4.7.1 Constructivist approach

The constructivist approach is based on the premise that knowledge is a construction of reality. It focuses on the ways in which young children think as they interact with the world. That is, it emphasizes active engagement of learners in constructing knowledge that will enable them to build theories about the world.

According to constructivists, people learn by constructing their knowledge by comparing it with their prior knowledge in order to come to a new understanding. Constructing Science knowledge (LO 2) is one of the three learning outcomes of the Natural Sciences Learning Area, as outlined in the Revised National Curriculum Statement (RNCS: 2002). According to this learning outcome the learners should be enabled to interpret and apply scientific, technological and environmental knowledge. The learners' ability is measured in terms of their ability to collect data from various sources, and also to organize and analyze the information they have collected (RNCS, 2002:9). In other words, this

outcome encourages the learners to make use of process skills (e.g. observing, comparing, recording information, sorting and classifying, interpreting information, predicting, hypothesizing, raising questions, planning science investigations, conducting investigations and communicating science information) to engage with the surrounding environment in order to make meaning from new information and experiences. Hence process skills are perceived as building blocks from which science tasks and concepts are constructed. As stated by Chaille & Britain (1997:22), Leach & Scott (2000:43) the constructivist perspective views learners as natural scientists and active learners who should be given the opportunity to engage in their own experimentation and problem solving.

Leach & Scott (2000:43) distinguish between personal and social constructivism. Personal constructivism focuses on the individual learner's conceptual framework which stresses that new knowledge needs to be intelligible and fruitful for the learner to make sense of it. Social constructivism looks at how learning is influenced by the social environment e.g. interaction between teachers and learners, and among learners themselves. In the education context, the two types of constructivism (personal and social) are very crucial because learning involves making sense of what is being learned which, in most cases, occurs when the learner interacts with the people and the environment surrounding him (e.g. parents, friends, etc.). That is, the learner can construct his or her own science knowledge as she tries to connect it with her own experiences from various sources including the home and the school. Personal and social constructivism, are therefore, interlinked and are equally important in knowledge construction.

In a constructivist classroom, the teacher is no longer responsible for transmitting knowledge, but acts as a facilitator with numerous roles: a presenter (of learner activities), an observer, a question and problem poser, an environmental organizer, a public relations manager (understanding and supportive), a documenter (of children's learning), a contributor to the classroom culture and a theory builder (Chaille & Britain, 1997:54). The teachers' roles mentioned above are related to or complement the roles of the teacher that are outlined in the South African Revised National Curriculum Statement

(RNCS, 2002), namely, mediators of learning, interpreters and designers of materials and learning programmes, leaders, researchers and lifelong learners, community members, etc. (RNCS, 2002:3). Through mediation, the teachers must acknowledge the need for learners to play an active role in acquiring new knowledge. In other words, the learners should take control of their own learning in order to construct new knowledge.

According to Martin, Jr, et al. (1994:46) a Constructivist Teaching and Learning Model is based on four key activities by the learner (i.e. the 4 E Learning Cycle): (i) exploration, (ii) explanation, (iii) expansion and (iv) evaluation. In each case, the teacher has a significant role to play as a facilitator of knowledge construction. In the process of knowledge construction the teacher should create learning circumstances which are meaningful to the learners. In order to deepen their understanding, learners should be encouraged to think and to exchange views with their peers.

The Constructivist Teaching and Learning Model (or Learning Cycle) which suggests a learner-centered approach to science teaching and learning requires the learners to explore learning activities in order to discover new knowledge (Martin, Jr, et al.: 1994:46). Exploratory activities include science investigations and cooperative learning. They should be encouraged to explain the ideas they discovered in their exploration in meaningful ways. They should be encouraged to expand their knowledge through interactions and communication with peers, teachers, and parents and with other people in their communities. Having explored and extended their science understanding, the learners should evaluate their knowledge. At this stage the teacher should assess them in order to see whether there is any change in learners' understanding and their mastery of science process skills.

All the (4E) activities have implications for proficiency in the language of teaching and learning. Learners cannot explore and explain concepts meaningfully if they are using a language in which they lack competence. Likewise, the language used in evaluating knowledge is very important. If learners are evaluated in a language which they do not understand well, the evaluation results may be distorted.

The effectiveness of the interaction between the teacher (as a facilitator) and the learners depends on the language used in the teaching-learning process. Also, literacy (reading and writing) plays a major role in generating new knowledge in science. In other words, learners make use of language skills, (reading and writing) to interpret and apply scientific knowledge in meaningful ways. As learners construct knowledge from different stimuli in the environment, meaningful knowledge construction depends on the way learners cope with the language of instruction. For example, Bell & Freyberg (1985) assert that learners may not comprehend or make meaning of what is said by the teacher if the teacher uses unfamiliar words or words with specialist meanings in science. Therefore, the language used in science teaching is important in constructing knowledge.

4.7.2 Cognitive approach

The cognitive approach is associated with Piaget's theory of cognitive development (Martin, Jr. et al. & Bohannon & Warren-Leubeker, 1989). According to Piaget's cognitive development theory knowledge comes from two sources: external and internal sources. External knowledge refers to physical knowledge that is acquired from external observations and interactions with the physical world e.g. parents, friends, teachers, learning materials, etc. Internal knowledge is created internally when the learner establishes mental relationships between objects (Gillen, 2003; Martin, Jr., 1994:38). That is, when learners acquire new knowledge, a mental connection occurs between new and existing knowledge. In such a case, the mind adapts to the new learning challenge, and existing concepts in the child's mind are changed as they add new concepts. This phenomenon is referred to as assimilation and accommodation (Martin, Jr. et al. 1994:39; Freeman & Freeman, 1994; Halpern, 1992:9). The implication of Piaget's theory is that the learner's thinking ability is fed by the physical (external) and mental (internal) worlds.

A cognitive approach to learning treats thinking as a basic ingredient for learning. It involves creating situations that support scientific inquiry by learners as groups and as individuals to construct scientific ideas meaningfully as a major part of their schooling activity (Greeno, 1992:60). It prepares learners to be better thinkers who can apply what

they have learned successfully in new situations. In other words, it involves the transfer of thinking skills in new and different situations. Hence Halpern (1992:9) says:

> …ability to transfer skills suggests that students can learn to think mathematically and scientifically and that they can use this knowledge successfully when they encounter problems that are different from those they previously encountered.

According to Chamot & O'Malley (1994:376) cognitive models ensure that learners are mentally active during the learning process. The learners can select the information from the environment, organize it and relate it to their prior knowledge. In the process of learning, the learners can decide what needs to be remembered so that they can use the information appropriately and logically, while reflecting on their learning success.

To construct knowledge, learners use a variety of cognitive strategies. These strategies include relating new knowledge to existing knowledge, making inferences, linguistic transfer, imagery, grouping, deductions, inductions and summaries (Chamot & O'Malley, 1994:375). All these cognitive strategies have to do with language use. For example, in making inferences, learners can use a linguistic context to predict upcoming information. Likewise, linguistic transfer involves the use of known language structures to assist comprehension or production in a new learning environment. Meaningful summaries, whether oral or written depend on the proper use of language. So in order to use cognitive strategies successfully, proficiency in the language of learning and teaching is crucial.

From the above discussion, it can be deduced that cognitive approaches have to do with thinking which relates to language competence. That is, language interactions shape the learner's thinking or cognitive development. Language interactions can occur in various ways, e.g. class discussions, dialogues between teacher and learners, peer dialogues and on-line computer network discussions (Hogan & Fisherkeller, 2000:106). The challenge is whether the language used in classroom interactions promotes learners' cognitive development. As stated previously, language is an important tool for communicating ideas and to make meaning of the learning situation. In science teaching and learning, for example, ideas can be expressed in linguistic (reading, writing, discussing, narrating, describing, etc.) and non-linguistic modes (actions, images, symbols). In other words,

science has a multi-semiotic system (Jones, 2000:89). The complex scientific discourse, therefore, requires learners who are critical thinkers and who can understand the different meanings of scientific concepts. The language of science in the form of talking, reading and writing enhances learners' understanding of science. That is, it is essential for science knowledge construction (Jones, 2000:95). So the importance of language of instruction in stimulating thinking and reflective abilities cannot be underestimated.

Greeno (1992:39) views thinking as a natural activity that learners use in learning mathematical or scientific concepts. He claims that lack of scientific thinking by students is not caused by them, but rather by the classroom situations that do not support the kind of thinking expected of learners. Therefore, thinking seems fundamental to cognitive growth and learning. This claim challenges teachers to employ learner-centred approaches in their classroom in order to enable their learners to develop scientific knowledge and understanding.

4.7.2.1 Science and thinking skills

Critical thinking refers to the learner's ability to unpack, analyze and critically evaluate knowledge (Mintzes & Novak, 2000:47). Critical analysis of knowledge implies that the knowledge can be modified when necessary. So science knowledge can be modified depending on the outcomes of critical analysis by the learner, hence it is claimed that scientific knowledge is dynamic (Jones, 2000:91). It is dynamic in the sense that it changes according to different contexts in which it is used. For example, with the emergence of new scientific discoveries, the existing meanings or concepts are challenged or modified.

Thinking skills are developmental in nature, with higher level skills building on more basic ones. They develop in distinct stages, with the highest level of development needed for complex scientific reasoning. At this stage of formal operations/formal thoughts people can formulate hypotheses and manipulate abstract symbols. The high level thinking skills make it easier for the learner to link the new information with concepts already learnt. As a result, the learner can recall and apply the information easily (Friend,

2002:40). This is an indication that there is a link between knowledge and thinking. That is, one uses knowledge to reason (seek information that supports claims); and conversely, one uses reasoning to construct knowledge.

According to Halpern (1992:13) a cognitive skills approach should result in improved teaching and learning in science because learners are confronted with problems to solve. The scientific problems should be embedded in a real-world context with multiple decision points to encourage critical thinking. Learners should be encouraged to work together and "think aloud" so that the teacher can give immediate feedback and identify learners' problem areas.

Critical thinking, as implied in the cognitive model, is a complex exercise. It mirrors one's understanding of concepts or ideas in the taught lesson. Language seems crucial as it influences one's understanding in learning. As mentioned in the section above, if the learners are not competent enough in the language used in teaching and learning, the likelihood is that they may not understand the content of the lesson. How can they be critical or analyze science concepts if they do not have an understanding of what they mean?

4.7.2.2 Science and conceptualization

Linked to Piaget's (1959) theory of cognitive development, conceptualization characterizes the stage of formal operations where learners think formally and abstractly as they interact with the world. According to Southerland, Smith & Cummins (2000:72) in conceptual building, learners explain their understandings in their own words and apply that knowledge in selected tasks. That is, they go beyond recognition of concepts to construct a detailed personal explanation to solve scientific problems.

Learning becomes effective when the new and existing knowledge are structured around the major concepts of the content or discipline (National Research Council, 2003:20). According to the above principle, learners bring many ideas to the class from various sources such as school, play, media, etc. from which they construct their new knowledge.

It becomes easy for the learner to connect new knowledge with prior knowledge when the content revolves around big ideas or concepts that are usable and familiar to the learner, rather than small fragmented concepts. This shows that learners relate new concepts to ideas or processes they already know. The above principle makes use of the constructivist paradigm which focuses on previously learned science concepts and the learners' understanding of the concepts, as a basis for the construction of new knowledge. So conceptualization is meaningful learning that occurs as the learner relates new knowledge or concepts to prior knowledge. In rote learning there is no integration between new and previous knowledge (Novak, Mintzes & Wandersee, 2000:3).

Seemingly, there is a relationship between conceptual development and linguistic development of the learner (Kecskes & Papp, 2000:5). When children enter school the only asset they bring to the classroom is language, usually the mother tongue which I will refer to as the first language (L1). Language becomes the main regulator of thinking and comprehension of what has been taught. If the learner does not understand the language of instruction, s/he cannot construct meaning on what is being said or taught (Bell & Freyberg, 1985:33). So this implies that conceptual development is also influenced by the language used in teaching.

Apart from language used by teachers and learners in the classroom, the language used in textual materials also appears to be a problem in science learning. Given the fact that most of the textbooks for the majority of black children in South Africa are written in English, by L1 speakers of English in most cases, the language used in the textbooks is usually complex and inaccessible to L2 learners. As mentioned in the previous chapters, teachers in black schools are also L2 speakers of English and some of them have limited proficiency in it. Many of the teachers depend on the textbooks for their teaching, and if the language used in the textbooks is difficult for them, such a situation has implications for the effectiveness of the teaching-learning process. Consequently, "science teaching in many instances has thus generally become an exercise in the transmission of knowledge in the textbook to learners" (Gray, 1996:226).

4.7.2.3 Science and misconceptions

Research shows that learners often bring rich prior knowledge to the classroom, and some of the knowledge may be false information (Roth, 1991; Tasker & Osborne, 1985). Sometimes the learners resist changing the preconceived conceptions, and that may result in disparity between the scientific explanations presented in class and the learners' prior knowledge. As a result of the mismatch between the knowledge that the learners bring to class and new knowledge they gain in class, misconceptions arise. Sometimes learners start to distort the new information and make it fit their prior knowledge. Also, many learners are not developing integrated understanding of science concepts; so they memorize facts, but they become unable to use the memorized facts and definitions to explain everyday phenomena (Roth, 1991:49; Tasker & Osborne, 1985:27).

Data collected in this research shows that misconceptions occur in science learning. Misconceptions can be barriers to learning in general. Learners' subsequent learning can be adversely affected if learners have not developed an appropriate understanding of fundamental concepts from the beginning of their studies (NRC, 1997:27). For effective teaching and learning, it is necessary that the misconceptions are broken down. According to the NRC (1997:27) the following types of misconceptions are the most common among science learners: preconceived misconceptions, non-scientific beliefs, conceptual misunderstandings, vernacular misconceptions and factual misconceptions.

Preconceived misconceptions are rooted in everyday learners' experiences. In other words, the learners' everyday experiences influence them to generalize the knowledge inappropriately. For instance, learners might think that underground water flows in streams because they see water on the earth's surface flowing in streams (NRC, 1997). This is a misconception that can affect their future understanding of other scientific concepts that relate to flow of water.

Sometimes learners acquire certain beliefs from various sources other than scientific education such as religion, mythical teachings, etc. These beliefs become internalized in the learners' minds, and sometimes it becomes difficult to change the learners' way of

thinking. The non-scientific beliefs can affect the learners' understanding of scientific concepts and further learning.

Learners bring preconceived concepts about certain phenomena in the classroom. Misunderstandings may then arise as learners are taught scientific information in a way that does not provoke them to confront the preconceived notions and non-scientific beliefs that conflict with the new knowledge.

Vernacular misconceptions occur as a result of mismatch between the use of words in the classroom and in everyday life. Some words may have different meanings in different domains. The word 'consumer', for example, can have different meanings in science and in our daily use. Learners can associate the term with animals only, and not with humans and other objects (e.g. electric consumption).

Factual misconceptions are often learned early in life and remain unchallenged till the learner reaches adulthood. For example, in some cultures there is a general belief that lightning never strikes twice in one place. Gray (1996) also noted this kind of belief among teachers in the KwaZulu-Natal Province. This belief is not scientifically valid, and it may remain a misconception in people's thinking. Actually, it reflects conflict between traditional knowledge and scientific knowledge which has implications for learners' understanding of science (Gray, 1996: 225).

It is important that science teachers create opportunities for learner thinking by integrating teaching for thinking with other learning areas or subjects such as mathematics, language, computer sciences, etc. This encourages creativity and arouses learners' curiosity. Also, teachers should teach in ways that will make learners' thinking apparent in ways that can be observed, transmitted, discussed, reflected on, and moved toward more competent performance and dispositions for reasoning (Glaser, 1992:75). That is, learners must be encouraged to make meaning out of their learning, which is fundamental to concept formation.

It is important for teachers to detect learners' misconceptions and address them or challenge them directly. It is possible to find out about these misconceptions when the

teacher tries to find out about what the learners already know, and find ways to build on that knowledge by engaging the learners in various activities that stimulate their thinking.

4.7.2.4 Conceptual change

Conceptual change refers to ways of breaking down misconceptions. Meaningful learning in science often requires learners to go through a process of conceptual change (Roth, 1991:49). In other words, learners must recognize the mismatch between their own personal theories and scientific concepts, and must make sense of scientific concepts. Conceptual change involves metacognitive awareness where learners have to reorganize their way of thinking in order to make appropriate links between their own ideas and scientific concepts. In metacognition learners have to monitor and evaluate their current understanding of certain concepts in order to make a meaningful link between prior and new knowledge. Chamot and O'Malley (1994: 383) have this to say about metacognitive awareness:

> Students with greater metacognitive awareness understand the similarity between the learning task and previous tasks, know the strategies required for successful problem solving or learning, and anticipate that deploying these strategies will result in success.

In light of the above statement, Fairbrother (2000:8) perceives metacognition as a self-regulatory strategy that includes the cognitive, metacognitive and motivational aspects. The cognitive aspect emphasizes the learner's ability to integrate new information with existing information, while the metacognitive aspect enables the learner to think about her learning, and choose appropriate strategies to enhance learning. The motivational aspect has to do with the learner's belief in him/her (self efficacy) which influences learning. Metacognition, therefore, helps the learner to plan, monitor and evaluate her thinking processes (i.e. to take control of learning and development).

The first step towards breaking down learners' misconceptions is to identify the misconceptions. It is easy to detect misconceptions in learners' essay assignments and discussions. Laboratory activities can also be used to find out learners' misconceptions as learners test ideas and hypotheses. As a teacher you can compile a list of all the

misconceptions in your class each time you identify them. Learners can be organized in small groups to discuss their misconceptions and explain their reasoning underlying the misconceptions. In this way they can learn to correct themselves and gain a better understanding of the new concepts.

Secondly, learners can be assisted to confront their misconceptions. Confronting conceptual change with events or information that contradicts the learner's existing conceptions is referred to as conceptual conflict (Adey, 2000:167; Tao & Gunstone, 1999:860). Conceptual conflict is at the centre of the Conceptual Change Model (CCM) which specifies conditions for conceptual change, namely: one has to be dissatisfied with the existing conception in order to undergo conceptual change; the new conception should be perceived as intelligible and fruitful by the one undergoing conceptual change (Tao & Gunstone, 1999:859). Conceptual change then involves the replacement of an existing conception by a new conception.

Research on conceptual change has shown that some learners may ignore the conflict between the new and old concepts, and remain with their conceptions (regression) or they may resolve the conflict by reflecting on and reconstructing new conceptions (Tao & Gunstone, 1999:876). For example, Niaz (1995) found that some learners protected their conceptions by ignoring the conceptual conflict, while Dreyfus, Jungwirth & Eliovitch (1990) found that bright successful students reacted enthusiastically to conceptual conflicts, and unsuccessful students tried to ignore the conceptual conflicts. The results of a study by Tao & Gunstone (1999) which investigated Grade 10 learners' conceptual change during a computer-supported physics unit showed that learners moved between alternative and scientific conceptions from one context to the other in the course of instruction. That is, learners experienced conceptual progressions and regressions during the lessons (Tao & Gunstone, 1999:876).

For successful conceptual change, learners should be aware that they do not possess the correct relevant knowledge so that they can correct their misunderstandings. Questions and discussions that challenge learners' thinking can be used to probe for additional misconceptions. Learners can be asked to discuss their personal theories and give

evidence that supports their explanations of certain phenomena. They can clarify their positions by comparing and contrasting the different theories, and thereafter, they can be given time to revisit misunderstood concepts; to see how the new concepts differ from their own theories. Sketches or diagrams and descriptions of phenomena can help students get a better understanding of some concepts. The teacher should respond to learners' statements or theories in a way that will guide and support learners' growth in thinking.

Thirdly, helping learners overcome their misconceptions can be done through the use of activities that create conceptual conflict. Discussions should centre on questions that will help learners resolve conceptual conflicts and make sense of concepts. The learners should think about ideas and try to link those ideas to their everyday experiences. They should look for relationships between the ideas they have and develop new meaningful ideas. Concept maps, for example, help learners construct new knowledge when they visualize groups of concepts and their interrelationships. Cooperative learning is also a good strategy in overcoming misconceptions through discussions, demonstrations and laboratory activities. The teacher should revisit common misconceptions as often as possible, and should assess on a regular basis the validity of learners' conceptions.

The above discussion places language at the centre of conceptualization and conceptual change. That is, for learners to conceptualize science content they must first understand the language that is used to explain such concepts. Secondly, language plays a dominant role in correcting misconceptions. The learners must use language to communicate their misunderstandings. Better communication always occurs through the language that the learner knows well, which is usually the learners' mother tongue (Tsui, 1996; Klein, 1986). This implies that it may be difficult for both the teacher and the learners to detect and correct misunderstandings if communication occurs in a foreign language.

4.7.3 Inquiry-Based Approach

Inquiry in science refers to learner activities that require learners' critical and logical thinking to discover and explain certain concepts. Such activities include posing questions, planning investigations and reviewing what is already known in light of experimental evidence (Martin-Hansen, 2002:34). In these activities the learners search deeper for scientific knowledge in order to form concepts and theories. They make use of critical thinking to draw conclusions from observed data.

According to Timons (2003:31) an inquiry-based model is not a useful tool to learners only, it is helpful to teachers as well. It enables teachers to conduct inquiry research in their own classrooms. An inquiry-based model, therefore, provides both teachers and learners with a better understanding of inquiry and confidence in using their critical thinking skills in science. Martin-Hansen (2002:35) outlines four types of inquiry that can promote effective teaching and learning of science: (i) Open/Full Inquiry, (ii) Guided Inquiry, (iii) Coupled Inquiry and (iv) Structured Inquiry.

The open inquiry is learner-centred. It starts with the learner's question that drives the investigation, followed by the learner designing and conducting an investigation or experiment. It encourages learners to take charge of their own learning and share the outcomes of their learning with others. This type of inquiry needs learners' high order thinking skills as they work with scientific concepts to carry out investigations, record collected data and analyze their data. It also develops the learners' research skills as well. At the end of the learning process the learner must communicate the results of the investigation to the teacher and other learners.

In guided inquiry the teacher gives assistance to learners by providing relevant scientific data from various sources to carry out the experiment. In this type of inquiry the facilitative role of the teacher becomes evident. It leads to open inquiry because the learners have to work on their own to achieve the desired outcomes of the investigation. The learners engage in discussions and class presentations in order to communicate their findings to the whole class.

The coupled inquiry combines the guided and open inquiries in a cycle. It starts with guided inquiry as the learners make use of their prior knowledge to make scientific predictions. The learners can choose a topic and predict an outcome for the activity. The topic must be easily accessible and compatible with the facilities available in the classroom. This stage corresponds with the first stage of the Inquiry-Based Research Model proposed by Timons (2003:31) in which learners work on a topic that they have chosen themselves.

For effective use of the inquiry-based approach, Timons (2003:36) suggests that teachers should assess the learners' experiments and learners must be awarded for their originality, their design of inquiry exercises, written summaries, graphing ability, final presentation and their ability to work with others. In this way learners gain greater confidence in the use of their critical thinking skills.

The use of inquiry-based activities helps the learners to develop better understanding of scientific concepts, the nature of science and the skills necessary to become independent inquirers about the world (Doran, Chan, Tamir & Lenhart, 2002:3). Inquiry-based activities require the learner to play an active role in her learning, e.g. making observations, performing experiments, analyzing data, etc. in order to arrive at conclusions that lead to certain theories. The more senses and skills the learners apply during the learning process, the greater the understanding and retention of concepts learned (i.e. conceptualization is fostered).

Participating in inquiry-based activities helps learners to gain the foundation for job skills outside of the school and it also combats the "science avoidance syndrome" (Lunsford, 2002:54; Timons, 2003:36). Inquiry-based activities challenge learners to question and predict results of scientific phenomena, and in that way, their critical thinking skills are developed. Inquiry-based approaches, therefore, set a good background for the learner to generate or construct scientific knowledge, while the teacher is empowered with skills to conduct scientific classroom research.

The inquiry-based approaches seem to encompass both the constructivist and cognitive models in that they put emphasis on the generation of knowledge by the learners themselves. Also, they develop the learners' cognitive thinking skills by engaging the learners in different activities. As mentioned earlier, the effectiveness of the inquiry-based approaches depends largely on the language used in the classroom. If the activities are carried out in a language that both the teacher and learners understand, it is likely that the learners can understand better, and attain scientific literacy.

4.8 Summary

The foregoing discussion has shed light on the relationship between language and science teaching and learning. The relationship is reflected in scientific literacy, which, besides strengthening learners' science process skills (investigation, comparison, inference, observation, etc.), also enriches their language skills through speaking, listening, reading and writing. The primary aim of scientific literacy is the generation or construction of knowledge by learners. As a result, it encourages learner-centred approaches where learners will play an active role in the construction of their own knowledge.

Science is a practical subject that needs communication between the teacher and the learners themselves. So effective communication occurs through the language that the teacher and learners understand well, and that is usually the learners' home language. In the context of this study, it is envisaged that learners will understand science better, and express themselves (orally and in writing) better in isiXhosa (their home language) than in English. There are other factors, however, whose influence on learners' level of science understanding cannot be ignored. Such factors include things like teachers' level of motivation and teaching styles, and certain socio-economic conditions under which the study was conducted. These factors are listed under the limitations of this study in the next chapter.

Secondly, the chapter has focused on the learning outcomes of the Natural Science Learning area that focus on knowledge construction through scientific investigations. The learning outcomes correspond with the three approaches (constructivist, cognitive

and inquiry-based) that put the learner at the centre of the teaching-learning process. All three approaches seem to recognize the importance of language in bringing about effective teaching and learning of science. In fact, the discussion has shown that the language used in the science classroom can be one of the causes of misconceptions if it doesn't match with the learners' mother tongue. The three approaches seem to point to the fact that knowledge generation or construction by learners has to do with the teaching styles that are employed by the teacher in the science classroom. If the teacher does not encourage interaction or active learning by the learners by engaging them in challenging activities, scientific literacy may not be attained even if teaching occurs in the learners' mother tongue.

The next chapter focuses on the research methodology employed in this study. It explores the different data collection methods used in this study in order to answer some of the questions that have been raised by the literature given in this chapter.

CHAPTER 5

RESEARCH METHODOLOGY

5.1 Introduction

As mentioned in Chapter 1, the theoretical framework underlying the purpose and focus of this study is the interpretive or phenomenological paradigm which seeks to "capture the lives of the participants in order to understand the meaning by analyzing conversations and interactions that the researcher had with the subjects" (Henning, 2004:19). In this study, the researcher had to observe how the research participants (teachers and learners) interacted in schools and how they attached meanings or interpreted their ways of interaction. Also, the researcher had to analyze the parents' perceptions of the use of English and isiXhosa as media of instruction in science in order to get their own meanings and understanding surrounding the issue of languages of instruction.

Appropriate to the interpretivist framework are the data collection and analysis methods used in the study. This study followed an ethnographic or qualitative design in data collection. Ethnography, according to De Vos et al. (2005:271), occurs over an extended period of time as the researcher spends time in the field. It is characterized by observation and other data collection strategies such as interviews and documentary analysis. The end product of ethnography is a description of the behaviour of the research participants and the experiences of the researcher (De Vos, et al., 2005:271).

In view of the above explanation, the main focus of this chapter is a description of the methodology employed in collecting data from the participants involved in the research. As a point of departure, this chapter discusses the research design and rationale for the research methods used. It also reports on the sampling criteria and selection of research sites. Lastly, the various instruments and methods used in the collection of data is

discussed in order to pave way for data presentation and analysis in the following chapters.

5.2 Rationale for research design

Mouton (2001:55) defines research design as a blueprint of how the researcher intends to conduct the study. In line with Mouton's (2001) description, Henning et al. (2004:36) refers to research design as a reflection of the methodological requirements of the research question that determines the type of data that will be collected and how the data will be processed. In other words, a research design is a plan or structure that guides the researcher to obtain information or evidence to answer research question(s). A research design, according to Mouton (2001:55), focuses on the end product, the problem or research question and evidence to address the research question appropriately.

Research can follow different designs depending on the type of study and research question(s). For example, an empirical study may follow a different design from a non-empirical study (Mouton, 2001:57). As an empirical study, the present study follows the experimental, qualitative and ethnographic designs. The experimental design framework in this study is used to compare how teaching and learning occurred in science (from Grade 4 to Grade 6)) when conducted in the two media of instruction (English or isiXhosa).

According to De Vaus (1991:6) and Best & Kahn (1989:114), in an experimental design people are assigned randomly to the experimental and control groups in order to ensure that they are the same at the beginning of the study (e.g. in terms of prior knowledge, length of instruction, etc.). There is also some manipulation of the experimental group that does not occur in the control group (i.e. the experimental group is manipulated by imposing or withdrawing certain conditions (De Vaus, 1991:6).

In the context of this study, intervention or manipulation as part of experimentation was done in terms of supplying the learners with science materials that had been translated into isiXhosa, while the control groups were given materials written in English only. In

order to please the parents of the learners in the experimental groups who were concerned about their children who would be deprived of scientific terminology in English if they had to learn through the medium of isiXhosa, we also supplied these learners with science materials in English. The English workbooks, however, were not used by the teachers and learners in the classrooms, but they were only used as additional references. So the experimental group received science workbooks in both languages (English and isiXhosa). Although the supply of materials to the experimental group in both languages (instead of isiXhosa materials only) was a means of gaining access to the subjects of the study, I cannot, however, rule out the effects of this practice on the results of the study.

Secondly, the study followed one of the principles of experimental design by trying to involve subjects who were identical in terms of exposure to the language of instruction (isiXhosa) at the start of the research. Although it is a bit difficult to claim convincingly that the learners had exactly the same competence in isiXhosa due to individual differences relating to cognitive, social and emotional development and many other aspects related to classroom practices, the fact that they were all advancing from the Foundation Phase to the Intermediate Phase formed one of the selection criteria for their involvement in the study. Moreover, the learners were taught by different teachers in the previous phase, and teachers are also unique in terms of their teaching strategies and styles and interaction with learners, and that could indirectly influence the type of learners produced at the end of the learning programme. For example, some learners can be more motivated than others as a result of the kind of support and stimulation they receive from the teacher. These differences could affect the teaching and learning process either positively or negatively.

For the purpose of the study, I chose learners who were progressing from the Foundation Phase (Grades 1 – 3) to the Intermediate Phase (4 – 6). These learners learnt all the subjects through the medium of isiXhosa in the Foundation Phase. That is, all the learners (both in experimental and control groups) had been doing the same learning areas (Languages, Numeracy and Life skills) through their mother tongue (isiXhosa), and all of them had a reasonable oral proficiency in isiXhosa as their mother tongue. The

similarity between the two groups at the beginning of the study was based on the fact that all of them were from the Foundation Phase (Grade R – 3) where they were taught all the learning areas in the mother tongue (isiXhosa), and learnt English as an additional language. In other words, all learners would be taught other subjects through the medium of English for the first time in Grade 4, that marks the beginning of the Intermediate Phase (Grades 4 – 6).

Thirdly, following the qualitative design which, according to Henning et al. (2004:5) is an inquiry that examines the qualities, characteristics or the properties of a phenomenon for better understanding and explanation, the study investigated the behaviour and practices of teachers and learners as they occurred naturally within the classroom settings. As teaching and learning are broad concepts that encompass many concepts and activities like the curriculum, teaching methodology, teaching and learning resources, the classroom environment, learning strategies, parental involvement, motivation, and many other activities, the qualitative research approach allowed me to make observations at different times and at different points in order to find out the extent to which these variables affected the teaching and learning process in science. In other words, I wanted to see all the activities and events (social, cultural and historical) occurring in the science classrooms (from Grade 4 – 6) in order to see their impact on teaching and learning. The classroom observations helped me to identify and understand underlying factors that impacted on effective teaching and learning of science in the Intermediate Phase.

The classroom observations also enabled me to get a clear picture and full understanding of what was happening in the science classrooms so that I could draw comparisons between the experimental and control groups in both schools from the teachers' and learners' perspectives. Through close interaction between myself as a researcher, and the subjects of the study (teachers, learners), I began to understand how the research subjects perceived and interpreted situations in which they lived. In other words, I was able to understand how teachers and learners made meanings of different classroom situations and activities, and how their interpretations impacted on the teaching and learning of science through the media of English and isiXhosa.

Burgess (1988:8) mentions flexibility as one of the features of qualitative research. Flexibility becomes evident as data collection and analysis occur simultaneously in qualitative research and, usually data collection is not hypothesis-driven, (i.e. not collected to support or reject hypotheses). In other words, researchers can modify their work as the collection and analysis of data proceeds to suit new situations.

As the study followed a three-year longitudinal design, I deemed the qualitative research design suitable in this case because of its flexibility. As I reflected on each research activity during data collection, sometimes there was a need for certain changes. The qualitative nature of the study allowed for such changes or modifications during the research process. For instance, some of the research activities that I planned did not work as I was doing my fieldwork, so I was able to engage in other activities relevant to the study. I tried, nevertheless, to adhere to the scheduled programmes and activities as much as I could, but due to certain circumstances beyond my control I had to adjust my research programme according to the situations I encountered. This meant, for example, that I had to reschedule other appointments (e.g. writing of tests, interviews, meetings), while I continued with observations in schools. Such adjustments were only possible because I followed a qualitative research approach that allowed for this flexibility.

According to Bogdan (1992: 120) a descriptive or qualitative approach encompasses portraits of the subjects, reconstruction of dialogue, description of physical setting, accounts of particular events and activities, and the observer's behaviour. In this regard, Henning et al. (2004:6) talk about "thick description" in qualitative research which gives a full account of the phenomena, and interpretation of information which is based on other empirical information and theoretical framework on which the study is based. In the following sections of this chapter the descriptive nature of this approach is evident: how the research sites and subjects were selected and how data was collected (observations, interviews, informal conversations, document analysis, etc.). All the interactions that occurred between the researcher and her subjects are portrayed in words. Therefore, the study fits the descriptive nature of qualitative research as it describes the process of data

gathering, while the last chapter focuses on the outcomes or findings of the study. All the information is presented in most cases in the form of words rather than numbers.

Although the research followed mainly a qualitative design in terms of data collection and analysis, it has been necessary to use some quantitative measures in data analysis to a limited extent. Quantitative measurement involves using a certain type of instrument to obtain numerical values or to compare and analyze different variables that are summarized and reported as the results of the study (Bless & Higson-Smith, 2004; McMillan & Schumacher, 1989:241). In the context of this research, for example, I have made use of graphs to compare the academic achievement of learners in science over the three years of this study. Although the graphs have been described qualitatively, the numerical values of scores fall within quantitative data analysis. Thus Mouton (2002:166) asserts that quantitative analysis is valuable even in qualitative studies.

In short, the methods that have been used to collect data in this study have been influenced by three research designs (longitudinal, experimental and qualitative). For example, as stated above, experimentation in the form of teaching Science through the medium of isiXhosa with the control group taught in English only has been followed for three years (2003 – 2005). Also, on the basis of classroom observations, interviews and conversations that characterize qualitative research, the two groups (experimental and control) were compared in order to arrive at the conclusions reflected in Chapter 8.

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5.3 Identifying research schools

On receiving LOITASA funding from NUFU in the beginning of 2002, the next step was to identify schools that had to participate in the LOITASA project as mentioned in the first chapter of this study. The two schools that were selected for participation in the study located in Cape Town townships[14], in predominantly isiXhosa- speaking communities.

It was easy to identify schools in Khayelitsha, a large township in Cape Town, as the Faculty of Education in which the LOITASA Project is based had a long working relationship with schools in this area with regard to the 4th year students' teaching practice. In other words, students who are in pre-service teacher training through the Post Graduate Certificate in Education (PGCE) are usually placed in different township schools, including Khayelitsha for their practicals. They spend one term in schools so that they can get exposure to classroom realities while they are still undergoing pre-service training. So the schools that were approached to participate in the research were known to us because they were also used as sites for students' teaching practice.

New Crossroads area was a second area identified as a site for our research purposes due to its proximity to the university, and the fact that its community was predominantly isiXhosa-speaking. We then ended up with two schools, one in Khayelitsha (Zama Primary School), and the other in New Crossroads (Sizwe Primary School). In order to keep the schools anonymous, I have given them fictitious names (Sizwe and Zama).

Although the study does not aim at comparing the two schools, research in the two schools has enabled me to get a better understanding of how different schools function at academic and management levels, and these differences have had an impact on the results

[14] Township schools are located in the low socio-economic areas of Cape Town and the majority of learners come from the black working class group. The majority of the learners in these township schools are mother tongue speakers of isiXhosa. Apart from overcrowding and severe lack of facilities, the schools are also confronted with violence and criminal activities.

of the study. Also of importance is the history and physical structures of the schools that have helped me understand the complexities and implications surrounding school activities and events, and their impact on teaching and learning in each of the research schools. The physical structures of the schools that seem to have an impact on the results of this study are discussed below.

5.3.1 Sizwe Primary school

Sizwe Primary School is situated in New Crossroads Township that branches off from the Nyanga East Township which is one of the oldest black townships in Cape Town (with Gugulethu and Langa). Crossroads was established in 1975 during the apartheid period when the law did not allow the different ethnic groups to live together in South Africa. During this time all black South Africans had to have a work permit to be in or around Cape Town, and many informal settlements emerged as more black people were coming to Cape Town, and they could not live in areas that were designated for whites or coloured people.

Crossroads is one of the large informal settlements which had a population of over 100 000 by the 1980s. The numbers increased as more people from the rural areas, especially from the former homelands, came to Cape Town for work purposes and to have better access to health services that were not available to them in the rural areas. As a result, there is overcrowding in the townships, and unfavourable living conditions such as lack of sanitation, poverty, unemployment and high rate of crime.

In Crossroads there are few brick houses and a lot of informal settlements or squatter camps. The people of the area where Sizwe Primary School is situated used to live in shacks in the Old Crossroads Townships. They had one school in the area, and they wanted more schools. With the help of Reverend Jesse Jackson who was touched by a woman's movement in this area, the New Crossroads Township and three schools were erected. Sizwe Primary School was one of them, with one high school and another primary school. The three schools are very close to each other and there is a community hall close to them.

Sizwe Primary School was started in August 1982 with five teachers (one male and four female teachers) and seven learners. It was started after a long struggle by women who were trying to resist the laws of the apartheid system, and who were trying to uplift their communities.

It is built with concrete walls and has an administration block, junior and senior phase blocks. There is a big class used as a media centre. The school has a flower garden surrounding a lawn. Although the school looks attractive from the outside, inside, the classroom walls need to be painted, and windows of some classrooms are broken. Apart from the classroom walls that are not attractive at all, gates and some classes that cannot lock, floor tiles are old and worn out, some of the electric plugs are not functioning, and there is not enough space for sports grounds and other structural developments.

There is a high crime rate in this area and armed robbery and break-ins have occurred several times at the school. Valuable assets of the school like computers have been lost as a result of robbery. Although there are two male caretakers and one female cleaner at the school, in some instances teachers have been robbed of their purses and cell phones at gunpoint within the school premises by thugs who jumped over the fence. As a result, teachers are always on the alert and anxious, looking out for any unfamiliar faces around the school.

Although the school started with five teachers and seven learners only, its population grew tremendously from 1982, and reached a peak of 33 teachers and 1225 learners in 1999. Unfortunately, from 2000, the school started losing teachers due to retrenchments and retirement. In 2004 the school had an enrolment of 793 learners (including 75 Grade R learners) and 19 teachers, including the principal, while there were 801 learners in 2003 with the same number of teachers. Of the 19 teachers there were 4 male teachers.

5.3.2 Zama Primary School

Zama Primary School is located in Khayelitsha Township. Khayelitsha is a township that is situated 30 kilometres east of the city of Cape Town. Khayelitsha literally means "new home", and it originated in the early 1980s when black people were moved by the apartheid government from existing townships (Gugulethu, Langa, Nyanga East) to a new township. According to the 2004 statistics, the population of Khayelitsha is estimated closer to 500 000 people, with about 80% unemployment rate, and 90% of the employed people earn less than R3 500 a month. Apart from the high rate of unemployment and poverty, Khayelitsha is faced with lots of other challenges such as overcrowded living conditions, lack of proper housing and sanitation, violent crime, burglary, and a high rate of HIV/AIDS and Tuberculosis (TB). A small percentage of people (about 14%) live in small brick houses, while the rest (86%) live in informal settlements or shacks[15]. Because there are no official electricity services in some of the shacks, many electric cables run from shack to shack; usually from old shacks to new shacks. Some of the shacks are businesses such as food and clothing shops, barber shops, tailors, suppliers of building materials, phone shops, etc. (http://www.dplg.gov.za/html/progs/urpNodes/KhayelitshaProfile.htm). But all the schools in Khayelitsha are built with bricks.

Most of the learners in the school live in Khayelitsha where the school is situated, although they spend the long summer holidays in the Eastern Cape with their parents' families. The majority of people in the townships come from the Eastern Cape Province, and they settle in Cape Town for work purposes, hence they build shacks as they cannot afford proper houses because most of them have low income jobs or are jobless.

The houses surrounding Zama Primary School are made of bricks, but the shacks are not far from the school. Many children come from the surrounding shacks where crime,

[15] Shacks refer to informal settlements in urban areas where the majority of working class blacks live. The houses are made of wood or plastic materials, and they catch alight easily, and are easily demolished by heavy rain and wind.

unemployment and poverty prevail. Like Sizwe Primary School, the buildings of Zama Primary School are made of concrete walls. It has an administration block and two blocks of classes with a hall that is not big enough to accommodate all the learners of the school. Although the soil is sandy, its garden is well looked after, with flowers. Inside the classroom there are lots of renovations that need to be done, e.g. fixing of broken windows, doors and torn out floor tiles, painting of walls and chalkboards.

Zama Primary School was established in 1986. The current Principal of the school was the first principal of this school. There are twenty-two staff members, including the Principal, and two administrative clerks (male and female). Of the twenty-two teachers, there are only four male teachers, and the principal is one of them. The total learner enrollment of the school had decreased from 966 in 2001, 929 in 2002, 803 in 2003, 774 in 2004, but increased again to 948 in 2005.

During my research at this school, I learnt that there were large numbers of learners coming from Mfuleni. Mfuleni is also one of the black townships with one primary school, so some learners had to travel long distances to Zama Primary School because the school in Mfuleni could not accommodate all of them. The other students come from Blackheath which is a nearby former coloured township. Although there were schools in this township, the medium of instruction was usually Afrikaans, and some of the black children did not know Afrikaans, and therefore they had to go to the nearest schools where the medium of instruction was English. Most of them chose Zama Primary School.

Although the school was experiencing problems with robberies and break-ins, there was stability in terms of school management, and the atmosphere was welcoming. The school participated in many extra-mural and cultural activities such as sport, music, drum majorettes, dance, etc. Through informal conversations with some teachers, I learnt that the school had a good reputation in music. The drum majorettes and the school choir were always invited by various organizations to perform on different occasions within the community, e.g. the police, health, and other departments. When the delegation from the

Norwegian Parliament, for example, visited the school early in 2004, the learners welcomed them with different performances such as drum majorettes and dance. The school's active involvement in sports and cultural activities was evident in pictures that were displayed in one of the corridors, in front of the Principal's office.

From the foregoing description of the two schools, it is apparent that the majority of learners involved in this study come from poor socio-economic backgrounds. The majority of the parents have low levels of education and they are unemployed, and therefore, they cannot afford to buy books and school uniforms for their children. Consequently, many learners do not wear complete school uniforms. Some come to school without stationery such as pens, pencils, erasers, etc. and have to borrow from others.

Fortunately, we were aware of the conditions in which the inhabitants of these townships lived before we started with the project, and we had to make plans to provide some kind of support to both teachers and learners involved in the study. We also wanted to ease the parents' burden by providing free materials to learners while continuing with the project. Hence the LOITASA Project supplied the classes that were involved in the project with free learner support materials.

5.4 Gaining access to schools

According to Measor (1988:56) gaining access to the lives of other people is always a problem. It involves building relationships with the subjects, being accepted by them and getting their trust. So as we attempted to get into schools, we were aware that we had to gain the trust of the teachers first, and thereafter it would be easy to access the learners and their parents.

To gain access to schools, we first identified the schools in which the project would be conducted. Generally, these were schools we had worked with as a faculty. Having approached the schools, Professor Desai then approached the Western Cape Department

of Education about the project, and we were granted permission to continue with the project at the two schools.

The second school (Sizwe Primary School) was chosen on the basis that some colleagues had done research in it, so the teachers were familiar with projects and had been cooperative. For example, a research assistant, Halla Holmarsdottir, working on a project funded by the Norwegian Research Council and led by Prof Brock-Utne, was also doing her doctoral research at the same school. The following sub-section gives a full description and criteria of how the schools were selected.

When we obtained the permission from the Department of Education in August 2002, we had to negotiate with the teachers who would participate in the research. The teachers who had to be involved in the project were those who were going to teach Grade 4 in 2003. We first made an appointment with the principal of Zama Primary School. The principal introduced us (Professor Desai and me) to his Deputy, the Head of Department and the two teachers who would be teaching Grade 4 at the beginning of 2003.

In order to gain the trust of teachers at Zama Primary School, we had to be open about the LOITASA Project. We explained how the project was established and what it aimed to achieve. We invited the teachers' opinions and feelings about the project so that we could have a common understanding in order to work together towards a common goal. In other words, we followed Bogdan's (1992:80) suggestion of overt access by making our interests known to the subjects, instead of going for covert access which implies collecting data without subjects' knowledge. After the discussion, the teachers showed interest and enthusiasm towards the project, and they invited us to attend a parents' meeting that was going to be held in the following month. The aim of the meeting was to inform parents about the project, and to ask their permission to involve their children in the project.

We followed the same pattern at the other school (Sizwe Primary School). We first met with the principal, a coloured gentleman, who was there in a temporary position. After

explaining to him what the project was all about and its aims, he seemed not to favour the use of isiXhosa as a medium of instruction, claiming that children needed to learn through the international language, English. Nevertheless, he allowed us to meet with the Head of Department and the three teachers who would be teaching Grade 4 in 2003. We then met with the teachers and gave them a background to the LOITASA Project.

After the explanation the teachers wanted to know how their school would benefit from the project. Although it was not easy to explain the concrete benefits of the project, we assured them of support and added knowledge and skills in the teaching of the two subjects (Science and Geography), and provision of free learner support materials that they could continue to use even after the project. We also mentioned the cognitive and psychological benefits of mother tongue education to learners. As some of the teachers had been involved in Halla Holmarsdottir's research study, they showed willingness to be part of this project as well.

5.5 Gaining access to parents

After meeting with the teachers at both schools, we had to meet the learners' parents. As a first attempt to communicate with the parents (of 2002 Grade 3 learners), we attended a parents' meeting that was held in November 2002 at Zama Primary School (Khayelitsha). The attendance was not good. Out of about eighty learners, only twenty-one parents turned up. After briefing the parents about the LOITASA Project and the benefits of mother tongue education in isiXhosa, it became apparent that parents were not at all aware of language policies and their implications at their children's school. The general concern was that their children should learn English in order to survive in terms of social and economic demands.

Fortunately, the principal of the school had invited his friend who was then working as a subject advisor in one of the Cape Metropole education districts. Both the principal and the subject advisor had gone through the system of mother tongue education from Grade 1 to Grade 8 during the apartheid education system. So they set good examples for the parents, may be because of the fact that they were taught through the medium of isiXhosa

through their primary education, they were fluent in English, and they were occupying senior positions in the Department of Education. They could also respond to parents' concerns such as the lack of appropriate scientific terminology in isiXhosa, by indicating that there were books with isiXhosa scientific terms that were used during their time, (e.g. oxygen was referred to as "umongo-moya"), and that would form a good foundation for the development of new terminology to suit the needs of today's learners.
The parents seemed convinced by our presentation and the input that was given by the principal and the subject advisor. Also, when some of the parents realized that their children were to be given extra support in English, they started to show eagerness to grant permission for this research to proceed. Consequently, out of 21 parents who attended the meeting, 19 of them gave a go ahead with the project on the day of the meeting.

As we were not satisfied by the small number of parents who attended the meeting, we thought the same could happen with Sizwe Primary School parents. So we decided not to hold a meeting at Sizwe Primary School, but to write letters to parents at both schools. I drafted the letter (see Appendix 1) in isiXhosa and translated it into English. We sent the letters written in isiXhosa to parents via the schools, so that the parents could understand the content of the letter. We asked the parents to respond on the following Monday (9th December 2002).

Ninety eight (98) letters were sent to Zama Primary School parents, and one hundred and one (101) were sent to Sizwe Primary School parents. Out of the 98 letters that were sent out (Zama Primary School), 48 parents (49%) responded, and forty (40) of them (83,3%) granted us permission to put their children in the isiXhosa medium of instruction classroom. We received forty one (41) responses (40,6%) from Sizwe Primary School, and out of the 41 returned letters, thirty six (36) of them (87,8%) agreed to have their children in the experimental group. At both schools the number of learners was sufficient as we planned to have one experimental class at each school. For ethical reasons we assured the teachers and parents that their schools would remain anonymous, and we would keep in touch and inform them about the results of the project.

5.6 The research subjects

As the study focuses on science teaching and learning in the Intermediate Phase, the research subjects were teachers, learners and their parents. In the first chapter the selection criteria for the research subjects are mentioned.

5.6.1 Teachers

At the beginning of the study in 2003 there were four teachers involved in the study, two from each school. All the teachers were females. Three of the teachers were over the age of 50 years, while the fourth one was in her mid-thirties. When the study began in 2003, one of the teachers had been teaching for 32 years, the second one for 25 years, the third one for 19 years, while the youngest teacher had ten years of teaching experience.

Concerning the teachers' academic and professional qualifications, three of the teachers (one from Zama Primary School and two from Sizwe Primary School) held the Primary Teachers' Certificate (PTC) and Matric (Grade 12), while one of them (from Zama) held a three-year Primary Teachers' Diploma (PTD) and the Bachelor of Education (Hons) degree. All three (PTC) teachers obtained their certificates in the 1970s, and the course was done after Grade 10 only. The same teachers obtained their matric (Grade 12) through private studies while they were teaching full-time.

The teachers were selected because they were going to teach Grade 4 in 2003. At the beginning of the research we were hoping that the same teachers could move to the subsequent grades with their learners. Fortunately, both schools allowed the teachers to continue with the project and move to Grade 5 with the same learners in 2004, although one of the teachers had to be replaced during the second semester of 2004 due to health problems. The data which is presented in the following chapter, then, was collected from the teachers who were involved when the project started in 2003.

5.6.2 Learners

The learners who were involved in the study were selected on the basis that they were doing Grade 3 in 2002, and would be doing Grade 4 in 2003, i.e. moving from the Foundation Phase to the Intermediate Phase. The intermediate phase marks a transition from mother instruction to a second language medium (English) and where five new subjects or learning areas are introduced (Natural Sciences, Social Sciences, Arts and Culture, Economic and Management Sciences, Technology) in addition to the three learning areas of the Foundation Phase, namely Languages, Numeracy and Life Skills. So the study started with Grade 4 learners in 2003 who were then on average 10 years old.

The other selection criterion was that learners were mother tongue speakers of isiXhosa who had been learning English as a subject in the previous phase. As the research followed a three-year longitudinal study, it aimed at looking at the learners throughout the intermediate phase (from grade 4 – 6) in order to establish a firm ground on which to compare the experimental and control groups of the study.

The number of learners changed from year to year since the study began in 2003, and we had no control over this change. For instance, since we started with the LOITASA Project in 2003, the number of learners varied in each school or grade for different reasons. The number of learners who participated in the study from 2003 to 2005 is reflected in the tables below (Tables 1 – 3):

Table 1: Number of Grade 4 learners: 2003

A. Zama Primary School	**Boys**	**Girls**	**Total**
Experimental	22	18	40
Control	37	15	52
TOTAL	**59**	**33**	**92**
B. Sizwe Primary School			
Experimental Group	18	16	34
Control Group	21	14	35

TOTAL	**39**	**30**	**69**
GRAND TOTAL (A + B)	**98**	**63**	**161**

Table 2: Number of Grade 5 learners: 2004

A. Zama Primary School	**Boys**	**Girls**	**Total**
Experimental Group	20	13	33
Control Group	29	13	42
TOTAL	**49**	**26**	**75**
B. Sizwe Primary School			
Experimental Group	27	18	45
Control Group	25	19	44
TOTAL	**52**	**37**	**89**
GRAND TOTAL (A + B)	**101**	**63**	**164**

Table 3: Number of Grade 6 learners: 2005

A. Zama Primary School	**Boys**	**Girls**	**Total**
Experimental Group	11	16	27
Control Group	29	16	45
TOTAL	**40**	**32**	**72**

In 2003 Zama Primary School had a higher number of learners (92) than Sizwe Primary School which had 69 learners only. There were two Grade 4 classes at Zama Primary School while there were three classes at Sizwe Primary School.

When we started the project at Sizwe Primary School two of the three Grade 4 classes were involved in the project. Unfortunately, the teacher who was responsible for the class which did not participate in the research project was transferred to another school in July 2003. The learners were then divided equally between the two teachers (experimental and control), hence the number of learners in Grade 5 increased in the following year. The numbers that are reflected in Table 1, however, show the number of learners who were involved in the study from its beginning. The movement of learners (who were not involved when the project started) to either the experimental or control groups is one of the limitations of the study mentioned later in this chapter.

While the number of learners increased in both groups at Sizwe Primary School due to the reason mentioned above, there was a decrease in the number of learners at Zama Primary School (92 to 75). The decrease at Zama Primary School was due to movement of learners to other schools. In an informal conversation with one of the teachers involved in the project, I was informed that some of the learners had to leave the school due to various reasons related to:

(i) HIV/AIDS

In this case learners had to take care of parents/ siblings who were victims of HIV/AIDS, or some had lost parents and had to move to other siblings, mostly to the Eastern Cape.

(ii) Divorce /separation of parents

Learners were affected negatively by their parents' separation or divorce as they had to move in with one of the parents/siblings who could be living far from the school, or in another province.

(iii) Abuse

Sexual abuse was the most common form of abuse that learners suffered at Zama Primary School. Such a practice influenced the removal of some learners from where they used to stay to other areas where they would be safer. The teacher mentioned that two of her learners in the control group, for example, were negatively affected by the abuse, and one of them contracted HIV through rape.

(iv) Financial problems

Some of the learners were raised (with other children) by grandparents who depended mainly on welfare grants. That kind of situation put a financial strain on the families which, in most cases, led to learners dropping out of school, or moving to other relatives where they would be taken care of financially.

(v) Distance

Some of the learners left the school because of long distances they had to travel to school. Linked to financial constraints, some families could not afford bus or taxi fares for the children, so they had to look for other schools where transport fares would be low or where their children could walk to school.

It is worth noting, however, that one of the schools dropped out of the research study in 2005, and the results of the study might have been affected by its withdrawal. As shown above, for the first two years of the study (2003 and 2004) there were two schools (Zama and Sizwe Primary Schools) in the study. But at the beginning of 2005 Sizwe Primary School withdrew from the study because the two teachers who had been involved in the study were both on sick leave, and sadly, one of them passed away in May 2005. The two new teachers who were teaching Grade 6 refused to be part of the study as they felt that being involved in the project would overburden them as they had to try to meet the demands of the Department of Education and those of the project at the same time. They also mentioned that most of the Grade 6 learners had learning difficulties, so they needed more time to work with them closely instead of spending more time on the LOITASA Project. The third reason of withdrawal from the study was that the new teachers did not see the need for the learners to be taught through isiXhosa as they would be shifting to Grade 7 in the following year where they would be required to have more proficiency in English, the language of teaching and learning.

This came as a great disappointment, and convincing the two new teachers to continue with the project failed, as we had to consider ethical issues that allow voluntary participation in research. As a result, we had to continue with one school (Zama Primary School) in 2005. In fact, according to Bless and Higson-Smith (2000:79) longitudinal studies are vulnerable to experimental mortality (dropping off or withdrawal), but the longitudinal study design had to be followed since this study is part of the bigger LOITASA Project that had to continue for three years. I am aware that the school's withdrawal from the project might have affected the overall results of the study.

From the above discussion it is apparent that social and economic factors have a great influence on teaching and learning. In both schools, such factors have been noted and their effects on the results of the study have been acknowledged under the limitations of this study as well.

5.6.3 Parents

As mentioned earlier in this chapter, the parents who participated in the study were those whose children were in Grade 3 in 2002, and who were going to Grade 4 in 2003. The parents were involved in choosing the language of instruction for their children by responding to the letters that were written to them at the beginning of the LOITASA Project in 2002 (see Appendix 1). The parents whose profile is described below are those who were interviewed during data collection in this study.

The age range of the interviewed parents of both schools was between 26 and 72 years. The youngest parent was 26 years of age whose child was schooling at Zama, while the oldest parent was 72 years, with two children at Sizwe Primary School. The oldest parent at Zama Primary School was 56 years of age, and she was fostering a grand-child as her parents were divorced while he was four months old. So the child became her responsibility since the parents' divorce.

At Sizwe Primary School there were three parents who were over the age of 50 years (62, 70 and 72 old). These parents were grandparents, but they were taking care of the children for various reasons. For example, the daughter of one of the grandparents (70 years old) passed away while her child was three years old, and the grandmother had to take full responsibility for the child. The second grandmother (50 years) had to stay with the child because her daughter (the biological mother of the child) abandoned him long ago. The third grandmother of 62 years of age had to bring up the child from the age of four years because her parents were separated. The fourth lady of 72 years of age was a foster parent to two young girls, one in Grade 5 and the other one in Grade 6. She adopted the Grade 5 girl when she was four years old, and during the time of the

interview the girl was twelve years old. Because of her good reputation in fostering other children, the local social workers asked her to take care of the girl as well.

When I conducted interviews with the learners' parents, I could not exclude the grandmothers as I felt that the learners they fostered were dependent on them for everything necessary for their education. They were the right people to talk to in order to get the correct information related to the learners' social and academic backgrounds that would assist in determining the kind of support needed by the learners.

For the purpose of this study, I interviewed thirty (30) parents in all. Of the 30 parents twenty (21) of them were parents of Zama Primary School learners. The 21 parents were interviewed in two focus groups and at two different times at Zama Primary School (i.e. in 2004 and 2005). Fifteen (15) parents were interviewed in 2004 while six were interviewed in 2005. Out of the 15 parents who were interviewed in 2004, nine of them had children in the experimental group while six of them had children in the control group. Of the 15 parents, 14 of them were women between the ages of 26 and 56 years. All the six parents who were interviewed in 2005 were all females and four of them had children in the science class which was taught through the medium of English while two of them had children in the experimental class.

At Sizwe Primary School I conducted interviews with nine (9) parents in 2004. Seven (7) of the nine parents had children in the experimental group, while two (2) parents had children in the control group. The parents were interviewed in two focus groups (i.e. those who represented the experimental group learners were interviewed separately from those who had children in the control group. As explained earlier in this chapter, Sizwe Primary School withrew from the study at the beginning of 2005, so I could not interview the parents in 2005 because their children were no longer participating in the study.

All the parents who were interviewed were mother tongue speakers of isiXhosa. All of them were originally from the Eastern Cape, and some of them were in Cape Town for work purposes or they stayed with their spouses and siblings. Out of the twenty-one

parents interviewed in 2004 and 2005, none of them had professional jobs, and very few of them were employed. For example, two of the parents were shop assistants, one was working in a restaurant, one was a volunteer worker in an HIV/AIDS organization, one was selling fruit at the school (Zama) where the interviews were conducted and the rest were unemployed.

There were very few parents who had high school education. Only two of the parents had attempted Grade 10, while one had attempted Grade 11 and only one parent had passed Grade 12. The parent with the highest qualification (Grade 12) was unemployed and the school usually asked her to supervise the classes when one of the teachers was absent. The majority of the parents had gone as far as Grade 7 in schooling, while Grade 3 was the lowest educational level of schooling of some of the parents.

As the interviews were conducted in two rounds (2004 and 2005), I expected to see more or less the same parents whom I interviewed in 2004 in order to validate my data in terms of reliability and consistency of the parents' responses. Unfortunately out of the six parents I interviewed in 2005, only two parents had come in the first round of interviews in 2004. One of the two parents had two children (twins) in the control group, while the other one had a daughter in the experimental group. Although the parents' attendance was disappointing, I had to continue with the interviews. My intention was to compare the parents' responses for 2004 with the responses they gave in 2005 with regard to their choice of English or isiXhosa as media of instruction in science from Grades 4 – 6. I wanted to see if there was any consistency in the responses of parents who were first interviewed in 2004, and whether there was any relationship between the responses of the parents who were interviewed earlier and those who were interviewed in 2005 only. Failure to conduct this kind of comparison is discussed under the limitations of this study in 5.8 below. All the interviews with parents were conducted in isiXhosa**.**

5.7 Data Collection

Data collection refers to the process of gathering information related to your research which involves identifying sources of data and selecting methods. Data collection occurs in different phases, namely planning, beginning data collection, closing data collection and completion (McMillan & Schumacher, 1989:185).

As the study followed a qualitative approach, I employed triangulation by collecting data from different sources and by using various methods. For instance, I interviewed the teachers, parents and learners of the schools that participated in the study. I also conducted classroom observations that included video recordings. The other data was collected through informal conversations with teachers and learners and other people whose inputs were seen to be relevant for inclusion in the study. Data was also collected by administering tests to learners from Grade 4 to Grade 6 (from 2003 to 2005) in order to investigate the effectiveness of the two media of instruction in science teaching. The learners' workbooks were also analyzed in order to see how the learners responded to science texts and assessment activities that were in English or isiXhosa.

In the following table the data collection techniques or strategies and activities used in this study are reflected.

Data gathering techniques	**Activity**
Observations	• Grades 4, 5 and 6 Science lessons – the experimental and control groups of Zama Primary schools (2003 – 2005). • Grades 4 and 5 of Sizwe Primary School (2003 and 2004). • Video recordings of Science lessons - the experimental and control groups - (Grades 4, 5 and 6 of Zama Primary School). • Video recordings of science lessons of the experimental and control groups of Sizwe

	Primary School (Grade 5 only) • Writing field notes.
Interviews	Interviews with teachers, learners and parents of the two schools. Interviews with the Principal and the Head of Division of Zama Primary School.
Tests/Assessment Tasks	Assessment tasks or tests were administered to Grade 4 – Grade 6 classes (experimental and control) from 2003 – 2005 at Zama Primary School. Tests were administered to Grade 4 and 5 of Sizwe Primary School (2003 and 2004).
Analysis of learners' work	Analysis of learners' workbooks (experimental and control groups) – Grades 4 and 5 of Sizwe and Zama Primary Schools. Analysis of Grade 6 learners' workbooks (experimental and control) of Zama Primary School in 2005.
Informal conversations	Keeping a research diary of information collected through informal discussions and conversations with different people.

5.7.1 Classroom observations

> "… observation as a research technique must always be systematic, directed by a specific purpose, carefully focused and thoroughly recorded… must be subject to usual checks for accuracy, validity and reliability" (Best & Kahn, 1989:175).

Observation is one of the research strategies used in many types of research designs; experimental, descriptive and historical research (Best & Kahn, 1989:175). To respond to the research question(s) that underpin this study, I made observations to gather information from the classroom in order to understand the realities of science teaching and learning through the media of English and isiXhosa in the two schools. The main focus of my observations was to note any similarities and differences in the manner in

which the teachers and the learners interacted in science lessons taught through the medium of English or isiXhosa.

In 2003 I could not make regular visits to schools because of my work commitments, as I was studying part-time. As the teachers started using the new materials in February 2003, my first classroom observation started on the 22nd of April 2003, two months after the start of the project. As I could not get access to schools in the second term due to mid-year examinations and other activities such as music competitions, HIV/AIDS workshops, etc. I continued with lesson observations in November 2003. My aim was to see progress made by teachers and learners in Science since the project started in February 2003.

Fortunately, I was granted study leave in 2004, and that enabled me to make regular visits to the schools. Due to the fact that I was conducting classroom observations in the two schools with two groups of learners (experimental and control) in each school, it was not possible for me to visit each school daily. The other factor that prevented me from doing daily visits in schools was the schools' timetables. My observations had to correspond with the teachers' timetables, and science was offered twice a week in both schools, on a Tuesday and on a Thursday. I was then forced to spend Tuesdays at one school (Zama Primary School) and Thursdays at Sizwe Primary School.

As I was working with two schools, I noticed that each class at each school had two double periods (120 minutes) per week for science. So I drew up an observation schedule so that I could observe the two groups of learners at least once a week at each school. In other words, I would spend a day per week at each school and observe the two groups of learners. I used to alternate the observation times for the two groups so that I could get a feeling of how teachers interacted at different times of the day. For example, if I started with the experimental group in one week, I would begin with the control group in the following week at each school.

The 2004 observations were done in Grade 5 classes. That is, I observed the same learners who were in Grade 4 in the previous year (2003), and who were in Grade 5 in 2004. Fortunately, the same teachers moved to the next class (i.e. Grade 5) with the same learners. This was an advantage to me as a researcher as I got closer to the subjects of the study and began to understand their behaviour in the classroom and the factors that influenced such behaviour. To the teachers and the learners, the advantage was that they became familiar with the project and its activities, and my regular presence in their classrooms became less threatening as time went by. As a result of my regular classroom visits, both the teachers and learners began to accept me, and began to be open to me with other issues that impacted on teaching and learning in general.

I observed mainly Science lessons, although I used to sit on some lessons like Mathematics, English, Life Orientation and Geography. I decided to observe other subjects in order to find out whether there were any similarities or differences in the way teachers and learners interacted in other subjects (although this is not the focus of the study). Following Best & Kahn's (1989:181) claim that teachers act unnaturally in the presence of a researcher, my suspicion was that the teachers would act unnaturally in science, especially in my presence, as they were aware that they were being observed whether they were implementing what they had been taught in Science workshops. My suspicion was that they would be more relaxed in other subjects because they would think that the researcher would not be concerned with subjects other than Science.

In 2005 I collected follow-up data on issues on which I still needed more clarity and verification as I had just begun with data analysis. That is, the observations aimed at filling some gaps that were identified as I was sorting out the data that I collected in the previous year. In other words, this stage of observation was towards the completion of data collection in the classroom.

Although I intended not to be a participant observer, I found myself on few occasions helping with some work. For example, in both schools I used to take care of learners while the teachers were attending to other things (e.g. being called to the Principal's

office or absent from school). Specifically, on more than two occasions I had to take care of the experimental group at Sizwe Primary School when the teacher was away from school, writing examinations. Learners were writing June examinations, and I had to invigilate them. Also at Zama Primary School, in the absence of the teacher I would keep the learners busy by helping them with reading. At one stage at Zama Primary School I sat in the control class with a parent who was asked by the school to substitute for a teacher who was writing examinations. I also used to help teachers with marking learners' work in Science. Helping in the classrooms as a researcher is in line with Woods (1986:39) claim that it is difficult to avoid being involved in some way in the life of the group in any long-term research. So I found myself participating somehow in certain activities in the classroom, and the learners treated me as one of their teachers as I continuously visited their classes.

As a back up to classroom observations, I conducted video recordings. In the three years of this study eight video recordings were done; two in 2003, four in 2004 and two in 2005. In each school, with the help of my colleague, I recorded the same lesson taught through the medium of English in the control class, and through the medium of isiXhosa in the experimental class. The recordings took about an hour for the experimental and control groups at both schools. The purpose of the recordings was to capture and compare how teachers and learners interacted in Science lessons in terms of language use, compare the teaching and learning strategies used in science and concept formation by learners in relation to the learning area and lesson outcomes of the Revised National Curriculum Statement (RNCS, 2002). Details and transcriptions of the video recordings are discussed in the next chapter. Due to the length of the video transcriptions, I could not attach them as appendices in this study. They can be made available for viewing when a need arises.

In short, classroom observations enabled me to see the realities pertaining to teaching and learning of science through the medium of English and isiXhosa in the Intermediate Phase. As I continued with observations, I began to get some answers, sometimes to a limited extent, to some of the research questions. Hence I decided to employ other

research strategies to probe deeper in order to get more clarity on certain issues relating to the teaching and learning of Science. I used interviews to get more information from the subjects of the study.

5.7.2 Interviews

McMillan and Schumacher (1989:36) describe an interview as an oral questionnaire where an interviewee gives the information needed orally and face-to-face. As the study is qualitative, I made use of ethnographic interviews that were characterized by semi-structured or in-depth questions. The interviews were conducted at different times during the three-year period of study. They were used to collect data from parents, teachers and learners.

5.7.2.1 Teacher interviews

The first round of teacher interviews was conducted in April 2003. The interviews were conducted with teachers of the experimental classes of both schools in April 2003. The aim of the interviews was to find out how teachers felt about the use of the mother tongue in teaching, and how the learners responded to the use of mother tongue in Science teaching. As the interviews aimed at establishing how teachers reacted to the use of isiXhosa in teaching Grade 4 Science, the teachers of the control groups of both schools were not involved in these interviews. The initial plan was to interview the teachers of the two control groups later in the year 2003, but due to problems related to school activities and other commitments of teachers, I could not conduct the interviews.

On the 17th and 18th August 2004, I interviewed the teachers of Zama and Sizwe Primary schools respectively. In total, four teachers were interviewed, two teachers from each school. All four teachers were teaching Grade 5 and all were women. Two of the teachers were responsible for the experimental groups (one from Zama and the other one from Sizwe), while the other two teachers were teaching the control groups.

Firstly, the teachers were briefed about the purpose of the interview, and they were put at ease by ensuring them that their responses would be kept confidential. I asked their permission to record their responses and they accepted my request. In both schools the interviews were conducted during the lunch hour in order not to disturb the teaching programmes of the teachers. As I had limited time, I decided to interview the two teachers (i.e. the experimental and control group teachers) in each school at the same time, and this also made the teachers feel at ease and more comfortable than to be interviewed individually.

The interviews were conducted on different days and I recorded the data separately in order to distinguish between the teachers' responses of the two different schools. To facilitate data analysis, the teachers' responses were coded as Z1 and Z2 for Zama Primary school teachers, while I used S1 and S2 for Sizwe Primary School teachers. I gave the number 1 for the experimental group teachers, and the number 2 was allocated to the control group teachers as per my data presentation in the next chapter.

The interviews were semi-structured and some questions were open-ended to allow further probing by the interviewer. Semi-structured interviews, according to Bless and Higson-Smith (2000:108) allow the discovery of new aspects of the problem by asking for further explanation from the respondents. To allow free and relaxed expression by teachers, the interviews were conducted through the medium of isiXhosa, and they took about 55 to 70 minutes at both schools. The detailed structure and contents of the interviews are discussed in the next chapter, and the interview guides are attached as Appendix 3.

5.7.2.2 Learner interviews

The learner interviews were conducted for the first time in April 2003. These interviews were conducted with Grade 4 learners of Zama and Sizwe Primary Schools and they elicited information relating to problems encountered by learners in science, parental support for learners, how they coped with isiXhosa as a medium of instruction in Science, learners' level of understanding in lessons taught through the medium of isiXhosa.

The second round of learner interviews was conducted on the 17th August 2004 with Zama Primary School Grade 5 learners, while Sizwe Primary school learners were interviewed on the 24th August 2004. It was not possible to interview the learners of both schools on the same day because of the long distance between the two schools and the different commitments of the teachers. My intention was not to disrupt the teaching programme of the schools, so I had to negotiate for dates and times of the interviews with the Grade 5 teachers who happened to be involved in the project.

In both groups the children were chosen at random. The average age of the learners who were interviewed in both schools was about 11 years. I interviewed 15 experimental group learners and 19 control group learners at Zama Primary School in 2004. The learners were interviewed in separate groups according to the language in which they received tuition (i.e. experimental group learners were interviewed separately from control group learners). At Sizwe Primary School I interviewed 13 experimental group learners and 12 control group learners. The rationale for involving a high number of learners in the interviews was to get more reliable results than using a small sample. To control the big group of learners and to keep them anonymous, each learner was assigned a number to use throughout the interview (1, 2 or 3). Whenever a question was referred to a learner, the learner would be called by the number assigned to him/her.

In 2005 interviews were conducted with Grade 6 learners of Zama Primary School (as Sizwe withdrew from the project). During this round of interviews I used a smaller sample (about 10% of the total population) as I realized that it was not easy to control a

big number of interviewees, and transcription of interviews was also strenuous and time-consuming with big groups. I then interviewed four experimental group learners and five control group learners.

Before starting with the interviews, I explained to them the purpose of the interview, and asked them to be free and honest about their responses. I also asked permission to record their responses, and they were very excited to find that they were going to be recorded. All the interviews were then recorded by means of a tape-recorder in order to capture authentic responses from the learners. The interviews were conducted in the learners' mother tongue (isiXhosa) so that the learners could express themselves freely in a language they knew well and in which they were confident to use. The interviews were semi-structured as I had prepared some questions to ask, but other questions arose from the learners' responses and I probed further to get clarity on certain issues. They lasted about an hour at both schools. The learners' responses were transcribed, and some of them are presented in Chapter 5.

5.7.2.3 Parent interviews

I experienced difficulties in getting parents for interviews as the interviews were conducted during school hours when some of the parents were at work, although many of them were unemployed. According to my interview schedule, parents' interviews should have been conducted from the 29th of March 2004 at Zama Primary School, but no parents turned up for that day. I tried to conduct the interviews in the evening, but to my disappointment no parents came despite oral and written requests that were sent with children.

Linked to conditions under which township people live, parents' failure to come to the evening interviews could be attributed to various reasons. Some of them were only coming back from work in the evening, while others were working night shifts. They had transport problems and perhaps insufficient money to catch taxis and were aware of the

prevailing high crime rate in the area, especially at night. However, I managed to conduct my first interviews with parents on the 4th of May 2004 at Zama Primary School, and on the following day I proceeded to Sizwe Primary School. I interviewed twenty-four (24) parents on the two days, the 4th and 5th of May 2004; 15 from Zama Primary School and 9 from Sizwe Primary School during school hours

In October 2005 I conducted a second round of interviews with parents of Zama Primary School only as the second school (Sizwe) had withdrawn from the study. The interviews aimed at comparing the parents' initial (2004) responses with the responses they gave in 2005 in order to find out if there were any similarities or mismatches between them. In other words, I wanted to test the reliability of the parents' responses and to follow up on other issues that I picked up when I was sorting out my first set of data. To my disappointment, out of the 16 parents who were interviewed in 2004 at Zama Primary School, only seven (7) parents made it to the second round of interviews. Two (2) of the seven (7) parents participated in the 2004 interviews. Nevertheless, I continued with the interviews as I hoped to get fresh responses that I could compare with other responses that were gathered earlier. Of the 7 parents five parents had children in the control class while two had children in the experimental group. In all, I interviewed 32 parents from both schools over the two years; 25 in 2004 and 7 in 2005.

Before I started with the interviews, I was aware of the influence of age, gender and ethnicity on data collection, especially in interviews. As Measor (1988:74) claims, people may find it "easier", "more acceptable" and "more proper" to talk to a woman. I suppose that being a woman became an advantage because most of the interviewees were women. So it was easy for them to relate to me as a woman. An added advantage was that I spoke the interviewees' language (isiXhosa). The ability to talk the interviewees' language created a very relaxed atmosphere of trust and cooperation. I felt accepted by the parents as they needed to know more about me (i.e. my home, my clan name, my education, etc.) and about the project.

The interviews were semi-structured and open-ended to allow time for comments and to probe for further information. I used the same question guidelines in both schools, and I interviewed the parents according to groups in which their children were placed in school. That is, parents whose children were in the experimental class were interviewed as a group separately from parents who had children in the control group. I used this strategy in order to avoid duplication of responses, and to treat each group as a unique group. I used focus group interviews as I thought that parents would stimulate each other to talk about certain issues and would be more relaxed than when I interviewed them as individuals. Another advantage of focus groups is that it provided participants with an opportunity to learn from each other, and to resolve important dilemmas they were confronted with (Bless & Higson, 2000:110). I gave parents numbers (1, 2, 3, etc.) in order to keep them anonymous, while at the same time maintaining the order of responses to facilitate data analysis. In all, I interviewed six focus groups of parents in two years; four from Zama Primary School (two in 2004 and two in 2005), and two from Sizwe Primary School in 2004.

The interviews took about 65 minutes for small groups to 90 minutes for big groups. A full description of information that the parent interviews elicited is given in the next chapter.

5.7.3 Assessment

In order to assess the learners' performance in science using the two media of instruction, we carried out an external assessment in addition to the other forms of assessments that were done by the teachers in their daily teaching. In other words, the assessment aimed at establishing how learners performed in science when using learner-support materials written in English (for the control group) and in isiXhosa (for the experimental group).
The initial plan was to assess the learners at the end of the last (fourth) module in the first year of the study (i.e. assess them on the science work they completed in 2003). But due to unforeseen problems and commitments at both schools, the assessments could not be carried out as planned. The learners were assessed once in 2003, twice in 2004 and twice in 2005.

The assessment was organized by the science specialist who used to facilitate the teachers' workshops. The two groups at both schools wrote the same test; and I translated the question paper into isiXhosa for the experimental groups. The control groups wrote in English. Teachers were only told about the work covered in the question paper, and were not given the questions beforehand. The tests were administered by the researcher and two colleagues from UWC in the presence of teachers. The results of the tests are reflected in Chapter 6.

5.7.4 Analysis of learners' workbooks

In order to find out how the learner support materials were used, and how the learners responded to the science activities, I had to go through the learners' workbooks. By analyzing the learners' work, I wanted to find out whether there were any differences in terms of conceptual development in learners taught science through the medium of isiXhosa, and those taught through the English medium.

The activity of analyzing learners' workbooks started in April 2003 when the learners were in Grade 4. I managed to collect 40 learners' books at random from both schools. Of the 40 books, 19 were from Zama Primary School: 9 from the experimental group and 10 from the control group. I collected 21 books from Sizwe Primary school: 11 from the experimental group and 10 from the control group. In 2004 and 2005 I collected books from the same learners who were then in Grades 5 and Grade 6 respectively. I continued with the analysis of the learners' workbooks in order to find out whether or not there was any improvement or development in learners' performance over the three years of their involvement in the research study.

A full analysis of the learners' workbooks is presented in Chapter 6 and discussed in Chapter 7. It reflects how the learners responded academically to the two media of instruction in science over the three years of this research.

5.7.5 Fieldnotes and research diary

In order to keep a record of my observations, I jotted down some fieldnotes each time I made observations. Bogdan (1992:107) refers to fieldnotes as a written account of what the researcher hears, sees, experiences and thinks in the course of collecting data in qualitative research. I tried to avoid writing fieldnotes in front of the teachers because I did not want them to feel uncomfortable and perceive me as an "inspector" who had come to judge their teaching strategies. I used to write my fieldnotes outside the classroom or at home on the same day while my memory was still fresh with regard to the observations of the day. In some cases, though, I would write those points that I felt were very important and needed to be captured soon before they were forgotten while I was still in school.

I kept a research diary for all the information I collected informally, like conversations in different settings (with friends, teachers, children and other people who were not directly involved in the study). Keeping a diary helped me to record and keep data that would help clarify or support certain issues during data collection and analysis.

5.8 Reliability and Validity

In order to measure the quality of research, many researchers usually employ reliability and validity which involve precision and accuracy. Reliability refers to the stability or consistency of research measurement in a study. It measures whether a particular technique would yield the same results when administered to the same object repeatedly (Mouton, 2001; Bless & Higson-Smith, 1997; Best & Kahn, 1989). According to de Vos et al. (2005:163) reliability is not concerned with what is being measured, but with how well it is being measured. However, researchers warn that reliability is not always accurate or perfect, depending on various factors and research conditions (de Vos, et al., 2005; Mouton, 2001).

Mouton (2001) suggests triangulation as a means of increasing reliability in research. In other words, the use of a variety of data collection methods which complement each other can reduce inaccuracy of research data. In addition to triangulation, de Vos et al. (2005:163) suggest the following procedures to increase reliability:

(i) Clear conceptualization of all constructs in order to develop an unambiguous definition of each construct.

(ii) Increasing the level of measurement by measuring at the most precise level.

(iii) Using pre-tests, pilot studies and replications.

Validity, on the other hand, refers to the extent to which a measure accurately reflects the concept it is intended to measure (de Vos, et al., 2005; Henning et al., 2004; Mouton, 2001; Bless & Higson-Smith, 1997). While reliability asks how accurate and consistent a measurement is, validity asks what the instrument actually measures and the meaning of measurement results (Bless & Higson-Smith, 1997). The validity of measurements in qualitative research lie with whether the data collection methods are investigating what the research is supposed to be investigating. Validity checks for bias or lack of precision, it questions the procedures used and the decisions made, and it addresses theoretical questions which underpin the research study (Henning et al., 2004:148).

To determine validity, many researchers use different yardsticks such as content validity, face validity, criterion-related validity and construct validity (de Vos et al., 2005; Mouton, 2001; Best & Kahn, 1987). Content validity is concerned with the extent to which a measure covers the range of meanings (topics or items) within a particular concept or the traits it was designed for and it cannot be expressed numerically. According to de Vos et al. (2005:161) content validity is used interchangeably with face validity, although they are not similar. Face validity is less accurate than content validity in that it does not look at what the instrument "actually" measures, but it looks at what the instrument "appears" to measure at face value (de Vos, 2005; Bless & Higson-Smith, 1997).

Construct validity, on the other hand, determines the degree to which an instrument measures a theoretical construct which may be abstract. It is concerned with the meaning of the instrument (i.e. what is being measured, and how, and why it operates in the way it does) in relation to the underpinning theory (de Vos et al., 2005; Mouton, 2001; Best & Kahn, 1987). In other words, it is the extent to which test scores can be accounted for by means of explanations or reference to a sound theory. Criterion-related validity compares scores on an instrument with a concept or trait being studied. The criteria used to measure the scores should be valid in order to produce reliable results.

In relation to the present study, accuracy or reliability of data was established by employing different methods of data collection (interviews, classroom observations, class tests, analysis of learners' work). In other words, triangulation was exercised to reduce inaccuracy and inconsistency in the collected data. For example, most of the data was collected by means of observations, and to make meaning of the data I interviewed teachers, learners and parents who were involved in the study. Follow up interviews, although in some cases I could not get all the research subjects as mentioned earlier in this chapter, aimed at verifying and checking consistency and accuracy of data and to avoid misinterpretation of various activities and responses relating to the study. Classroom tests were also administered to complement data which were collected by other means (e.g. classroom observations, interviews) as explained earlier.

Concerning validity, the present study took into consideration the notions of content and construct validity in that data collection was driven by the research questions and theoretical framework underpinning this study. That is, the interpretivist research approach which relies on the use of various data collection techniques and different sources of data is the framework on which this study is based as explained in the first chapter. The use of different sources of data or triangulation strengthens the study's reliability and validity.

The qualitative nature of this study allowed for credibility, transferability, dependability and conformability as constructs which promote reliability and validity in research (de

Vos, et al., 2005:346). In terms of credibility which needs accurate identification and description of research subjects, this study has described the settings, research subjects and some problems encountered in this study in Sections 5.3, 5.6 and 5.9. The research limitations reflected in Section 5.9 account for dependability which assumes that the world is changing, and therefore, research interpretations should be understood within the context of a particular setting. Dependability ties in with the qualitative research design which allows for flexibility and the interpretivist research framework followed in this present study.

Although transferability or generalisability of this study to other settings may not be completely guaranteed due to the fact the study was conducted in a different setting with various challenging factors (e.g. economic, social), the use of triangulation and various informants strengthen its usefulness in other settings which look at science teaching and learning, and mother tongue education. Finally, in terms of conformability, data presented in Chapters 6 and 7 confirm the research findings in Chapter 8. In other words, there is a relationship between the gathered data and the research outcomes of this study, and this also strengthens the case of reliability and validity of this study, despite the problems and limitations mentioned in 5.9 below.

5.9 Limitations

Firstly, as the study deals with the crucial issue of the use of the mother tongue (an African language) in science, it would have been appropriate to involve more schools in such a project. The results of the study are based on two schools only, and therefore, do not represent a general overview of Western Cape schools.

Secondly, as Best and Kahn (1989:117) claim, it is not possible to eliminate all the extraneous variables in classroom research, the influence of these variables in the study cannot be ruled out. As the study involved teaching and learning of science, attempts were made to control extraneous variables by giving extra support to teachers and learners, but the support was only academic. The socio-economic and cultural factors that could have influenced the study were not controlled. As mentioned in Section 5.6.2

of this chapter, for instance, it appears that social problems had an effect on learners' retention in schools which might have influenced the interaction between teachers and learners in the classroom.

Thirdly, the nature and duration of the study, the nature and commitment of the participants, the research environment and working conditions at the two schools can be seen as limitations of the study. Although the study followed an experimental design over a three-year period, some of the initial plans were changed to suit the different situations of the two schools. For example, I could not follow my initial plan in data collection, as mentioned in certain sections of this chapter, due to unforeseen circumstances and reactions of the different participants in this research.

As a fourth limitation, the study involved learners (humans) who had to learn effectively for their future, and for ethical reasons, some of the requirements of the experimental design were not adhered to. For instance, the experimental group was supplied with English and isiXhosa materials instead of isiXhosa materials only in order to serve the interests of the parents who wanted their children to access science in English as well. This exercise, perhaps, might have had an effect on the results of the study.

Fifthly, some of the interviewees of the study might have given responses that do not reflect their true feelings, but only to please the interviewer. So such responses could not be the true reflection of the participants' feelings or perceptions, and their influence on the results of the study cannot be overlooked.

5.10 Summary

This chapter gave a detailed account of all the activities, subjects, tools and techniques that were used to collect data for this three-year study. It shows that the researcher made use of triangulation in data collection in order to strengthen validity and reliability of this study. The next stage is to organize, account for, and provide explanations of data in order to make sense of the different scenarios which are presented in this chapter. That

is, the following chapter presents collected data in order make meaningful interpretations and to arrive at the research findings presented in Chapter 7.

CHAPTER 6

DATA PRESENTATION

6.1 Introduction

The previous chapter gave an account of the different research approaches and techniques that were employed to collect data for this study. In this chapter the raw data is presented in categories that relate not only to the research questions, but also to the objectives of the study which are reflected in the first chapter.

Firstly, influenced by the triangulation process of data collection, this chapter presents data which was collected by means of classroom observations, interviews, class tests and analysis of learners' workbooks. This chapter is structured in a manner which attempts to answer the research questions which are given in Chapter 1, while giving authentic data samples that were captured by means of the different data collection strategies. The research questions have to do with science teaching and learning, learners' academic performance in science, parental support and language-in-education policy awareness. Based on the research questions, this chapter intends presenting raw data, while giving a basic analysis of data in order to pave way for deeper critical data analysis in the next chapter.

As a starting point, data from classroom observations is presented. Secondly, data from interviews (teachers and learners) is presented in order to get a better understanding of issues pertaining to science teaching and learning through the medium of English and isiXhosa. Data from interviews is also used to verify and interpret certain classroom activities, and to get views of other participants such as parents who did not form part of the classroom setting. Finally, the chapter presents data that emerged from written tests and science tasks that were analyzed from the learners' workbooks.

6.2 Classroom observations

As indicated above, data relating to science teaching and learning was collected by means of observations where I observed how the teachers[16] interacted with the learners in the science classrooms. Guided by interactionist theory within qualitative research, my observations focused on the teaching approaches that were used by the teachers in their science lessons, i.e. how they facilitated or mediated science learning using two different languages of instruction. Such observations could not ignore the situational factors which influenced teaching and learning, the kind(s) of resources that were used in science teaching and learning and the languages that were used to facilitate teaching and learning in this study. I also took note of the classroom atmosphere in order to understand how and why the teachers and learners interacted in various ways.

In my observations I noted that the classroom atmosphere differed in the experimental and control groups at Zama Primary School. For instance, the atmosphere was more relaxed in the experimental group than in the control group, with children moving around and a bit noisy, while there was always silence in the control group when the teacher was around. I also observed that the experimental group teacher (Z1) was very soft, and she used to sit with her learners on their desks instead of sitting at her table. On the other hand, the control group teacher (Z2), although she was kind and accessible to her learners, displayed a more authoritative personality than the experimental group teacher. Hence the atmosphere in her classroom was not as relaxed as the experimental classroom.

At Sizwe Primary School both teachers (S1 and S2) displayed strict and authoritative personalities. The learners used to be punished when they misbehaved e.g. for making noise, failure to do their homework, and failure to understand certain parts of their work. As a result, the classroom atmosphere in both groups was always a bit tense. However, I also noted that despite their strict and rigid classroom environments, the two teachers made time for leisure with their learners. For example, they would go out for picnics

[16] To keep the names of the teachers anonymous, I will refer to the experimental group teacher as Z1 for Zama and S1 for Sizwe, while control group teachers will be referred to as Z2 (Zama) and S2 (Sizwe).

where they would have fun with their learners and enjoy themselves. The nature of classroom atmosphere may be relevant in analysing and interpreting teacher-learner interaction in the next chapter.

According to my own observations there was a general lack of teaching and learning resources at both schools, not only in science but in other subjects as well. In both schools there were no science laboratories and libraries. The schools lacked books (including textbooks) and basic science equipment such as test tubes, beakers, and other equipments. During my observations at schools I noted that the teachers at both schools shared one science textbook, a sample copy from Oxford University Press, one of the publishing companies in Cape Town. There were no other textbooks for the learners, even for other subjects. As a result, the teachers and learners made use of the science workbooks which were supplied by the LOITASA Project. The teachers confessed that they used the learners' workbooks for all their preparations and as reading materials in other learning areas.

Due to a lack of science equipment in schools, there were only two experiments that were performed by the Grade 5 learners at Zama Primary School (one in each group), and there were none at Sizwe Primary School. The experiments that were performed in my presence did not require a lot of scientific apparatus; they needed common things like batteries and wire. Z1 expressed the negative impact of the lack of resources in her teaching in this way:

> Z1: Siyasokola kakhulu,… kukho enye i-eksperimenti endicinga ukuba inika umdla kakhulu, apho kukho intsimbi efakwayo, ibonakalisiwe phaya encwadini, … ndathetha ngesiNgesi abandiva tu,… ndathetha ngesiXhosa, abandiva nalapha esiXhoseni, ndabe ke ngoku ndingakwazi ukuyenza…
> **We are struggling a lot,… there is another experiment which I think is very interesting, where there is an iron rod that you insert, it's shown in the book,… I spoke in English and they did not understand me at all,… I spoke in isiXhosa, and they didn't understand me even in isiXhosa, and I was unable to perform it….**

From the learners' side, the learners' workbooks were the only resources available. Some of the activities in the learners' workbooks encouraged the learners to collect and design their learning resources. I noted, however, that the experimental group learners at

Zama Primary School had more collections of resources (e.g. seeds, pictures) in their books than the control group learners. I also observed that the labels that were made by the experimental group learners were in isiXhosa, except for certain pictures which had English labels.

Concerning teacher support, data revealed that the teachers at the two schools did not get enough support from their colleagues, including the senior management staff of the schools. But Zama Primary School teachers acknowledged the support of the principal, but not of other teachers. Seemingly other teachers showed interest and support only when they knew that there would be visitors coming to the school.

I noted that the lack of support to teachers had an impact on their commitment and dedication to the project to which this study belongs. That is, due to lack of support, some of the teachers felt that the project's work was an added burden on them. Three of the four interviewed teachers showed signs of lack of motivation and interest to continue with the project, while one of them saw her personal growth in the project in terms of content knowledge and teaching approaches. Seemingly the teachers' attitudes influenced the teachers' practices in science. For instance, the teacher who displayed positive attitudes and enthusiasm towards science showed improvement in her teaching methods while the others were only stressed.

6.2.1 Teaching strategies

Concerning lesson preparation, at both schools (Zama and Sizwe) the teachers used to present the same lessons as they used to plan together. In both cases the teachers would start with the explanation of the content while the learners were listening and towards the end of the lesson the learners would be asked to read in groups from their workbooks.

Regarding teaching strategies, all four teachers (experimental and control) made more use of questions and answers, as well as the telling or "teacher-talk" methods. In the control groups at both schools, S2 and Z2 would first pose the question in English, and in most instances there would be no responses (or silence) from learners. The teachers would

then translate the questions into isiXhosa and learners would start raising their hands as a sign of willingness to answer the questions. In most cases learners would respond in isiXhosa, especially if they had to give long answers.

I also noted that the control group learners were prompt to answer short questions such as "what, who?", but they would hesitate or keep silent when they were asked explanatory questions such as "how and why." In a Grade 4 lesson, for example, Z2 started the lesson with a simple question: "*Give me an example of any domestic animal you know.*" About half of the class had their hands up, although the other half of learners was just staring at the teacher, with an expression of having not understood the question. Many short (one-word) answers like "*dog*, sheep, *bird*, *cat, cow*, etc." were given with a correction from Z2 that a bird was not a domestic animal.

Following these questions were another series of short questions where the teacher would leave out one word from the sentence, and say "dash, dash, dash". For example, "*cow supplies us with …(dash, dash, dash)*, and in response, the learners were giving the different cow products (in one word) such as "milk, cheese, butter, etc". But when the teacher changed over to long questions where the learners had to express themselves in long sentences, the learners became silent. Actually, the first part of the lesson where the learners were giving short answers was an introduction to a new lesson, and the teacher was testing the learners' knowledge on the work that was done previously.

Thereafter, the lesson continued with simple questions which focused on the uses of sheep, the types of mammals and the types of sheep. Throughout the whole lesson of about 60 minutes, there were four questions which required the learners to answer in long sentences: *(i) Why are those animals useful to us? (ii) Why do you say they get slippers (from sheep)? , (iii) Why do you say people are mammals? and (iv) Why do we get many sheep at the Karoo?* These questions were followed by a long explanation by the teacher about the Karoo region and part of the explanation was in isiXhosa. When the teacher was explaining, the learners were listening without any participation. The lesson was

finalized by giving learners work in groups and they had to answer questions from their workbooks (see Appendix 2, Z2/03).

The same lesson was presented in the experimental group by Z1. The most dominant teaching strategy which was used by Z1 was also question-based. The teacher (Z1) started the lesson by asking learners to look at the pictures which she had put on the board. Thereafter learners had to talk about what they had observed about the animals which were shown in the pictures. In response, the learners came up with different answers such as: (*Kukho izilwanyana eziluncedo – There are useful animals*). The teacher led them with questions to differentiate between useful animals and those that were not useful, e.g. *"Kutheni nisithi ziluncedo ezi?/ Why do you say these are useful? Kutheni nisithi aziloncedo ezi?/ Why do you say these are not useful?"*

In addition to questions, the teacher also made use of long questions and explanations. In the lesson the teacher gave four long explanations, with questions that required short answers from the learners. She made use of various questions amounting to 51 in all, but most of the questions (about 47) required short answers such as "Yes/No" or one-word answers. She also gave an opportunity for the learners to work in groups and answer questions in their workbooks. The lesson transcripts are attached as Appendix 2: Z1/03.

As I spent more time in Grade 5 classes at both schools in 2004, I noted that all the teachers (S1, S2, Z1 and Z2) also made more use of questions and answers in their teaching, with lots of explanations or teacher-talk. There was very little time given to learners to work on their own or to discover things on their own. Instead the teachers asked a lot of lower order questions and very few middle and higher order questions which challenged learners to analyze, interpret and apply their knowledge were asked (see Appendix 2: Z1/04, Z2/04, S1/04, S2/04).

Group work was also used by all the teachers (S1, S2, Z1 and Z2) in Grade 5, but in most cases it was not properly managed. At both schools learners were asked to work in groups to answer questions in their workbooks. In fact, the learners' workbooks were the

only resources that were available to learners to use during science lessons. At Sizwe Primary School learners would work together as groups, but neither of the teachers (S1 and S2) would give them time to present their work to the whole class. Instead learners would come individually to the teacher to mark their work. In that way, it was not easy for me as an outsider to see whether or not the learners had understood their work, except in a few instances when I helped the teachers with marking.

At Zama Primary School learners were encouraged to work in groups as well and present their work to the whole class. I observed that the learners would present their work (similar work) sometimes with mistakes, but Z1 would not comment or correct learners' mistakes, but she would let learners continue without any intervention. In that way, I could not see or understand the value of group presentations in her class. On the other hand, in Z2's class group work was managed well. Learners were encouraged to interrogate each other and comment on each others' work, and Z2 used to challenge her learners during their group presentations. Although many learners used to struggle in asking questions in English, some of the questions were relevant and those learners who could not question or comment in English were allowed to use their mother tongue (isiXhosa). So group presentations were very exciting and challenging in Z2's class.

Concerning experiments, I observed one Grade 5 experiment at Sizwe Primary School in 2004, while two Grade 5 experiments were conducted at Zama Primary school for both groups. The first experiment which was performed at both schools was on the first science module and it was about seed germination. The learners had collected seeds which they had planted, and they had to observe the process of germination. The learners at both schools seemed excited about their work as they were always watering the plants, putting them outside when there was sunlight, and checking whether there were any changes in the plants in terms of growth and development.

The second experiment I observed was performed by Grade 5 learners of Zama Primary School (control and experimental). The experiment illustrated the generation of light in which learners used batteries and bulbs to produce light. The learners, especially the

experimental group, showed great confidence in setting up the experiment. They explained to the whole class in isiXhosa all the steps they followed to connect the bulbs and the batteries in order to produce light. As the Norwegian leader of LOITASA Project who does not understand isiXhosa was in the class, they had to explain in English. The learners' explanation was good and it showed not only their interest in what they were doing, but also their good understanding of the whole process of light generation. The learners also responded well to questions which were asked by the Norwegian visitor and they expressed themselves well in English.

Z2 used to teach a lesson twice; firstly in isiXhosa with key words in English, and later in English with little code-switching. I noted the same practice throughout the three year duration of this study. That is, Z2 did the same thing from the time the learners were in Grade 4 until they were in Grade 6. However, I noted some innovative strategies with Z2 in Grades 5 and 6 as she involved her learners actively in some of her lessons through role play, research and designing posters. I noted that she would use these strategies after she had taught the lesson in a lecture mode in isiXhosa. In other words, when she was repeating the lesson with little code switching, she would engage her learners in activities such as role play and research. For example, in one of the Grade 5 lessons I observed Z2 focused on food chains. To make meaning of the lesson, she asked the learners to play the roles of the different members of the chain, e.g. the sun, the snake, the plants, the springbok, etc. where the different members had to have a dialogue or conversation with each other. Although some of the learners were struggling to communicate in English, they showed interest in the lesson because Z2 was encouraging them. Those learners who were not part of the chain also seemed to enjoy the lesson and all of them were paying attention to the play with laughter. Thereafter, the learners were asked to make posters of their presentations, and all these were pasted on the classroom wall.

It is in the same Grade 5 class where learners were asked to conduct research in the form of interviews in their neighbourhoods. They had to investigate people's attitudes towards wind power. The learners came with different responses where they had to make

deductions of whether the majority of people were in favour or not in favour of wind power.

In some lessons, the control group learners at Zama Primary School were encouraged to make newspaper and magazine cuttings to show their understanding of certain science concepts. For example, in one lesson learners had to cut and paste pictures that showed different types of energy. They had to explain how each picture represented a certain type of energy. As a result, the walls of the control group class were full of learners' work in the form of pictures.

Although Z1's learners were more active than Z2's learners in terms of responding to questions and expressing themselves in longer and meaningful sentences in isiXhosa, I never observed a lesson where they had to role play, or carry out research, except when they were performing the experiment on light generation. Z1 also made use of pictures as teaching and learning resources in her science lessons, and the pictures were also pasted on the walls of her class.

In short, the most dominant teaching strategies which were used by teachers in the science classrooms included questions and answers, group work and the telling method (or chalk and talk). In all the groups teachers used to talk more than the learners, and in many cases, except for Z2, group-work was not properly managed. Only two (2) experiments were performed by learners during my classroom observations, and both schools lacked teaching and learning resources.

6.2.2 Teaching science through the medium of English

In the two control groups (in both schools) where science was supposed to be taught through the medium of English, the teachers made more use of isiXhosa through code-switching and mixing. For example, at Zama Primary school the teacher (Z2) would first teach the lesson mostly (more than 80%) in isiXhosa and use English only to emphasize the key concepts of the lesson, and then write on the board in English. The same lesson

would be repeated mostly in English, (sometimes in the following period) but with less code mixing and switching in isiXhosa. Of course, I cannot guarantee that Z2 was repeating all the lessons in English in my absence, but I noted that whenever I sat in her classroom for observations, a new lesson would first be taught predominantly in isiXhosa, while the same lesson would be repeated in the following period with less use of isiXhosa.

When I noticed code switching by teachers in Grade 4 lessons, my impression was that the teachers were employing this kind of strategy because learners had just shifted from Grade 3 where they used to be taught in isiXhosa. I expected more use of English in Grades 5 and 6, but the data I collected show that the same strategy was used by S2 and Z2 in Grades 4 and 5, while Z2 employed the same strategy in Grade 6 as well. I noted that if the lesson was recorded by means of a video camera or if there were other visitors in the classroom except me who was a regular observer, Z2 would use more English than isiXhosa. For instance, in a Grade 5 lesson which was recorded in the presence of visitors from Norway, Z2 interacted with her learners in an artificial manner where she used English (about 90%), and the learners were even more passive.

When the lesson was conducted in English, the learners would be very quiet and passive, and some learners would look bored and drowsy. Likewise, when questions were asked in English, the majority of learners would be silent without any signs of having heard or understood the question. Learners' silence would force the teacher to translate the questions into isiXhosa. Once the questions were translated into isiXhosa, the learners would start raising their hands as a gesture that they wanted to give answers. Learners would wait for the teacher to give an explanation of the questions in isiXhosa even when the actual lesson had been taught in isiXhosa previously. My expectation was that learners would be able to respond to English questions confidently in a repeat lesson as I was under the impression that the learners had understood the lesson or concepts when the lesson was taught in isiXhosa for the first time. In written work, the teacher had to explain each written question in isiXhosa and the learners had to write their answers in English. In cases when the teacher did not give an explanation in their mother tongue,

the learners would bother her by asking for isiXhosa explanations, hence she would first explain to the whole class before they could start writing.

During my observations at the two schools, I also noted that the learners were not penalized for using their mother tongue in other subjects, including English lessons. In fact, during science test administration to Grade 5 learners in 2004, I noted that some of the control group learners answered in isiXhosa although the questions were in English. One of the teachers, S2, confirmed that sometimes some of the learners used to write answers in isiXhosa (although the questions were in English) and they would, in most cases get the answers correct.

Unlike at Zama Primary School where the same lesson would be taught twice, firstly in the learners' mother tongue and secondly in English with less code-switching and mixing, S2 would use isiXhosa (more than 80%) of the lesson, and proceed to the following lesson. The following lesson is an example of a lesson which was presented by S2 to her Grade 5 learners. The lesson shows that S2 asked questions in English, but learners remained silent and they looked confused. Those learners who responded did so in short phrases or concepts or in isiXhosa instead of English. Reacting to her learners' silence, S2 provided the answers herself and she encouraged the learners to respond in their mother tongue (isiXhosa) as well.

1. T: Zinc. What is zinc?
2. L: Yinkcenkce, Miss ***(*it is a metal, Miss)**
3. T: Hayi kaloku **(no) [trying to remind them that they have to respond in English].** What is Zinc?
4. Ls: Quiet
5. T: Zinc is metal…. Yimethali **(it is metal)**…..is made of a metal. What is it made of?
6. Ls: (all) is made of a metal
7. T: Okay, no.5 (asking them to read the fifth question)
8. Ls: (read question 5: Why are the wires separated by a glass?)
9. T: Why?
10. Ls: Quiet
11. T: Why?
12. Ls: Quiet
13. T: Why?
14. Ls: Quiet

15. T: Niyawuva umbuzo phofu? **(Do you understand the question by the way**)? Do you understand?
16. Ls: (All) No Miss
17. T: Okay. Kutheni le nto la macingo… besithe ii'wires" ngamacingo, mos… why la macingo ohlulwe ngeglasi? **(Why are the wires… we said the wires are wires, mos… why are the wires separated by a glass)?** If you look at your bulb, there is a glass that separates the wires. Why?
18. Ls: Quiet
19. T: Aninabhalbhu **(Don't you have a bulb)?…** Kujongwa apha kwibhalbhu **(You have to look at the bulb)** - (gives one group a bulb). Why?
20. L1: To make them tight
21. T: He says to make them tight. What do you say, Anele?
22. L2: Yena ubona le ifakwe kuyo **(he sees where the bulb is inserted).**
23. T: Okay, sixelele **(Okay, tell us)**
24. L3: (Mumbling in English)
25. T: Say it in Xhosa then
26. L3: Uxolo Miss, yenzelwe la macingo uba izokwazi ukubambelela nale nto
(Sorry Miss, it has been provided with these wires so that it can fit tightly in this thing)

In the following lesson extract of the Grade 5 control group (Zama Primary School) the emphasis on the key concepts of the external structure of a bird in English is evident (e.g. wings, limbs, feet, air sacs, eyes, membrane, etc.) while the rest of the text is in isiXhosa.

> I**bird** njengoko ndisithi isebenzisa ii**wing**s,… ngoko sithi zii**limbs**. Phaya kwi**movement** yayo, phaya phantsi kwee**feet** kukho izingxobo ekuthiwa zii-**airsacs**, zikwazi ukuthi **fly**, ibe **light** ingabi **heavy**. Siye phaya kwii-**eyes**, kukho i**membrane**….
>
> **The bird, as I say, uses wings… then we call them limbs. In its movement, underneath the feet there are sacs called airsacs to enable them to fly, to be light and not to be heavy. We go to the eyes, there is a membrane….**

In one of the Grade 6 control group lessons I observed at Zama Primary School, the teacher was trying to correct learners' misconceptions. The teacher started a discussion which focused on things that the learners did not understand in the previous science lessons. She asked the learners to express everything that they did not understand on a section she had just finished on types of energy. Some of the learners gave statements that revealed that they did not conceptualize certain aspects of their work. It appeared that some of the learners had preconceived scientific concepts that did not match with new knowledge they received in class. For instance, in the following responses the

learners seemed to be confused about certain scientific concepts hence they raised the following concerns regarding science learning:

> L1: Bendiwandarisha ukuba xa ndibetha intsimbi kutheni ndingaziboni ii-athom. Njenge-battery,… iba lelinye igama kwi-science.
> **I was wondering why I don't see atoms when I hit an iron. Like a battery, …it becomes another word in science**
>
> L2: Bendingayazi ukuba ilanga lisinika amandla,….. bendisazi ukutya
> **I didn't know that the sun gives us energy, ….I knew about food**
>
> L3: Kutheni xa ndidlala elangeni ndityhafa kodwa kuthiwa ilanga linika amandla?
> **Why do I get tired when I play in the sun whereas it is said that the sun gives energy?**
>
> L4: (trying to elaborate on L2's question) Mhlawumbi udlale, udlale uye kuphumla emthunzini, uphinda uyifumane i-eneji ube-fresh. Ingena kanjani i-eneji emthunzini?
> **Perhaps you play and play and go rest in the shade, and you regain energy and become fresh. How does energy get into the shade?**
>
> L5: (responding to L3's question) UYesu uyingenisa ngeendlela ezingabonakaliyo.
> **Jesus puts it in invisible ways.**

Surprisingly, I never came across such misconceptions in the experimental group. Perhaps one would argue that unlike the control group learners the learners were never challenged to reveal their misconceptions. In all, the interaction between the teachers and learners in the control groups was more in isiXhosa than in English. English was mainly used to stress the key concepts that the learners had to master in the lesson (s).

Given the fact that the teachers were supposed to interact with their learners in English only, the use of isiXhosa in the control group classes is another limitation of this study over which I had no control. For ethical purposes, I could not dictate to the teachers what they had to do or not do in their own classrooms. Moreover, my initial agreement and understanding with the teachers was that I would come and observe how they taught science "naturally" [17]in their classes, and I had to adhere to that agreement. Furthermore, if teachers believed that learners learnt better in their mother tongue (isiXhosa), forcing

[17] Teachers had to teach in a normal way, without being guided by any instructions from the researcher. I wanted to see and understand the realities of the classroom in terms of teaching strategies and languages used to mediate learning.

them to use English throughout their teaching would not only be unethical, but would perhaps put a strain on the teachers' practices.

Guided by the philosophy of qualitative research, I had to observe how the teachers and learners were interacting in their "natural environments." My own interpretation of "natural environments" implied that the teachers did not have to deviate from their usual or normal classroom practices or act artificially in my presence. It is against this milieu that my analysis in the next chapter takes cognisance of other variables that could have had an impact on classroom interaction data.

6.2.3 Teaching science through the medium of isiXhosa

Unlike the control group teachers who used to switch from English to isiXhosa in their teaching, the experimental group teachers (S1 and Z1) and their learners adhered to isiXhosa during their classroom interactions. The learners used English words or phrases to address their teachers only (e.g. *"Yes Ms, Uxolo (Sorry) Ms"*), otherwise they used isiXhosa to communicate with their teacher and with each other.

Likewise, teaching through the medium of isiXhosa was also characterized by more teacher talk than learner talk during lesson presentations. In other words, the learners were not encouraged to play an active role in their learning in order to discover new knowledge on their own. Their teachers (S1 and Z1) made more use of the telling method where the learners remained passive recipients of knowledge. For example, two Grade 5 lessons at both schools show that the teachers had much more to say than their learners. The learners were only involved in the lesson(s) by repeating what the teacher had already said, or by confirming that they had heard what the teacher was saying. The following lesson extracts of Zama and Sizwe Primary Schools are examples of interaction that occurred between teachers and learners in the Grades 4 and 5 science classes taught through the medium of isiXhosa (see Appendix 2: Z1/03; Z1/04 and S1/04).

Grade 4: Zama Primary School (Z1/03)

Z1: 1. Izingxobo zezandla, iiglavu, ziyenziwa…ezofele lwegusha ngothwathwa lwegusha. 2. Igusha ke… kukhona ke neegusha ezineentloko ezimnyama, kuthiwa yiSwartkop ngelinye igama…iintloko ezimnyama ke ngesiXhosa….. 3. Kukhona iigusha ezineentloko ezimnyama, kukhona ezinye ekuthiwa ziiKarakul. 4. Zonke ezo zinto sithi ziindidi zeegusha… 5. Iigusha njengam nawe inazo izinto esinazo….amalungu la sinawo. 6. Inamehlo igusha. 7. Kanti ke amehlo egusha angqukuva**….. 8.** Kwakhona igusha inomsila. 9. Umsila wegusha mde…. 10. Siyawazi, anditsho? *(she doesn't give them time to answer)* 11. Iphinde ibe namanqina igusha. 12. Phaya emanqineni ineza ndawo ingathi zizihlangu. 13. Egusheni yintoni ukubizwa kwazo? 14. Eza nto zisuswayo xa likarajwa inqina legusha, zisuswe….?

1. The hand gloves are made…gloves of sheepskin…with the leather of sheepskin. 2. A sheep then…there are sheep with black heads, they are called the Swartkop in other words….black heads in isiXhosa….3. There are sheep with black heads, there are others known as Karakul. 4. All those things we call the types of sheep… 5. The sheep, like you and me have all what we have…the organs that we have. 6. A sheep has eyes. 7. And the eyes of a sheep are round….. 8. Also, a sheep has a tail. 9. The tail of a sheep is long… 10. We know it, isn't it? (she doesn't give them time to answer) 11. Also a sheep has feet. 12. There on the feet it has those things that look like shoes. 13. What do we call these in sheep? 14. Those things that are removed when the sheep foot is cleaned, and removed…?.....

After explaining about the sheep in 12 long sentences, Z1 asked the children about the shape of the eyes of a sheep. She asked one learner to come to the front and show the class a round shape. The learners looked shy and no one responded to the teacher's instruction. Bothered by the non-response from her learners, she showed them a fist as an example of something with a round shape. Thereafter, she drilled the learners to pronounce the term "round" as "ingqukuva/round" in isiXhosa as reflected in the following example.

Z1: 15. (She shows a round shape with her fist). Sithi kaloku into engqukuva yinto enje,… yinto enje,… yinto enje. Bebekhona abantu bebethe….. but bayoyika ukuza ngaphambili. Bebethe,… bebe-right,… bebenze kakuhle aba bantu because,… Injani le nto ndiyibonisileyo?

We say a round thing is like this,… something like this,… something like this….There were people who said,… but are afraid to come to the front. They said,… they were right, … these people have done well because, …. How is this thing that I have showed?

Ls: (chorus) Ingqukuva
(chorus) It is round
Z1: 16: Injani? (1)

How is it?

Ls: 17. Ingqukuva (chorus) (1)

It is round

Z1: 18. Injani? (2)

How is it?

Ls: 19. Ingqukuva

It is round

Z1:20. Injani? (3)

How is it?

Ls: 21. Ingqukuva

It is round

Z1:22. Injani? (4)

How is it?

Ls: 23 Ingqukuva
It is round.

Z1: 24 Yintoni umzekelo wento engqukuva?

What is an example of a round thing?

Ls: 25 Ngamehlo enkomo

It is the cow's eyes

Z1: 26. Ngamehlo enkomo. Yintoni umzekelo wenye into engqukuva?

It is the cow's eyes. What is an example of another round thing?
Ls: 27. Liphela Ms (referring to the small old cars that are used as taxis in the black townships of Cape Town)
It is a cockroach Ms (referring to the small old cars that are used as taxis in the black townships of Cape Town)
Z1: 28. Ewe, liphela,…. Amabhastile angqukuva neh,….nebhola ingqukuva, anditsho?
Yes, it is a cockroach,… the hybrids (cows) are round, neh…. and a ball is round, isn't it?
Ls: 29 Ewe nelitye, Ms
Yes, and a stone Ms

The following extract shows more teacher-talk and less learner-involvement at Sizwe Primary School. The teacher (S1) talked alone in 26 long sentences while learners were listening without active participation in the lesson.

Grade 5: Sizwe Primary School (S1/04)

S1: 1. Ewe uloliwe, uloliwe yitreyini mos **(Yes, a train is a train mos).** 2. Kudala uloliwe **(Long ago the train)**…. 3. Kudala ke uloliwe… into eyayisenzeka kwakubaswa umlilo **(Long ago the train… what used to happen was that fire set.)**
4. Wayengahambi ngaphandle komlilo **(it did not go without fire).** 5. Ubonakalisa ukuba ubushushu obu bunamandla **(it shows that heat has energy).** 6. Kwakufuneka kubaswe umlilo omkhulu phaya entloko **(It needed a big fire to be set there at the head).** 7. Yayimnyama ke intloko ukwenzela ukuba ingabonakali naxa iqhuniyiselwe **(The head was black so that it couldn't show when it had marks of smoke).** 8. Lonke ixesha laa mlilo uyavutha, uyabaselwa ngamalahle **(All the time that fire is burning, it is kept burning by the coal).** 9. Ukuba ngaba awukho laa mlilo ithetha ukuba netreyini imile, ayihambi **(If that fire is not there, it means that the train has stopped, it is stationery).** 10. Ngoku zaphucuka izinto, zaya ziphucuka izinto **(Now things have improved, they began to improve gradually)**. 11. Kwangena iintloko zetreyini ezitsalwa yidizili **(There came train heads that are fueled by diesel).** 12. I"diesel-oil" ke yilaa oyile inika injini yetreyini amandla, ibe shushu, ifudumale, ihambe ke itreyini ngenxa yala mandla e-oyile iwafumeneyo **(The diseel-oil is that oil that gives the power to the train engine, it becomes hot, it warms up, the train then moves because of the oil it has got).**

13. Zaphucuka izinto, kwavela mntu uthile ekuthiwa nguThomas Edison **(Things improved, a certain person called Thomas Edison came to the scene).** 14. Ngubani loo mntu **(Who is that person)?**

Ls: (all) Thomas Edison

S1: (Writes on the board: Thomas Edison) 15. Ibalana lam lincinci nje **(My story is short).** 16. Zonke izinto ziyenziwa **(All the things are invented**). 17. Ayithi into ize ibekho, ibekhona nje (**Nothing just exists*).*** 18. Nale tshokhwe ndiyiphetheyo kukhona umntu owacingayo ukuba ze kubhalwe ebhodini into ebonwa ngabantwana kufuneka kubekho itshokhwe **Even with this chalk I am carrying, there is a person who thought that in order to write something to be seen by children on the board, the chalk should be available).** 18. Kukhona umntu owayenzayo **(There is a person who made it).** 19. Sikhumbule ukuba nezi khamera sizisebenzisayo kukhona abantu abacingayo ukuba makubekho ikhamera kuzofotwa ukuze kuphume ubuso bakho **(We must remember that even these cameras we use, there are people who thought that there should be a camera to take photographs to show your face).** 19. Okay?

Ls: (all) Yes Miss.

S2: 20. Ngoku apha lona umntu **(Now here this person)….** 21. Kukho igama esiNgesini, sithetha ngoku"inventa" **(There is a term in English, we are talking about inventing).** 22. Wa-inventa **- (He invented).** (Writes the word down). 23. Uku-inventa ke, kuthiwa loo mntu wacinga, akagqiba ukucinga wenza umbane (**To invent, it is said that this person thought, and did not only think but made electricity).** 24. Wacinga wenza umbane ngenxa yentsokolo eyayikhona ngelaa xesha lakudala, amanzi ethatha ixesha elide emiswe eziko, ebila **(He thought and made electricity during the olden days, water took a long time to boil on fire).** 25. Ngoku wacinga ngeendlela ezimfutshane ezizokwenza umsebenzi ukhawuleze **(Now he thought of shorter ways to make things to work faster).** 26. Wacinga ngokuba makubekho umbane **(He thought that there should be electricity).** 27. Loo mntu lowo sithi ngubani **(What do we call that person)?**

Ls: (all) Thomas Edison

S2: Ngubani loo mntu **(Who is that person)?**

Ls: Thomas Edison

The above lesson extracts do not only show more talk by the teachers, but also the quality of questions that were used by the teachers to interact with their learners. Although the

teachers do not switch codes, they do not give adequate space for learners to construct their own knowledge through critical thinking and self discovery. They do not capitalize on the fact that they are using the first language of the learners.

6.2.4 Learner interaction and learning strategies

In order to understand how learners tried to make meaning of science lessons, I observed how learners interacted with each other and how they responded to science lessons. My observations were based on the manner in which learners expressed themselves in the language of instruction, and the extent to which they understood science work. In other words, I wanted to find out whether the medium of instruction had any effect on learners' understanding of science and their way of interaction in the classroom.

As mentioned above, both schools encouraged interaction between learners by giving group work. I noted that the control group learners at both schools interacted in their mother tongue (isiXhosa) when they were working on certain tasks in their groups. The interaction was relaxed and there was no code-switching to English except when control group learners stressed key science concepts in English like their teachers as shown in one of the examples above. For instance, in a Grade 6 lesson on electricity, the control group learners used isiXhosa for discussion, but they also mixed the key concepts in their discourse as shown in the following sentences.

> Ii**wires** zale **bulb** zifile, aziniki **light,** masifune enye. Ndifuna ukubona ukuba i**light** yenzeka njani.
> **The wires of this bulb are dead, they do not give light, let's get another one. I want to see how light is generated.**

Similarly, the experimental group learners interacted with each other in isiXhosa during group discussions. They used loan words for science terms that were unfamiliar or not found in isiXhosa e.g. *i-oksijini (oxygen), imatha (matter), icala eliphozithivu (the positive side), i-ekhosistim (the ecosystem),* etc. The group discussions were conducted

mainly in isiXhosa, and the learners presented their work orally and in writing through their mother tongue. There was no use of slang or "tsotsitaal" in their discussions. That is, all the discussions were carried out in formal isiXhosa language.

In addition to group work interactions and code switching to isiXhosa, I noted that all the learners used to repeat what their teachers had said in the lessons. As they were not actively involved in lessons, learners were passive and they used to agree to what teachers were saying (e.g. "Yes Miss").

6.3 Interviews

In Chapter 5 it was mentioned that data collection was conducted by means of different techniques such as observations, interviews and analysis of learners' work. Teacher and learner interaction is discussed as part of classroom observations. For better understanding of the classroom activities and interaction between teachers and learners, I interviewed the teachers and learners. In 6.3.1 below, I present data collected by means of interviews from teachers, parents and learners. The purpose of interviews was to complement some of the data captured by means of observations. That is, interviews were conducted to validate some of the information that came out of classroom observations, learners' workbooks and tests.

6.3.1 Teacher interviews

6.3.1.1 Teacher training

None of the teachers who were interviewed (N = 4) had special training in science. Three of the teachers (S1, S2, and Z1) did the two year Primary Teacher's Certificate (PTC) in the 1970s after they had passed Form III which is equivalent to Grade 10 today. There was no specialization in the PTC course; trainees were prepared to teach in primary schools where they had to teach all the subjects. The teachers did their matric (Grade 12) studies privately and none of them did science at matric level. One of the teachers (Z2)

did the Primary Teachers' Diploma for three years in the early 1990s. She also did not get special training in science. She was trained to teach at primary school, and had to do all the primary school subjects.

During interviews all the four teachers confessed that they did not have deeper academic knowledge of science, and they never had in-service training in science since they started teaching. What also emerged from the teachers' interviews was that Z1 and Z2 had been teaching at the lower grades (Grades 1 and 2) for a number of years where there was no science taught as a subject. They were new at the Intermediate Phase at the beginning of this study. Likewise, S1 and S2 had been teaching in the lower grades before the start of the LOITASA Project in 2003.

With the introduction of the new curriculum (OBE), a number of workshops were conducted for the implementation of the new curriculum in schools. According to teachers' responses none of the teachers had ever attended science workshops. Teachers claimed that the teachers' workshops which were organized for them by the LOITASA Project were useful to them. The workshops served as brain-storming sessions where they got empowered in terms of content and pedagogy before they could teach the science modules to the learners.

6.3.1.2 Teachers' awareness of Language-in-Education Policy

As the present study deals with language-in-education policy implementation, some of my interview questions had to do with their awareness of the language-in-education policy issues. Specifically, teachers were asked if they had any language policy in their schools that guided their choice of the language of learning and teaching. The teachers' responses illustrated that none of the schools had any language policy, and the teachers' knowledge of the current South African Language-in-Education Policy was very limited. They displayed limited knowledge of the general language policy of South Africa (RSA Constitution) which stipulates eleven official languages.

When I probed deeper in terms of their own understanding of the Language-in-Education Policy, I could not get anything other than the establishment of the eleven official languages instead of English and Afrikaans which used to be the official languages in the previous government. Actually, Z1 and Z2 indicated that the school was still in the process of formulating a language policy when I interviewed them in 2004. But when I asked the same question in 2005, they responded that they were still using the old policy. As the school language policies determine the languages used for learning and teaching in schools, I asked questions relating to the use of isiXhosa and English as media of instruction. I wanted to verify my classroom observations for data analysis in the next chapter.

6.3.1.3 Teaching through the medium of English

In order to establish the significance of language in the classroom, teachers were asked how they interacted with their learners using the two media of instruction. Regarding the use of English as a medium of instruction in science, the two teachers (S2 and Z2) who were teaching the control groups claimed that although attempts were made to conduct the lessons in English, they had to translate everything to the learners in their mother tongue, isiXhosa, because the learners could not understand the lessons conducted in English. In other words, both teachers claimed that they were forced to code switch for effective teaching and learning to take place.

The teachers' responses confirmed what I observed in the science classrooms taught through the medium of English as discussed in 6.3 above. That is, the control group teachers used more of isiXhosa than English in their lessons to facilitate learning. Code switching as a necessary practice in the classroom is evident in the following teachers' responses:

> 1. S2: …yonke into, incwadi yonke, ilesson yonke,… if bayafunda nge-English kufuneka ndi"translate" because kaloku abayazi i-English,… abayi"understandi" le nto bayifundayo…..kufuneka ndi"translate" word by word.

…everything, the whole book, the whole lesson,… if they read in English I must translate because they do not know English,…. they don't understand what they are learning, …I must translate word for word.

2. Z2: Ndiye ndibone kwalapha ebusweni,…i"facial expression"… ukuba bendifundisa ngesiNgesi ndibuze umbuzo iba ngabantwana ababini,… ndibone ke ngoku ukuba mandibuze ngesiXhosa… ubone ke ngoku iklasi yonke ephendulayo,… bayalandela…
I see how their faces look,… the facial expression… if I was teaching in English and I ask a question it's only two learners,…and now I see that I should ask in isiXhosa,… and now you see the whole class answering,.. they understand….

3. Z2: …ngelinye ixesha umntwana,… xa kunzima…, uye lo mbuzo awubhale ngesiXhosa…ufumanise ukuba u"right", ….akayazanga tu,… ngcono abhale ngesiXhosa kunokungabhali.
…. sometimes a child,… when it is difficult…, he writes the question in isiXhosa,… you find that he is right,…. He didn't know it at all, …. it is better (for him) to write in isiXhosa than not to write at all.

The three responses (1 – 3) explain why teachers did not use English for most of the time in their classrooms. My own observation, as discussed in 6.3 above was that there were very few learners who would participate in lessons taught through the medium of English. Thus the teachers had to switch from English to isiXhosa to accommodate the majority of learners in their lessons. The responses also show that the learners did not attempt to answer English questions; they waited for the teachers to make translations for them before they could answer questions.

6.3.1.4 Teaching through the medium of isiXhosa

Although I noticed that the experimental group teachers (S1 and Z1) used mostly isiXhosa in their teaching, to confirm my observation I asked them what language was dominant in their teaching of science. I was interested to see if there was really a problem in terms of teaching science in African languages as authors who argue for the use of mother tongue education in African languages mention that opponents of such teaching put forward the lack of scientific terminology in these languages (Alidou, 2004; Heugh, 2003; Brock-Utne, 2001; Chumbow, 1997; Hameso, 1997; Bamgbose, 1991).

One of the teachers (Z1) explained that she used isiXhosa most of the time, and she would borrow English words in cases where the isiXhosa science concepts were unfamiliar or difficult to understand. She gave an example of the term *"inkqunto"* which means "matter" in English. The term "inkqunto" is not used in everyday isiXhosa discourse, and it was a bit difficult for the learners to understand. Although its actual meaning, "the real thing," is appropriate and makes sense when used or applied within the scientific context, it was very unfamiliar to learners. Likewise, the use of the term "ecosystem" which was translated in a descriptive way in isiXhosa as "*isixokelelwane sezinto eziphilayo*/ *a network of living organisms*" in the learners' workbooks was quite a challenge to the teacher. Hence she claimed that in both cases she used loan words such as "*imatha"* (for matter) and "*i-ekhosistim"* (for ecosystem) so that learners could understand easily, while also allowing them to extend their linguistic repertoires through the use of loan words.

> Z1: Ndisebenzisa isiXhosa ngaphandle kwelo gama kuthe kwanzima ukulibiza….. ukulicacisa,… linzima, linzima,.. umzekelo, "inkqunto",…. kucace ukuba abantwana abacacelwa nje tu…., but ndithethe isiXhosa.
> **I use isiXhosa except for that word that is difficult to pronounce…. to explain, …it is difficult, difficult,… for example, "inkqunto/matter"….(when) it is clear that the children do not understand completely…., but I speak isiXhosa.**

When I interviewed the second experimental group teacher (S1) on the language she used predominantly in her teaching, her response contradicted my own observations in her classroom. She claimed that she used to switch over to English so that learners could know the meanings of certain terms in both languages (English and isiXhosa). But as I used to sit in her classroom, I never heard her mixing English terms in her science lessons. Also none of the video recordings[18] of her lessons supported her claim. Actually, one of the lesson extracts presented in 6.3 above does not have a mixture of English words. In her response to my question on why would she switch over to English in her lessons, she appeared concerned about what would happen when the learners

[18] In addition to notes that I took during classroom observations, I also recorded some lessons in science. The transcripts of some of the recorded lessons are attached as Appendix 2, and video cassettes of all the lessons are available.

switch to the English medium of instruction at high school. She raised her concern in this way:

> S1: …. xa ndifundisa ngesiXhosa amagama athile ndiwabiza ngesiNgesi ukwenzela ukuba bawazi macala omabini…..Ndisebenzisa zombini ezi lwimi….kwakufika eSenior Primary or High School akuzukuthiwa phaya isiXhosa sodwa…. that's why ke mna ndi"switch(a) over".
> **….when I teach in isiXhosa I pronounce other names in English so that they can know them in both ways…. I use both of these languages….when they get to Senior Primary or High School, it won't be said isiXhosa only…. that's why I switch over.**

In all, the teachers' responses supported the classroom data which showed that control group teachers switched codes because the majority of learners did not understand when taught through the medium of English. Likewise, experimental group teachers and learners interacted through isiXhosa except for a few English loanwords.

6.3.2 Learner interviews

6.3.2.1 Learning science through the medium of English

In addition to classroom data, I wanted to know how learners felt about English as a medium of instruction in science. I envisaged that the learners' perceptions of English as a medium of instruction would correlate with how they interacted with each other and with their teachers in the science classroom, and how they performed in science tests. When the control group learners, for example, were asked if they liked to be taught science through the medium of English, 15 of them (N=19) showed positive attitudes towards English. They preferred English medium of instruction for work purposes (i.e. to get better jobs) and for international connections.

> L1: Ngoba xa sicela umsebenzi siza kuwucela nge-English.
> **Because when we seek employment, we shall do that in English.**

> L2: Ngoba i-English iza kubhekisa kude, mhlawumbi ufuna ukuya e-America,…mhlawumbi awukwazi ukukhumsha kakuhle, i-English yakho ayizukuvakala.
> **Because English will take you far, perhaps you want to go to America,… may be you can't speak English well, your English won't make sense..**

However, there were only four learners (N=19) from the control group who claimed that they could not understand well in English. The problems they mentioned had to do with English having difficult words that they could not understand. They also claimed that they were struggling to write in English. Some of the responses showed that learners were more exposed to isiXhosa (their mother tongue) than English, hence they claimed their low level of competence in English.

In order to verify and validate the data I collected through classroom observations such as the learners' passive participation in lessons taught through the English medium, I asked how the learners felt about the teachers' code switching from English to isiXhosa during lesson presentations. I got various responses that showed that learners benefited from teachers' code switching and mixing or translations. That is, they understood better in their mother tongue than in English. I also noted that learners were aware that their poor performance at school was influenced by their lack of competence in English. The following responses, for example, have to do with low levels of competence in English and how learners benefited from isiXhosa translations in the science classroom.

L3: Kubakho amagama esingawaziyo nge-English.
There are words that we don't know in English.

L4: Uxolo Miss, ngoba ayo-language yethu, sisoloko sithetha isiXhosa, ezinye izinto asizuzazi zonke …… utitshala uyasitolikela ngesiXhosa.
Sorry Miss, because it is not our language, we always speak isiXhosa, we won't be able to know other things….. the teacher translates for us in isiXhosa.

L5: Uxolo Miss, nakwi-report, pha kwi-English abanye bafumana oo-5, abanye bafumane oo-1….ithetha ukuba abeva i-English
Sorry Miss, even in the (progress) reports, in English some get marks of 5, others get 1…that means they don't understand English.

L6: … ndiye ezinye izinto ndingaziva kakuhle kodwa ndiphinde ndibuze, kodwa ndibone ukuba andikeva kakuhle.
….I do not understand some things very well but I ask again, and I see that I haven't understood well again.

L7: Mna ndivele ndiphume ndingayazi, aphinde uMiss abuze ukuba ukhona umntu ofuna ukucaciselwa,…. ndiqonde ukuba andiyiva nyani le nto,… mandimyeke kuba uza kude adikwe ndim

I just go out not knowing it, and Miss (teacher) asks again if there is anybody who wants some clarity again…I feel that I really do not understand this…. let me leave her alone because she will get bored with me.

Surprisingly, a large number of the learners who claimed to like English seemed to benefit from getting translations in their mother tongue from their teacher. When I asked them if they were not getting bored when the teacher translated into isiXhosa for those who did not understand English, I received responses like:

L8: Asidikwa xa kutolikelwa abanye kuba Maam le nto sicinga ukuba siyayazi kanti hayi, besingayazi. Ngoku siphinde siyive kakuhle ngoMiss.
We don't get bored when the others get translations because Maam it would happen that we didn't know what we thought we knew. Now we understand it better from Miss (teacher).

When the learners were asked if they would like to continue with English as a medium of instruction in subsequent grades, only one (1) learner (N = 19) responded that he would not like to be taught in English in the next grade due to his low proficiency in it. The majority of the interviewed learners showed positive attitudes towards English, despite the fact that their responses showed that they did not understand or perform well in science taught through the English medium.

6.3.2.2 Learning science through the medium of isiXhosa

The experimental group learners who were interviewed at different times of the research period (at Grades, 4, 5 and 6) displayed positive attitudes towards isiXhosa. Their responses showed their pride and loyalty towards their mother tongue, and at the same time, eagerness to learn other languages, especially English. They also displayed confidence in terms of their English competence and the advantage of using the two science books (English and isiXhosa, as explained in the first chapter). They claimed that they had better understanding of lessons and they were doing better at school than the control group learners.

According to the experimental learners, they could express themselves better in English and in isiXhosa than the control group learners who appeared to be shy. Knowing

English and isiXhosa was perceived as an added advantage by learners because they could understand and translate oral discourse from one language to the other (from English to isiXhosa and vice-versa). The following comments were made by Grade 6 learners in favour of isiXhosa.

> L9: Kufuneka i*language* yakho uyifunde,… awunakufunda ezinye ii"*language*" ungayazi eyakho. Kufuneka uqale ngeyakho, ulandelise ezinye.
> **You must learn your language,… you cannot learn other languages if you don't know yours. You must start with your own (language), and thereafter learn others.**

> L10: I-English yethu ayikho phantsi konke kuba sifunda ngeencwadi ezimbini.
> **Our English is not below standard because we learn in two books.**

> L11: Izinto sithi sizazi nge-English nangesiXhosa.
> **We know things in English and in isiXhosa**[19]

> L12: Siyabogqitha aba be-English ngoba sifunda iincwadi ezimbini, siyi-understand(e), siyigqibe ngokukhawuleza.
> **We do better than the English learners because we study two books, we understand and finish it quickly.**

> L13: Sibajongela phantsi kuba ezinye izinto abazazi ngesiXhosa. Abaye abazazi kwa ukuzazi, baba neentloni, abafuni ukuthetha. Thina siyathetha. Xa kufike iindwendwe thina siba free singabi nantloni,… sithethe zoyi-two ezi lwimi. Abanye sibatolikele…
> **We undermine them (the control group) because they don't know other things in isiXhosa. Others do not know them at all, they become shy, they do not want to speak. We speak. When there are visitors we become free, and we do not become shy,… we speak the two languages. We interpret to others.**

Unlike the Grade 6 control group leaners, the experimental group learners of the same grade showed enthusiasm and eagerness to continue with isiXhosa as a medium of instruction beyond Grade 6. When asked how they felt that they had to switch over to English as a medium of instruction in Grade 7, I got responses such as the following:

> L14: Siziva singayithandi kuba thina besifuna ukuqhubeka side siphume apha eZama, ngoba besifuna nathi ukuba siphumelele, sifunde zombini ezi-language…

[19] At the beginning of this study it was explained that parents wanted their children to learn English better because they were concerned about their children's English proficiency levels when they get into Grade 7 (at the end of the project). Thus we had to give the learners extra support in English by giving them English Language workbooks and science books in English. The English science books were not used in the classroom, they were only used to refer to unfamiliar isiXhosa terms. The control group learners also received English language workbooks.

We don't like it because we wanted to continue until we leave Zama, because we want to be successful, to learn these two languages…

It was interesting to note that the experimental group learners had positive self esteem and they did not associate isiXhosa with low jobs, instead they were positive about their lives in the economic world. They also showed pride in learning through isiXhosa, and they wished that they could be known by the whole world (South Africa and beyond) that they were learning through the medium of their mother tongue, isiXhosa.

L15: Besifuna ukuthi gqi nathi ngesiXhosa kwiNatural Science,… sibe zii-Black…. umntu wokuqala esiya phezulu,… siye kwi-space, singaziyekeli. Sifuna ukungenela i-competition, sifuna abanye abantwana, sibabonise ukuba sifunda kanjani ngesiXhosa.
We wanted to come up with isiXhosa in Natural Science,… and become Blacks… the first person going up,…. (and) go to the space, (and) do it. We want to enter for a competition, we want to show other children how we learn through the medium of isiXhosa.

On the whole, the experimental group learners appeared more confident in terms of language proficiency (English and isiXhosa) and academic performance. They showed an understanding of the importance of ones' mother tongue in education, and the need to learn additional languages. The control group learners, on the other hand, appeared to be having more problems in science than the experimental group learners. Some of the problems are reflected in 6.3 above. In the following section (6.3.3) I discuss parent interviews within the context of media of instruction in the two languages (English and isiXhosa).

6.3.3 Parent interviews

As mentioned in the first chapter, getting into the English or isiXhosa class was a matter of parents' choice that was later verified with learners in order to find out whether the learners were happy or not with their parents' choice of media of instruction. The following data present information that was gathered from parents by means of interviews with regard to the choice of language of instruction in science from Grade 4 to Grade 6.

6.3.3.1 Langugage-in-Education Policy awareness

With regard to language policy awareness, the parents did not show any understanding of the South African Language Policy, let alone the Language-in-Education Policy. Only two of the interviewed parents (N = 21) at Zama Primary School showed a bit of knowledge of the language policy, and none of them were ever informed by their children's school about its language policy. None of the parents at Sizwe Primary School had knowledge about the Language-in-Education Policy too. What became apparent was that the letters that were written to the parents to ask their permission to involve their children in the study opened their eyes with regard to the parents' role in choosing the media of instruction for their children. For example, one of the parents at Zama Primary School made this comment:

> Into eze kundi-*surprise(a)* kukuba sifikelwe zileta ezithi ezi zinto ziza kufundwa ngesiXhosa; kwangona ndizidlayo ngoku… ukuba ikhona into ibi-*wrong(o)* xa ezi zinto bezititshwa ngesiNgesi…so ke xa ngoku ezi zinto ikho into ethi mazititshwe ngesiXhosa,… *which means* besinalo ilungelo, although besilivinjiwe ukuba abantwana bethu bafunde ngee-languages zabo abakhula ngazo.
>
> **What surprised me was to receive a letter saying that these things (subjects) will be learnt through isiXhosa; it was then that I became proud… that there was something wrong when these things were taught in English… so when now there is something saying that these should be taught in isiXhosa… which means we had a right, although we were deprived of that right that our children should learn through their languages that they grow with.**

6.3.3.2 Choosing English as a medium of instruction in science

Out of the 30 parents (Zama and Sizwe) who were interviewed in 2004 and 2005, twenty (20) of the parents had chosen English as a medium of instruction for their children, while ten (10) had children in the experimental group. Responding to the question of why they chose English as a medium of instruction in science, the parents' responses included the high and international status of English in the economic world, while some of the responses implied that there was no need for their children to learn through the medium of isiXhosa because they already knew their home language, whereas English was necessary for international and inter-racial communication and cognitive development of their children.

The parents appeared to be preparing their children to fit into the world of the white, coloured and other racial groups that could not speak isiXhosa. Actually, they strongly felt that English was the only language that could facilitate communication between the different ethnic groups. Some parents were also concerned that at high school and university levels English would be the main medium of instruction, so their children had to be taught in English earlier in order to cope at higher educational institutions. The general impression was that if the learners were taught through the English medium, they would be more proficient and fluent in the language. A deeper analysis of parents' interviews is given in the next chapter.

P1: Sizama ukuba baqhelane nesiLungu kuba asisoloko sisithetha
We are trying to get them used to English because we are not always speaking it.

P2:…umntu xa efuna isonka uya emLungwini, ngoku kunyanzelekile ukuba akwazi ukuthetha isiLungu.
…when a person is looking for a job, she goes to a white person, so it compulsory that she must be able to speak English

P3:Ndifuna abekrele-krele, avuleke ingqondo xa ethetha nabanye bebala…
I want him/her to be clever, and be open-minded when talking to other racial groups…

P4: IsiXhosa soze uye ndawo ngaso. If uya eNew Zealand, soze uthethe siXhosa apho.
You will never go anywhere with isiXhosa. If you go to New Zealand, you will never speak isiXhosa there.

P5: Kukho abantu abamnyama abafana nathi, bathetha olwa lwimi lwakowabo…unyanzeleke ukuba uthethe isiNgesi xa uthetha nabo ngoba uyasazi isiLungu, abasazi isiXhosa.
There are black people like us, they speak their own home languages…you are forced to speak English with them because you know English, they do not know isiXhosa."

P6:…xa eyakuthi afunde ngesiNgesi, loo nto iya kumnceda kuba ngelinye ixesha bayaphuma badibane nabamhlophe abe yena engeva nokuba kuthiwani…"
…if he will learn in English, that will help him because sometimes they go out and meet with white people, and he will not understand what is being said…"

P7: …ndafumanisa ukuba iyakuba nobunzima into yokuba afunde izifundo zakhe ngesiXhosa, umzekelo, xa enokuthi afunde i"*History*" ngesiXhosa kuza kubakho la magama antsokothileyo phaya azakuba nobunzima kuye ukuwaqonda….noba yi"*Biology*" … inamagama anzima anokuthi angathandeki futhi xa eguqulelwa esiXhoseni.

…I discovered that it could be difficult for her to learn her subjects through isiXhosa, for example, if she could learn History through the medium of isiXhosa there will be some complicated words that will be difficult for her to understand…whether it is Biology…it has difficult vocabulary or terminology that could not sound well when translated into isiXhosa."

P9: Ukuba bangafunda ngesiXhosa, umhlaba ungehla…"
If they can learn through isiXhosa, things can be very easy (below standard)…."

P10: Ndinengxaki mna, eYunivesithi ufika kukho i-English. *If* isiXhosa sinokuba *compulsory*, ndingamkhupha owam umntwana,….. *no problem if* isiXhosa singaqhubeka siye eYunivesithi.
I have a problem, when they get to University there is English. If isiXhosa can be made compulsory, I can take my child out (of school),… no problem if isiXhosa continues up to university.

However, some of the parents contradicted what they had said earlier about the high status of English. The same parents showed their concern about their children's mother tongue as a transmitter of cultural values and identity. They wanted their children to know their mother tongue even if taught through the medium of English. The parents also seemed aware that their children would do better in their mother tongue than in English although they wanted English for certain socio-economic functions mentioned above. When the parents were asked what they thought happened in their children's classrooms when they were taught through the medium of English, they responded thus:

P11: Ootitshala bacacisa ngesiXhosa, ze abafundi baphendule ngesiNgesi…..ootitshala kufuneka bancede abafundi, bacacise ngesiXhosa kuba abafundi bayaqonda ngesiXhosa. Bangaqhuba kakuhle kakhulu ukuba banokubhala ngesiXhosa kuba bangabhala into ende abayaziyo.
The teachers explain in isiXhosa, and the learners answer in English…. The teachers should help learners, and explain in isiXhosa because the learners understand better in isiXhosa. They can perform very well if they can write in isiXhosa because they can write something long (texts) that they know.

The following responses show that the parents wanted their children to maintain their mother tongue, while they were learning English as well.

P12: …ndathanda loo nto ukuba abe phantsi kwesiNgesi….ingekuba isiXhosa ndisichasile….kodwa ndiyakholwa ukuba alwazi ulwimi lwakhe…
…I liked that he must be in the English class…not that I hate isiXhosa… but I would like him to know his language…

P13: EngumXhosa nje umntwana wam ndifuna asazi isiXhosa, ahlale esazi ukuba ungumXhosa, asithande isiXhosa sakowabo.
As a Xhosa by birth, I want my child to know isiXhosa, and always know that he is Xhosa by origin, and he must love his home language isiXhosa.

When asked how they would react if the government had to make isiXhosa compulsory as a medium of instruction, some of the parents said:

P14: Andiboni ngxaki kuloo nto, ukuba uRhulumente uthi makufundwe ngesiXhosa,… iyafana loo nto nale yesiNgesi.
I don't see any problem in that, if the government says learning must occur through the medium of isiXhosa,… that is the same with the English case.

The above responses show that parents prefer English for its socio-economic benefits, while recognizing the importance of the mother tongue in terms of cultural identity an pedagogic advantages. In the following section I highlight some factors which influenced some of the parents to choose isiXhosa as a medium of instruction in science.

6.3.3.2 Choosing isiXhosa as a medium of instruction in science

When parents were asked why they chose isiXhosa as a medium of instruction for their children, they responded as follows:

P15…umntu ukhululekile, angathetha nokuba yeyiphi i'*language*' yakhe, especially i'language apho azalwa khona….so zoyi-11 ii-'*official language*' zethu, nokuba uthethe eyiphi…
A person is free, can speak any language of her/his choice, especially her/his home language… so all our 11 official languages, it doesn't matter which one s/he speaks…"

P16:… zonke ii'*language*' zibalulekile, and akunyanzelekanga ukuba utshintshele kwenye i'*language*' xa ufuna ukuzi '*express*(a)'. Thetha nge'*language*' yakho, ukuba umntu akaku '*understand*(i)' unokubuza kumntu o'*understand*(ayo)'…
…all the languages are important, and it is not compulsory that you switch over to another language when you want to express yourself. Speak your own language, if a person doesn't understand you, she can ask someone who understands…

They chose isiXhosa in order to recognize its official status and to put it on par with other official languages as an expression of human rights, freedom and democracy. IsiXhosa was associated with the learners' cultural identity as well as better academic performance

at school. Parents felt that their children would do better at school if they were taught in their home language like the white children taught in Afrikaans or in English.

> P17:… ulwimi lwesiXhosa lulwimi lwasekhaya, kufuneka azazi izithethe zesiXhosa…kuba le i-English yeyokuba afumane umsebenzi…abe ulwimi lakhe engalulahlanga … Akhule eyazi inkcubeko yakhe.
> … *the Xhosa language is my home language, she must know the Xhosa cultural traditions*
> **…because this English is for the purpose of getting a job…while maintaining her own language…. She must grow up knowing her culture.**

> P18:… kukho izikolo, mhlawumbi zamaBhulu… eStellenbosch kufundwa nge-Afrikaans 'almost' zonke ii'*subject*', … xa befika kwiMatriki bafumana ezona '*result*' ziphucukileyo ngeyona ndlela ngaphezu kwezi zethu … 'i*result*' zibe '*poor*' kuthi thina maXhosa …
> **… there are schools, perhaps the schools for Afrikaners… in Stellenbosch almost all the subjects are taught through the medium of Afrikaans, …when they reach Matric, their results are better than ours, the Xhosa-speaking people…and we the Xhosa-speaking people get poor results.**

> P19: ….eyona nto ebangela ii-*results* zibe-*poor* kuthi thina maXhosa koku kupitiliza la-Afrikaans,… ize i-*paper work*…ayisete ngolu hlobo lwe-*language* yakhe, ….kodwa wena mntu uzoyibhala, uzoyibhala ngala *language* yalaa mntu……
> **…what makes the results to be poor among us the Xhosa-speaking people is the lack of proficiency in Afrikaans,… and the paper work… is set in another language…. But you will write in the language of that person (sic. foreign language)…..**

Parents were aware of the low status accorded to African languages by the speakers of African languages themselves; despite the fact that the home language is what and who you are (i.e. it reflects one's identity). Some parents seemed to understand the benefits of the mother tongue in learning another language. For example, some indicated that one needs to know the mother tongue, especially in writing, in order to acquire an additional or a second language.

> P20: … awuzukukwazi ukuyipela i-English ungasazi isiXhosa… uqale wazi isiXhosa…"
> **… you won't be able to spell in English if you do not know isiXhosa… you must first know isiXhosa…**

In the above responses it appears that parents chose English as a medium of instruction so that their children could get jobs, while they also wanted their children to maintain isiXhosa for cultural identity. and better understanding of school subjects.

6.3.3.4 Parental support

This section focuses on the support of parents to teachers and learners as a means of promoting teaching and learning. What came out of the interviews was that some of the parents could not give support to their children due to several reasons such as absence from home, coming home late, and lack of competence in learners' school work. Those parents who had difficulties in understanding schoolwork made use of their neighbours. What I noted was that parents who claimed to have difficulties in understanding their children's schoolwork were having children in the control group of both schools, while those who had children in the experimental group indicated some evidence that they helped their children with their schoolwork. The following parents' responses, for example, illustrate that some parents found it difficult to give academic support to their children, and others tried to support their children where they could afford to.

> P21: Mna ndiyamncedisa kwezinye izinto, ezinye andifikeleli kuzo ngoba laa mfundo yethu ayifani nale; ndithi ke ukuba ngaba ndiyabona kukho into endingayiqondiyo ndithi kwabo baqondayo mabamncedise.
> **I help him with other things, I do not cope with others because our education is not the same with theirs; and if there is something I do not understand, I ask those who understand it to help him.**

> P22: … *sometimes* nam xa ndifumana ubunzima kuye kubekho ukoyika, uqonde ukuba nawe awukwazi ukuyenza, ndicele mhlawumbi u'*brother*' wam asincedise… uqonde ukuba andiyiva nje tu le nto…
> **… sometimes when I experience difficulty fear starts, and you feel that you cannot do it, I perhaps ask my brother to help us…and you feel that you do not understand this at all…**

Contrary to the above response from parents who had children in the control group, the following response shows that the parent knew and had participated in her child's schoolwork.

> P23: … uyafika athi kuthiwe mabeze mhlawumbi ne'*seed*' yengqolowa… ndithathe isonka ke ngoku mna ndikhangele phaya ezo 'seed',… mhlawumbi makeze namagqabi ezityalo ezi zizikhulelayo,… sihambe siye phandle siyozikhangela, abuze ukuba yintoni, ndimchazele ukuba yinto ethile, and 'then' ayibhale ke ngoku.
> **He comes and says that they have been asked perhaps to come with a wheat seed… I take bread and look for the seed…perhaps he must come with leaves of natural**

vegetation… we go outside to look for them, and he asks what it is, and I tell him what it is, and then he writes it down.

According to teachers, parents never came to school to check their children's work, except when they were called in to collect their children's end of the year school progress reports. Their attendance at school meetings was also poor. However, one of the experimental group teachers claimed that there were indications in her learners' work that parents were helping children in her class. She had noted a change since the learners started learning through the medium of isiXhosa.

Z2: Nabazali bayayinika inkxaso,….. ndithetha nje ngezi eksperimenti… ufumanise ukuba abazali bayayijonga yonke le nto uyititshayo,… batshintshile kunakuqala…abuye (umfundi) ethetha "more" kunakuqala,.. esithi: "Ubhuti ebejonge le ncwadi waze wandicacisela yonke into ekule ncwadi."
And parents are giving support…I am talking about these experiments…you find that parents look at everything that you teach… they have changed than before… and he (the learner) comes back talking more than before…saying:"My brother looked at this book and explained everything that is in this book."

From the learners' responses, it appeared that some parents, especially mothers, helped their children with schoolwork to some extent. Two of the interviewed Grade 5 learners claimed that their mothers helped them in different ways such as asking the child or learner questions on the work, letting the child read and write on his own, explaining difficult concepts, etc. Another two interviewees mentioned the support of their neighbours because their family members were impatient with them or had insufficient knowledge of science as a school subject because of their low educational qualifications.

Ndiyalufumana nase-next door uba mhlawumbi ndiyambuza utata ukuba ithetha ntoni,… athi kutheni utsho ngoku,…. Athi: "andifundanga mna ndiyeke
I also get it (support) from next door if perhaps I ask my father what it (the work) means, … .he says why I only say that now,…. He says: "I am not educated, leave me alone.

When asked if the learners were read to by their parents, only four of the learners (N = 19) claimed that their parents used to read them some stories, including folk tales (iintsomi). Two of the learners were read to by their fathers, while the other two were read to by their mothers. Three of these learners who were in the control group were read

to in their mother tongue (isiXhosa), and only one of them claimed that his parents read English to him.

6.4 Presentation of learners' work

6.4.1 Learners' workbooks

The purpose of analyzing the learners' work in science was to find out the learners' level of understanding in science, and whether the language(s) of instruction had any influence on their understanding. In addition, I wanted to see whether or not the learners were able to carry out some work (e.g. experiments) that required them to go out of the classroom for additional information. I also wanted to see whether the parents were involved in their children's work, and the extent and form of their involvement. I analyzed nine (9) books from each class at each school (i.e. 9 from the experimental group of each school; and 9 from the control group from each school in 2003 and 2004). In other words, I analyzed 18 books of the control and experimental groups at Sizwe Primary School. I also checked 18 books of the same groups at Zama Primary School in the same year. In 2005 I checked ten Zama Primary School books (5 from each group) as Sizwe was not part of the project in 2005. The reason for checking fewer books was that learners' numbers had decreased in both groups due to a number of reasons mentioned in the previous chapter.

In the control groups at both schools I noted that some Grade 5 learners (4/18) could not write one correct sentence in English. Apart from the fact that the learners struggled to give the correct answers to the questions, with grammatical and spelling mistakes, I noted that four of the learners (N = 18) had serious problems with writing. For example, some learners in the control group at Zama Primary School responded in the following way to some questions:

<u>Question 1</u>: Briefly describe where you get the energy that you use everyday to come to school, do sport and be able to play

<u>Zama learners</u>

L1: it can not give soil

ond nee phodus o osign
ond ro phoduss soil
ond solussins
L2: lheeli
bood
lleekool
leekiwo

Sizwe learners

Two learners at Sizwe Primary School responded as follows to the above question:

L3: Use anezi byon sport play
Amya mapu sopa
Uouka Wrhes onhla Ukmule
Maya have hoves

L4: Tito nezi esinamso
Titeti enzi etomeni
Titeti enzi asiomci
Titeti eoji omelonci

Question 2: Name more ways in which plants can differ from one another and therefore not compete with one another:

L1 (Zama: same learner as above) responded as follows to the above question:

Lokezukiwo
Zulokiwolokiwo
Leekiwolowo
Kiwokiezuliwo cekiwo

Question 3: Mention three ways in which seeds can be distributed. Also mention which is the method that you believe most seeds have been adapted to and why you think so.

A third learner (Sizwe: L3) responded in this way to the above question:

Wheesnees da aneemus
Wheesness da wheend
Wheesnees dawhat
Whend motst owas weatstheliwo

And a fourth learner responded this way:

L4: it bespecti animals
it bespecti water
it bespecti by food

It is very difficult to establish which language has been used by the four learners to respond to the questions because it is neither English nor isiXhosa, but a collection of letters that do not make sense at all. The work does not make sense, and one cannot even guess what they wanted to communicate through what they have written. One can at least guess in the fourth reponse that the learner could not write "disperse or distributed", but could at least write the nouns (animals, water and food) which were the key words to what the question required. None of the four learners attempted to respond to the second aspect of the question that needed their reasoning.

On the other hand, the experimental group learners at Zama Primary school responded in the manner reflected below to the same questions.

Question 1: Chaza ngokufutshane apho uwafumana khona amandla owasebenzisayo mihla le ukuza esikolweni, ukudlala imidlalo nokuba ubenako ukudlala.
Briefly describe where you get the energy that you use everyday to come to school, do sport and be able to play.

> L5: Amadla ndiwafumana xandisitya ukutya neziqhamo naxa ndisele amanzi
> **I get energy when I eat food and fruit and when I have drunk water**
>
> L6: Amandla ndiwafumana ngokuthi nditye ukutya okusempilweni ukuze ndifumane amandla. Ukuba ndifuna ukuba namandla kufuneka ndidlale imidlalo eyesikolo, nothi isikolo qha nakwezinye iindawo *(I get energy by eating healthy food so that I get energy.* **If I want to get energy I must play school games, not only at school, at other place as well)**

Question 2: Chaza iindlela ezininzi apho izityalo zithi zohlukane esinye kwesinye zitsho zingakwazi ukukhuphisana.
Name more ways in which plants can differ from one another and therefore not compete with one another.

> L5: Ezinye izityalo zifuna ukukhanya kwelanga lento zifuna ilanga zifuna umbala obonakalayo. Ezinye izityalo zikhetha umtunzi lento ziketha umthunzi azifuni ukuthselwa ngamagqabi.
> **Some plants want the light of the sun the reason why they want the sun is that they want a bright colour. Other plants choose the shade the reason why they choose the shade is that they do not want their leaves to get burnt.**
>
> L6: Izityalo apho zithanda ukwehluka ezinye izityalo zibaselangeni ezibesemthunzini. Umbona yena uthanda umthozi ezinye izityalo zithanda ilanga kelonto ithetha ukuba kulaphozohlukana khona ezinye izityalo ezingegobhona enye into sisenzela nokutya ukuze zohlukane.

Plants somehow differ… some plants are in the sun and others are in the shade. Maize likes the shade other plants like the sun then that means that it is where they differ. Other plants other than maize another thing they make food for themselves so that they differ.

Question 3: Xela iindlela zibe ntathu enokuthi isasazeke ngayo imbewu. Phinda uxele ukuba yeyiphi indlela okholelwa ukuba imbewu iqhelene nemeko enjalo kwaye kutheni ucinga njalo.
Mention three ways in which seeds can be distributed. Also mention which is the method that you believe most seeds have been adapted to and why you think so.

L5: Imbewu isasazwa ngabantu ngokuthi atye isiqhamo alahle imbewu
Seed is dispersed by people by eating fruit and throw away seed

L6: Imbewu isasazwa ngabantu amanzi emninzi ziyaphaphatheka imbewu
Seed is dispersed by people too much water seed is dispersed by air
Indlela eqhelekileyo yile xa umntu ebesitya isiqhamo alahle imbewu yileyo iqhelekileyo
The familiar way is the one when a person was eating fruit and throws away seed that is the familiar one.

Out of the nine experimental group learners' workbooks that I checked at Zama, I noticed only one learner who used to mix English words or concepts in isiXhosa sentences as follows:

1. **Kuvele** iradicle **isibindi (The radicle then appears)**
2. **I**radicle **iyehla (The radicle goes down)**
3. **Inako ukufumana** ioxygen **(It can get oxygen)**

In addition to the learners' workbooks, I also analyzed learners' written work where they were asked by their teachers to give a written report on a science excursion they had had at Eskom, an electricity centre. The science excursion was held in June 2004 with Grade 5 learners at Zama Primary School. The rationale behind this analysis was to find out the extent to which the learners could express themselves in the two languages (English and isiXhosa), and to determine whether or not they had understood the whole process of electricity generation which was presented to them at Eskom. Five essays from each group (control and experimental) were chosen at random. The written reports are analyzed in the following chapter, and the samples are attached in Appendix 4. The following are examples of two learners' written reports (one from each group) which were chosen at random. The isiXhosa version is translated literally in order to reflect the actual meaning and punctuation of the text in both languages.

LEARNER 1: CONTROL GROUP

1925 when Eskom stats the first bech of eskom. Eskom have a line of eletrisity much of onethousand one hundred rand. Eskom was using a candle for elecrisity a candle elecrisity use as gases, water, kley. Coal make – 13 kley maked gases mak-02 water-06 store water – 02.
Air
Air is claen. Make energy make big of life air is very powerfull. Now on eath we are going to have air elecrisity.
Now people are working there they are saying Escom they stop to say Eskom.

LEARNER 2: EXPERIMENTAL GROUP

L3: Umbane wenziwa ngamanzi kuntsalwa amanzi ngemibhobho emilanjeni uye kumatshini. Umatshini ufudumeze umpunga uphuma udikidiki umphunga udibane nomoya umphumga uphinde usetyenziswe ufakwe kwimatshini ube ngumbane opheleleyo uthunyekwe kwindawo ngendawo ufika sowupholile. Thinabantwana nabazali kuthiwa masisuke ngasembaneni silumkele amanzi angadibani namanzi. Xa ususa iplagi qale ucime umbane ungagcwalisi iplagi. Enye into sukutsalela umelwane.

Electricity is made with water water is pulled with pipes from the rivers and it goes to the machines. The machine warms up the steam the steam is luke warm it mixes with air the steam is used again and put in the machine and it becomes real electricity it is sent to different places and it is coo when it arrives. We, children and parents it is said we must move away from the electricity we must be careful that water mustn't get into contact with the water (sic electricity). When you remove the plug you must first switch off the electricity do not overload the plug. The other thing, do not connect electricity for your neighbour.

In the following section I present data which indicates how the learners performed in Science tests which were not prepared by their teachers. In the previous chapter it was mentioned that the tests were set by the Science lecturer at the University of the Western Cape (UWC) who used to conduct teachers' workshops. The presentation focuses on the scope of the tests in terms of the kinds of questions that were asked in relation to the Natural Sciences Learning Area outcomes and the OBE requirements.

6.4.2 Science Tests

In 2003 one test was given to the Grade 4 learners in November. The test covered the first two modules of science. The test assessed the learners' comprehension, which links with LO 2 which has to do with scientific knowledge construction. The learners had to read the extract and answer questions that were based on an extract. The learners were

also required to apply their science knowledge by responding to a case study which had to do with air.

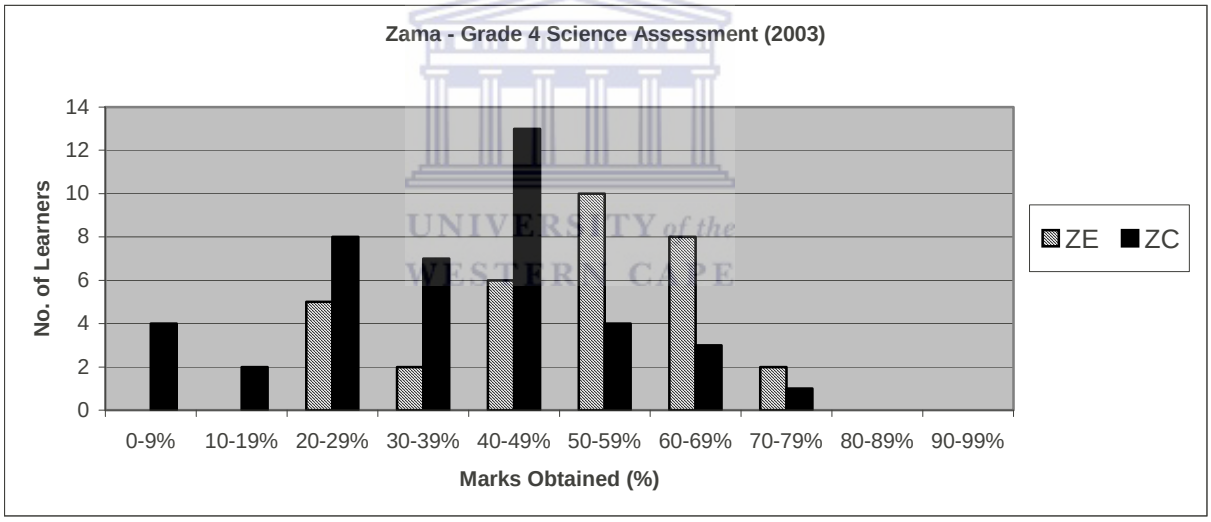
Two tests were given to Grade 5 learners in 2004. The first one was administered in March and the second one in November 2004. The first test required learners to choose correct answers from a given list, to do sequencing where the learners had to put statements in the correct order, and to interpret pictures. The second test followed the same pattern, although the questions and pictures were different. In relation to the Natural Sciences Learning Area outcomes, both tests covered two of the outcomes (LOs 2 and 3: science knowledge construction and the interrelationship between science, society and the environment). The third Learning Area outcome (LO 1) requires learners to conduct scientific investigations and the tests did not focus on investigations.

In Grade 6 one test was given in November 2005. The test had three questions. The first question had one multiple choice type question and a matching question. In the second question the learners had to label two diagrams: the planets and the earth's surface. The third question required the learners to read a text and link it with what is happening in their environments in terms of water pollution. Samples of question papers are attached as Appendix 3.

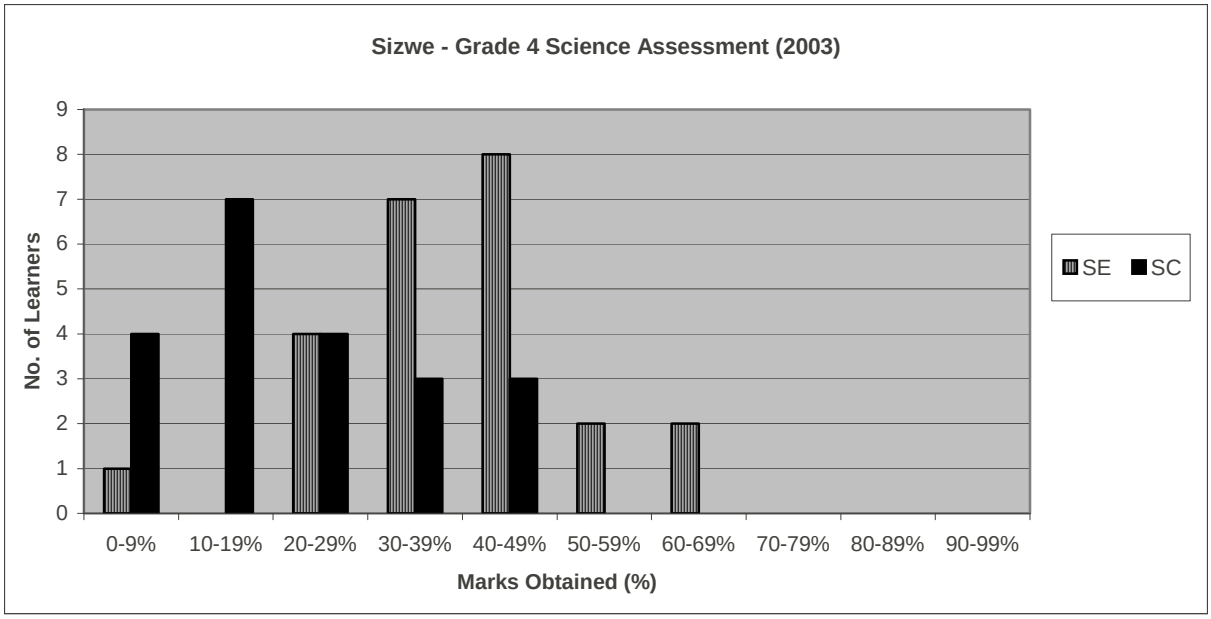
The learners' performance in the tests described above is presented by means of bar graphs below. To maintain consistency, I plotted marks of the last test or assessment because in some cases one test was given (e.g. Grade 4 classes of the two schools wrote one test). Secondly, at Sizwe Primary School one test was administered to Grade 5 due to difficulties mentioned earlier. So in order to enhance comparison of the groups, I had to consider marks of the test which was written by the two groups of learners in both schools. The other marks which are not reflected in the graphs can be made available should the need arise.

The bar graphs show the number of learners for both groups who obtained marks within a certain score bracket (e.g. 40 – 49%, 50 – 59%, etc.). The X-axis represents marks

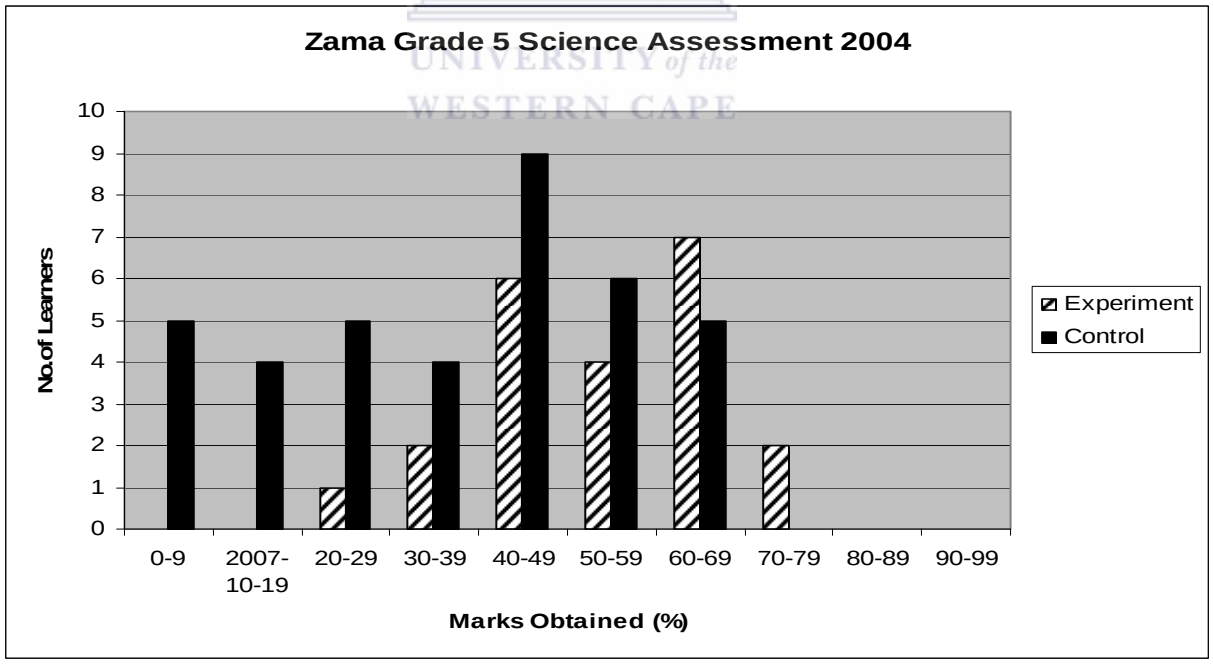
which were obtained by learners (in %), while the Y-axis represents the number of learners in each mark category. I opted for this kind of graph design because I envisaged some confusion and complications if I were to plot the scores for each individual learner on the same graph because not all the learners wrote all the tests from Grade 4 to Grade 6. Moreover, it became easier for me to group the learners who wrote a particular test according to the marks they obtained in order to give an overall picture of the performance of the whole class. This graph design is also appropriate for data analysis which emphasizes more qualitative analysis than quantitative analysis. I must mention that the test results that are presented here were collected from the two schools (Sizwe and Zama) in 2003 and 2004, while 2005 results comprise Zama Primary School results only because Sizwe Primary School withdrew from the project in 2005.



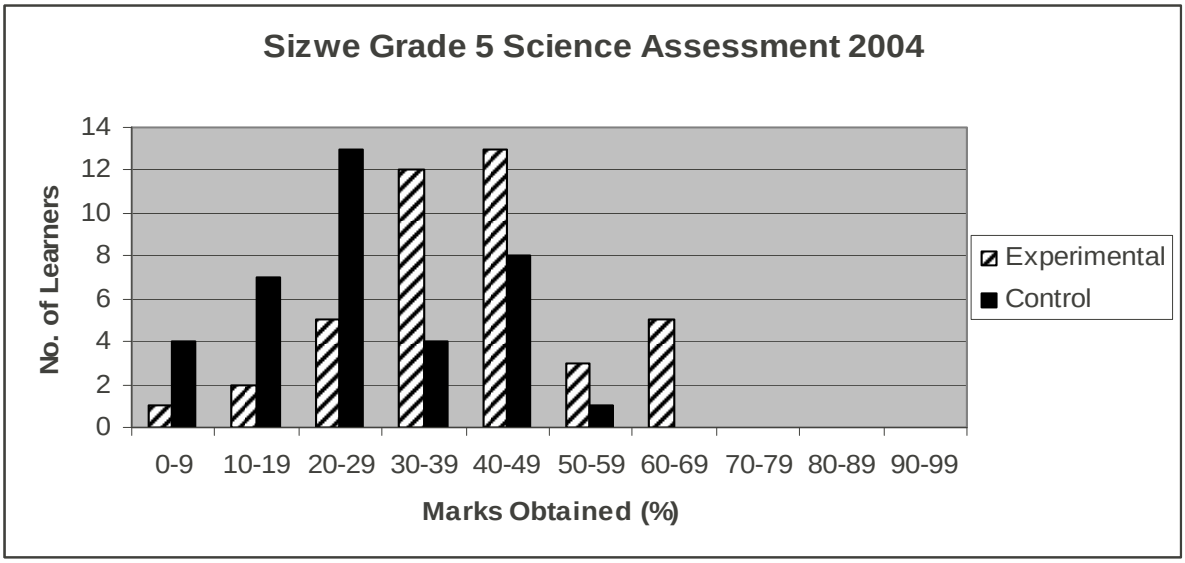
Graph 1: Zama Primary School - Grade 4 Science Test scores - Experimental (ZE) and Control (ZC) groups



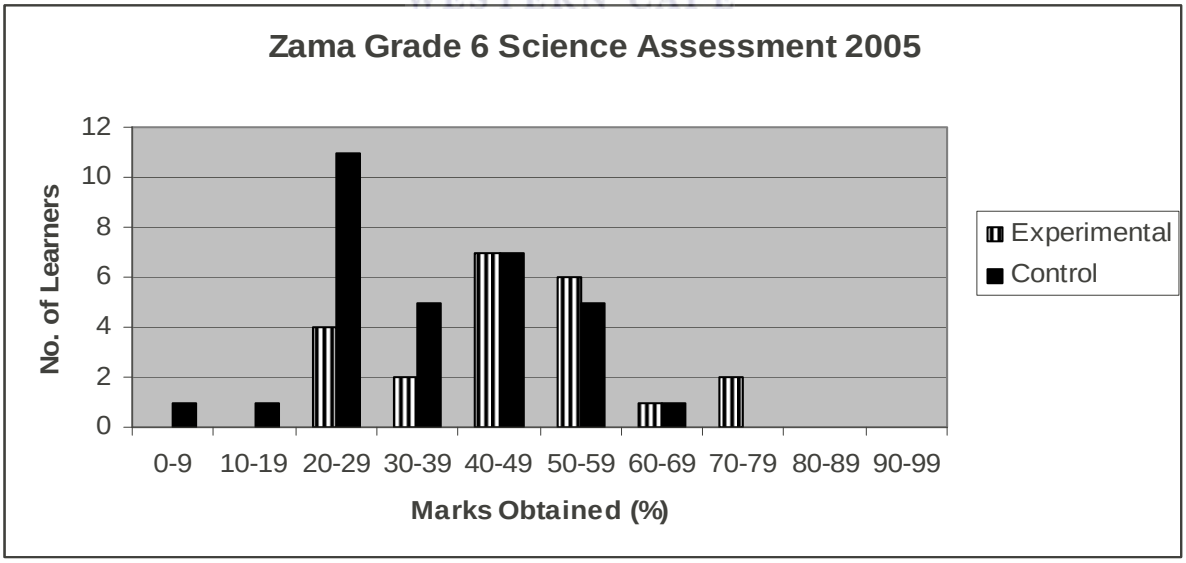
Graph 2: Sizwe Primary School - Grade 4 Science Test scores - Experimental (SE) and Control (SC) groups



Graph 3: Zama Primary School - Grade 5 Science Test scores - Experimental (SE) and Control (SC) groups



Graph 4: Sizwe Primary School - Grade 5 Science Test scores - Experimental (SE) and Control (SC) groups



Graph 5: Zama Primary School - Grade 6 Science Test scores - Experimental (SE) and Control (SC) groups

6.5 Summary

The data presented in this chapter is based on classroom observations, interviews, analysis of learners' workbooks and classroom tests. Classroom data indicates that control group and experimental group teachers use more or less the same teaching strategies, although there is more teaching in isiXhosa in the experimental class. The most dominant teaching strategies in both groups are questions and answers, and group work with more teacher talk.

In terms of learner interaction, the control group learners use their mother tongue in class discussions and to communicate with their teachers, and they struggle to express themselves in English. The samples of learners' work also show that learners in the control group find it difficult to express themselves clearly in English, while the experimental group learners can express themselves clearly and confidently in isiXhosa.

Data collected from interviews supports most of the classroom observations. For example, the control group teachers seem to be using more isiXhosa than English in their classrooms. Also, learners respond better to isiXhosa questions than to English questions. Data shows that there is a lack of science resources in both schools, and this shortage impacts on the teaching-learning process. The teaching-learning process seems to be affected by inadequate parental support as well. The learners' workbooks show that there are few activities that the control group learners have attempted to answer. The graphs also show that the control group learners and the experimental group learners are not on equal footing in terms of performance. The following chapter will unpack, analyze and interpret the data in order to get its meaning and implications.

CHAPTER 7

DATA ANALYSIS AND DISCUSSION

7.1 Introduction

Following the raw data presented in the previous chapter, I analyse data in this chapter. The data analysis is informed by the research design and the theoretical framework underlying this study, i.e. the qualitative research design and the interpretivist research paradigm on the one hand, and science knowledge construction on the other hand. The interpretivist research approach is in line with interactionist analysis which guides data analysis in this study (Henning et al. 2004:20). It ties in with the focus of this research which aims at understanding how teachers and learners interact in the science classroom through the media of English and isiXhosa. Therefore, the purpose of this chapter is to describe, analyze and interpret interaction in the science classroom taking place in two languages of instruction (English and isiXhosa).

Many authors concur that qualitative research data analysis involves breaking up the data into manageable themes, patterns, trends and relationships in order to make sense or meaning of it (Bogdan & Biklen 1992:153, Henning et al, 2004:102, Hitchcock & Hughes, 1989: 73, Mouton, 2001:108). Hitchcock and Hughes (1989:73), in particular, explain the process of data analysis as a process where the researcher has to organize, account for and provide explanations for data, i.e. the researcher has to "move from a description of what is the case to an explanation of why it is the case." Hence Henning et al. (2004:103) claim that the process of analysis is the "heartbeat" of research which may occur in the form of "thick description". They refer to "thick description' as information that gives a picture about the context, intentions and meaning of a particular act (Henning, 2004:128).

On the basis of the above description, data analysis is the most critical stage of research where the researcher has to be very skillful and creative to pull all the pieces of data together. This implies creating a clear picture of the research journey and the destination (i.e. the results of the research). In the context of this study, a description of research events and situations is given in Chapters 5 and 6. This chapter intends to make sense of those descriptions of situations by giving explanations or interpretation(s) of such acts or situations. It makes a connection between the presented data and the research findings that are subsequent to data analysis. This implies that data analysis determines the authenticity of the research findings. If the data is well analyzed and interpreted, the research results will be more meaningful and reliable than when there are gaps and misconceptions during data analysis and interpretation.

In the light of the data presented in the previous chapter, this chapter starts with the analysis of classroom observations. The analysis pulls together or categorizes related themes and facts together. The themes, though relating to the research questions, may not necessarily follow the same sub-topics of the last chapter. Some of the data collected by different techniques (e.g. observations, interviews) may be interwoven in order to give a coherent account of the data or research events. The five sub research questions stated in the first chapter are recaptured as follows:

1. What approaches or methods do teachers use in teaching science through the medium of English or isiXhosa in the Intermediate Phase?
2. What learning strategies do learners use when they are taught science through the medium of English or isiXhosa?
3. How do learners cope and perform in science taught through the medium of English or isiXhosa?
4. What kind of support do parents provide to teachers and learners?
5. To what extent are the teachers and parents aware of the South African Language-in-Education Policy that guides teaching and learning in schools?

7.2 Teaching approaches

With regard to classroom data, data analysis focuses on teaching strategies, the use of English and isiXhosa as media of instruction in science, and learning strategies in the experimental and control classes at both schools. In actual fact, it addresses the first research question: What teaching approaches or methods do teachers use in teaching science through the medium of English or isiXhosa?

7.2.1 Teacher- centred approaches

Language as a means of communication is a very important tool in the classroom because it enables learners to talk, think, read and write. In other words, it mediates learning hence it is regarded as a prerequisite to science learning (Wallace, 2003:8; Freeman & Freeman, 1994). With regard to teaching approaches, the common feature in teaching either through the medium of English or isiXhosa was more teacher talk with little learner involvement, and few challenging questions. Teacher talk or the telling teaching method is less interactive and it does not encourage active participation by learners in their lessons. The teacher plays the biggest role by talking or pumping knowledge into learners, while learners become passive listeners. It is one of the traditional teaching methods which is associated with autocratic management and teacher-centredness (where the teacher controls everything in the classroom). Tsui (1996:152) has this comment about teacher talk:

> The teachers have the misconception that an effective teacher should be able to solicit immediate responses and that responsible teachers should be talking all the time…
> When there is more teacher talk, there will be less student participation, resulting in long silences in the classroom that prompt the teacher to talk even more.

Although the question and answer method is usually interactive and learner-centred because it stimulates the learners to think and express their thoughts, its effectiveness is determined by the types and quality of questions asked. If the questions are not challenging, their effectiveness may not be guaranteed. In the case of this study, all the teachers (N = 4) in Grades 4, 5 and 6 made more use of questions of the lower order

(more than 80%) than questions of the middle and higher order which challenge learners to think. For instance, in one of the lessons by Z1, out of 51 questions she asked only 4 of them were middle order questions, and there were no questions that stimulated higher order thinking skills or reasoning. That is, out of the 51 questions, 47 of them required short answers from the learners.

Cleghorn (2005:108) claims that in cases where the medium of instruction is a second language of the teachers and learners, the question and answer method usually prevents teachers and learners from expressing themselves in the language of instruction. In such cases teacher-learner interaction usually takes the form of a three phase discourse where the teacher (i) initiates a question (I), (ii) the learners respond (R), and the teacher supplies feedback (F) (Jones, 2000; Ellis, 1985). In IRF situations, learners may avoid expressing themselves in the L2 and resort to one-word answers due to limited proficiency in the L2. IRF is usually associated with a teacher-centred lesson or transmission teaching because the teacher is always the initiator, and learners are not given enough opportunity to explore the learning content on their own. They are restricted by the nature of the teacher's questions. Therefore, IRF discourse promotes the authoritarian status of the teacher and rote learning.

Likewise, group work is an interactive strategy where learners learn collaboratively. It encourages learners to explore and discover things on their own, and instill good values in learners (e.g. sharing, tolerance, respect, etc.) if it is managed properly. In terms of the Vygotskian theory, group work can also enable the learners to attain the ZPD if they work in collaboration with more capable peers and under the guidance of a teacher or adult (Freeman & Freeman, 1994). So if group work is not properly managed, it may not scaffold learners to reach their highest level of learning (ZPD).

In terms of knowledge construction or active learning by learners in the science classroom, the quality of the teachers' questions did not allow creativity, self expression and self discovery by learners. Instead the questions encouraged the learners to learn chunks of science knowledge without connecting such knowledge to a broader context

that promotes critical thinking. Cleghorn (2005:108) refers to this kind of learning as collateral learning. In collateral learning learners do not integrate new knowledge with their existing knowledge in order to arrive at their highest level of understanding or development (ZPD) which is associated with independent and abstract thinking. It is, therefore, logical to say that if the questions are not challenging to the learner, the new knowledge may not be mediated in a way that enables the child to reach his ZPD as explained in Chapter 3, irrespective of the language of instruction.

The presented data shows that all the teachers (N = 4) lacked adequate skills to implement and manage learner-centred approaches effectively. The lack of such skills can be attributed to the fact that three of the teachers (S1, S2 and Z1) were trained in the 1970s, and had been teaching for a number of years using traditional methods which see the teacher as the most active role player in the teaching-learning process. A shift from the old teaching approaches such as more teacher talk to the new learner-centred OBE approaches may take a while before it is fully assimilated and understood by the teachers, especially in cases where teachers are faced with many demoralizing challenges such as lack of teaching and learning resources, violence, crime, poverty, HIV/AIDS, and many others, in their classrooms. Despite the fact that the National and Provincial Departments of Education are trying to give support to teachers in the implementation of the new curriculum, teachers still feel that time is limited for them to grasp everything and effect reasonable changes in their classrooms. The following comment by a teacher in one of the newspapers explains how teachers feel about implementing the OBE curriculum.

> We had hopelessly inadequate training. In the past we spent three years studying so we could stand in class and teach. Now they give you one week's training and then expect you to be an expert, providing quality education (Cape Argus, January, 20, 2004).

However, data also shows that the younger teacher (Z2) attempted learner-centred approaches such as role plays and dialogues in her class. When the project started in 2003, the data showed that all the teachers (N = 4) made more use of the telling (teacher talk) method. With the assistance of the LOITASA workshops, an improvement was noted with Z2 during my regular visits to schools in 2004. In fact, her improvement was

in assessment activities as she was still using the telling method with her Grade 6 learners. She admitted that the LOITASA workshops had helped her develop better teaching skills in science. She felt that the science work was very interesting and she was gaining lots of knowledge from the workshops she attended. She claimed that some science activities were challenging, and she was beginning to gain confidence and enthusiasm in teaching the subject. On the other hand, the other teachers (S1, S2 and Z1) did not appear to be reflecting on their teaching practices. Instead they felt overburdened and such an attitude could not lead to enthusiasm and innovativeness in the classroom.

Z2's enthusiasm and eagerness to learn new things can be understood in terms of her age, flexibility, motivation and hopes for her future career. That is, she appeared willing to take up new challenges as a means of personal development. As she did her teacher training in the 1990s, there is no big gap between her pre-service training and the implementation of the new outcomes-based curriculum which was introduced in 1994. It also appeared that Z2 understood the principles of the new curriculum better than the other three teachers who were trained in the 1970s (S1, S2 and Z1). In addition, having better qualifications (a university degree) which the other teachers did not have could be seen as another factor which enhanced her better understanding of issues within the academic or educational context.

7.2.2 Code-switching as a teaching resource

In situations where the teachers and learners are interacting in a language in which they have limited proficiency, the following are the possible ways in which teacher-learner interaction can proceed in science teaching:

1. The teacher may ask good questions and the learners may see the answers but fail to express themselves clearly due to lack of experience in descriptions and explanations.
2. The teacher may fail to ask the question correctly due to conceptual misunderstanding or lack of understanding of scientific reasoning.
3. The teacher may ask wrong questions due to poor language ability on her part.

4. The teacher may ask questions that demand rote memory of textbook knowledge.
5. The teacher can abandon questioning and interaction and go straight into giving notes.
6. The teacher can try to run interaction in a code-switching or code-mixing manner, and dominate discourse (O-saki, 2005: 44 – 45).

In the context of this study, the approaches (especially 1, 4 and 6) seem to be more dominant in explaining how teachers (S2 and Z2) interacted with their learners in the science classroom. In our meetings and workshops I noted that both teachers in the control group had reasonable second language competence in English. They could communicate well in English with their learners but due to the fact that learners remained silent when English was used in lessons, teachers were forced to switch over to isiXhosa. So code-switching for S2 and Z2 was a means of facilitating or mediating learning (Freeman & Freeman, 1994:58). That is, they used code-switching and mixing as valuable resources for the benefit of their learners in understanding science content. Stated differently, code-switching and mixing enables the teachers to convey the meaning of their lessons, while it helps learners to understand the lesson content (Cleghorn, 2005).

For instance, studies by Brock-Utne (2006), Holmarsdottir (2005), Mwinsheikhe (2003) and Vuzo (2005), although conducted in different countries (South Africa and Tanzania) illustrate that teachers made use of code-switching to make their lessons meaningful to the learners. This could mean that teaching and learning is better facilitated by the learner's mother tongue than a second language. In the context of this research, it makes sense to support the idea that in order to facilitate learning, isiXhosa should be accorded official status as a medium of instruction beyond Grade 3.

Code-switching seemed to have instilled a sense of "dependence on translations" where the majority of the learners would not even try to answer English questions but they would wait for the teacher to translate the questions into isiXhosa before they could attempt to give answers. Although translation in the learners' mother tongue was used to facilitate learning, it can also be seen as one of the factors that limited the learners'

exposure to English language input in the classroom. Considering Krashen's Theory of Input Hypothesis (i + 1) dealt with in Chapter 4, the more learners interact with isiXhosa , the better they understand the lessons, but at the same time the more they lose in getting authentic English input. Thus some of them end up with very limited academic proficiency in English.

Concerning language use in the science classroom, presented data shows that (control group) teachers and learners relied on code-switching and mixing, while the experimental group teachers sometimes used loanwords. For instance, the teachers (S1 and Z1) used to borrow English conjunctions (such as "but, because, and others") and used them when they were giving explanations in complex sentences. The teachers also used English terms to praise the learners (e.g. Good, very good) and to confirm if the learners were listening to her talk (ne, okay). In all the observed lessons the learners responded to their teachers as (Yes Miss) as a sign of respect and affirmation.

In this specific study, code switching was used for various purposes: to direct the learners to answer in English (as a management tool). Secondly, code switching was used as a scaffolding tool or a clue which the learners could use as a basis to broaden their understanding of the lesson. Thirdly, it was used not only to encourage the learners, but also to relieve tension which came as a result of learners' silence in the class. In all, code switching was used for classroom management, mediation or scaffolding and encouragement. This implies that code switching is a strategy which the teachers use to facilitate learning when there is a mismatch between the medium of instruction and the learners' home language i.e. when learners cannot cope with the language of instruction. Thus Meerkotter (1998) describes code-switching as a communicative resource to manage interaction in the teaching-learning situation. However, the effectiveness of the strategy becomes limited to the interactional support during lesson presentation in the classroom only because it is not acceptable in the examinations.

Actually, code-switching was seen as a norm in all the subjects and grades of the Intermediate Phase at both schools. In fact, as I usually visit schools for teaching practice

[20]supervision every year, I have noticed that code switching in black schools is used up to Grade 12. For example, listening to a history lesson in isiXhosa at Grade 10 or 11 is very common in almost all the schools I have visited, and it is done by experienced teachers who also claim that students do not understand English. Aderndorff (1996:389) also noted that code-switching occurs in many South African schools and universities and it is a useful communicative resource used to accomplish educational objectives. Code-switching usually occurs in cases where the teacher/lecturer and students are speaking the same language.

7.2.3 Drilling of learners

Data shows that teachers also used drilling as a strategy to emphasize key concepts of their lessons. The lesson extract on page 206, for example, shows that after drilling the learners in the concept of the "round shape/ingqukuva," Z1 asked the learners to give other examples of objects with a similar (round) shape. In this case, the question was relevant, and it was a follow-up to the drill questions above. The learner's response, however, was a bit confusing because the lesson was about (domestic) animals, and the learner was referring to a car (iphela/cockroach)[21]. Actually, the learner was referring to the round shape of the headlights of a car/taxi (iphela).

Regardless of the fact that the learner gave an unexpected or inappropriate answer (a cockroach/small taxi) in this case, the teacher accepted the answer without giving any explanation to the learners of why the answer was acceptable. Considering the linguistic

[20] Teaching Practice is one of the requirements of a one year teaching certificate, the Post Graduate Certificate in Education (PGCE). Students are placed in schools for a term, and some of them are placed at high schools to teach at the Senior and Further Education and Training Phases (FET), i.e. from Grade 7 to 12. As lecturers we go out to support and assess the students in terms of their teaching practice and professional development.

[21] The isiXhosa term "iphela" refers to a cockroach (insect). But in Cape Town's black townships (Nyanga, Gugulethu, Khayelitsha, and others) the term is used to refer to old model cars, such as the Valiant which are used to transport people. These cars are referred to as "amaphela" because of their wide shape. The term is derogatory because it describes the taxis as old fashioned and ugly when compared to the modern combis. Most of the small taxis (amaphela) are not in good condition or road worthy. In the isiXhosa culture, a cockroach is an insect which is associated with dirtiness and greediness. My assumption is that the term originated out of competition with the normal taxis or combis in terms of their ugly state and the fact that they always overload their taxis because they are greedy for money.

background of learners, the term “iphela”, when referring to a car, could be very confusing to a learner who was not raised in Cape Town’s black townships. It has to do with rural and urban isiXhosa varieties. For instance, while rural people are still using horses as means of transport with few taxis on the road, in the urban areas people started the taxi industry long ago in order to transport workers. Thus the old model cars were used as taxis, and people created their own language or register to refer to these cars (amaphela). In relation to variation in the classroom, Gxilishe (1996:7) states that teachers confront language varieties among their pupils in their everyday teaching. To mediate learning, it is necessary that teachers clarify these language varieties in the classroom.

Without commenting on the term (iphela), Z1 continued her explanation with something else that had no connection at all with the previous answer (iphela/taxi). She told the learners about the round shape of hybrid cows. The indication was that the whole cow was round, whereas she was only referring to its eyes. This statement could also be confusing to the learners because the mentioned objects (the taxi and the cow) did not have anything to do with the round shape, except that some of their parts are round. In other words, the teacher could not draw the connection between the objects that were mentioned by the learners such as a cow and a car/taxi, and the concept or round shape she was trying to explain. There was no coherence in her lesson. This could have resulted from her loss of focus in the long explanations she gave in her lesson. The implication is that whilst the teacher was trying to give examples that would explain her lesson well, her examples could not mediate the correct information to the learners.

In the above scenarios, one may argue that despite the fact that teachers and learners were interacting through a language that they all understood, learners were not encouraged to think. At one level learners understood the teachers’ explanations well in their own language. At another level, the teachers only provided information to learners, and there was no opportunity for learners to engage with the lessons in order to construct their own knowledge. So learners’ critical thinking skills were not adequately stimulated. According to Freeman & Freeman (1994) this kind of interaction perceives learners as

"plants" who must wait for the teacher to give them the information they need. Too much teacher talk does not facilitate active learning, instead it may lead to boredom and lack of creativity by the learners. This approach goes counter to the second Learning Area Outcome (LO 2) of the Natural Sciences which encourages knowledge construction by the learners (RNCS, 2002). In knowledge construction learners should be engaged in a variety of learning activities such as observations, investigations, etc.

The use of terms with common sense meaning and words with scientific meaning can lead to misconceptions or learning difficulties (Dennick, 2002; Ogunniyi, 2002; Bell & Freyberg, 1997). Unless such words are identified and corrected, they may not enable learners to construct the intended meanings in the science classroom.

While acknowledging the importance of learners' mother tongue in teaching and learning, it is also imperative that teachers use interactive teaching strategies so that learners' creativity and imagination can be enhanced. Teaching through the learners' mother tongue is most effective if it is accompanied by appropriate teaching strategies and resources. So, it may be misleading to take for granted that teaching and learning will always be effective if it occurs through learners' mother tongue even if the teaching and learning environment is not well planned and organized.

7.3 Learning strategies

In this section the second research question is addressed: What learning strategies do learners use when taught through the medium of English or isiXhosa? In relation to Interactionist Theory discussed in the fourth chapter which draws a connection between language and thought, emerging trends show that learning in one's mother tongue is more advantageous in terms of better conceptualization than learning in a foreign language.

7.3.1 Mother tongue as a learning resource

As mentioned in the previous chapter, all learners (control and experimental) interacted with each other in their mother tongue (isiXhosa). Interacting in their mother tongue was more relaxed than using English because the learners could express their views in a more meaningful way than using English. Furthermore, using isiXhosa was the only way in which they could understand each other and the content of the science lessons. Through group work, the learners could reach a higher level of understanding by assisting each other. That is, they were able to scaffold or support each other using a language they all understood. Peer discussion in the learners' mother tongue helps them to explore ideas and to reveal concealed misconceptions (Rollnick & Rutherford, 1996:102).

Whilst interaction among learners occurred in isiXhosa when working in groups, the key concepts remained in English in the control group. As explained earlier, this practice could be attributed to the fact that learners had to write their examinations in English despite the fact that they were taught mostly in isiXhosa. Also, one could say that the learners were imitating what was modelled to them by their teachers.

Concerning learning strategies, it is clear from the presented data that the control group learners were not spontaneous and active in their interaction with their teachers. They expected the teachers to translate the questions into isiXhosa before they could attempt to answer questions. As a result, their way of learning was passive because they remained silent when their teachers were communicating in English. Similarly, data on written work in the learners' workbooks showed that some of the learners could not express themselves logically and meaningfully in English. The learners' performance in this regard could be explained in terms of their lack of confidence to express themselves in English, hence some of them responded in isiXhosa to English questions.

Although the learners struggled to express themselves in English, they expressed themselves meaningfully in their mother tongue. Answers given in isiXhosa were longer

than the one-word responses that they usually gave in English. The learners' behaviour in this case correlates with Klein's (1986:28) comment that the child's first language competence is a valuable resource which always interacts with other sorts of knowledge he may draw on in his learning.

On the basis of the above analysis, it appears that only a few learners understood science lessons when the interaction occurred in English. But when the interaction occurred through the teacher's and learner's mother tongue (isiXhosa), teacher-learner interaction was better. The teachers' translations into isiXhosa were a means of facilitating learning. The teachers also explained better in their own mother tongue. Therefore, it may be argued that if isiXhosa-speaking learners could be interacting through the medium of English only with their teachers in the classroom, little learning would take place.

7.3.2 Mother tongue and better self esteem

For many learners, learning through the medium of isiXhosa (their mother tongue) appeared to be a factor influencing their self esteem and confidence in a positive way. The experimental group learners showed better confidence than control group learners. They perceived isiXhosa as a language that could contribute to their advancement in various avenues of life, like English.

Learners showed pride in their language as a medium of instruction. They seemed to be aware of the importance of the mother tongue in acquiring a second language. That is, they showed interest in learning English as a second language while retaining their language as a medium of instruction. Such responses revealed their intuitive awareness of additive bilingualism instead of subtractive bilingualism, and the cognitive benefits of the mother tongue.

Learners also showed confidence in terms of competence in English. They claimed that some of them were doing better in English and in other subjects (that were taught through the medium of English) than some of the learners who were taught through the medium

of English. So they perceived isiXhosa as a good foundation for learning English. Some supporting evidence was given by one of the parents who claimed that her daughter was the top learner in Grade 5 for Natural Sciences and Social Sciences in 2004. She made the following comment:

> UX… akanawo umahluko kwaba bafunda edolophini nabaselokishini. Intle i-English yakhe. Uzimisele and u-**sure** ngomsebenzi wakhe. Ubefumene i-**academic awards** kwigreyidi yonke kwi-English, iScience nakwiSocial Science. Loo nto yenza ukuba ndifune afunde ngolwimi lwakhe.
> **X… is not different from those who are schooling in town and in the townships. Her English is good. She is very determined and is sure of her work. She got academic awards in the whole grade in English, Science and Social Sciences. That makes me want her to learn through her own language.**

I confirmed the above information with the Grade 6 English teacher who also informed me that some of the learners in the experimental group were good in English. Actually, she confessed that she was shocked by the learners' competence in English because she did not think that the experimental group learners would do better in English than those who were in the control group. Her claim was based on the fact that the control group learners were more exposed to English than the experimental group learners, forgetting that communication and teaching in the control groups occurred more through the medium of isiXhosa in the form of code-switching and mixing. In fact, the teacher's expectation in this regard reveals her belief that learning through the medium of English improves competence in it.

The Grade 6 learners in the experimental class also showed enthusiasm and eagerness to continue with isiXhosa as a medium of instruction beyond Grade 6. When asked how they felt that they had to switch over to English as a medium of instruction in Grade 7, learners responded that they wanted to go to higher educational levels with isiXhosa as a medium of instruction. They had dreams about advancing in life through their own language (e.g. becoming astronauts, doctors, social workers, singers, etc.). The learners displayed positive self-concepts in terms of competing with other science learners internationally. They did not associate isiXhosa with jobs of low standard; instead they were positive about their lives in the economic world. They also showed pride in

learning through isiXhosa, and they wished for publicity (i.e. to let people know that they were taught in isiXhosa, a language that is sometimes marginalized by other people).

On the basis of learners' positive attitudes towards isiXhosa as a medium of instruction, it is not surprising that they outperformed the control group learners academically (Harlen & Qualter, 2004). According to constructivists, people learn by constructing their knowledge by comparing it with their prior knowledge in order to come to a new understanding. As children start school, they bring with them their home languages which are linguistic resources. So the home language becomes the base on which to extend the classroom knowledge through the teachers' mediation or facilitation (Harlen & Qualter, 2004:97). The logic is that the learner will think in the home language and make better sense of the new concepts in his home language than in a second language. Likewise, the teacher can give better support if he communicates with the learners in a language in which s/he has better proficiency and confidence. So teaching and learning is better facilitated through the teachers' and learners' mother tongue than in a second language.

7.3.3 English and misconceptions

According to the presented data, more misconceptions and memorization were observed with the control group learners who were taught science through the English medium than with those who learnt science through the medium of isiXhosa. As reflected in Chapter 6, for instance, some control group learners could not conceptualize some information relating to plant sex organs, different sources of energy, scientific terms used in lessons, etc. Some of the misconceptions seemed to arise from the knowledge that learners brought to the classroom (e.g. two individuals as male and female, and not having the two sexes in one plant), the abstract nature of science (e.g. invisibility of atoms) and religious beliefs (Jesus as the provider or source of energy).

The learners' misconceptions could be explained in terms of indigenous and scientific world views and also in terms of a mismatch between everyday language usage and

scientific usage (Ogunniyi, 2005; Sutherland & Dennick, 2002; Schollum & Osborne, 1997). Scientific explanations in English (L2) can be influenced by the conventions of the L1 discourse and by the abstract nature of scientific terms (the unobservable items) (Schollum & Osborne, 1997). IsiXhosa-speaking learners, for example, can associate the concept of energy with being physically strong (amandla) only, while in English the same term can refer to various states: action, capacity, intensity, determination, etc. Learners may also find it difficult to accept that something which is not observable can exist (e.g. atoms).

Explained in Piaget's cognitive development process, learners' misconceptions could indicate that learners did not assimilate and accommodate the new concept into their existing knowledge. That is, they could not match the new experience with what they already knew, and therefore, there was no change in their way of thinking. Learning may be difficult if teachers present abstract concepts before the learners have had concrete experiences of the concepts (Freeman & Freeman, 1994). In the case of this study, learners' misconceptions can also be attributed to the transmission mode of lesson presentation by teachers where learners were not engaged or were not given an opportunity to interrogate the learning tasks. So learning through the medium of English did not promote effective learning.

7.4 Learner performance in science

The performance of learners in science is discussed on the basis of data collected from their workbooks (as shown in the previous chapter), and their performance in science tests. It responds to the third research question: How do learners cope in science taught through the medium of English/isiXhosa?

7.4.1 Underdeveloped literacy skills in English

As has been explained in the previous chapter, I checked the language(s) used by the learners in their books as well as their level of understanding of science. The raw data of learners' work reflected in the previous chapter shows that 4 of the Grade 4 control group

learners (N = 9) at Zama Primary School had severe writing difficulties that could be attributed to their lack of competence in English. Where the learners gave answers to explanatory questions, their answers did not make sense at all. These learners could not write one correct word or sentence in English. Their responses made no sense at all. The other common problems which I detected from at schools were grammatical and spelling errors which resulted in meaningless work.

It is logical to think that those learners who had problems in writing would have reading difficulties as well, but this study did not probe further or pursue learners' reading problems. In other words, these learners had underdeveloped literacy skills in English and in their mother tongue which are important not only for understanding and responding to academic texts, but also for developing literacy skills in an additional or second language (English).

The other five Grade 4 control group learners (N = 9) could at least write something in English, but they also had serious grammatical and spelling errors. Their answers were very short, and they could not elaborate or explain certain scientific phenomena. In most cases, questions that required long answers were left unanswered by the learners. This kind of engagement by the learners could indicate that the learners could not do their best in their science work due to their lack of understanding of the language of instruction. Secondly, lack of proficiency in English seemed to block the learners' creativity because I noted that these learners did not have any additional materials and free diagrams in their workbooks like their experimental group counterparts. For example, the following statements which were shown earlier on page 227 do not make sense at all.

<u>Question 1</u>: Briefly describe where you get the energy that you use everyday to come to school, do sport and be able to play

Zama learners

L1: it can not give soil
ond nee phodus o osign
ond ro phoduss soil
ond solussins
L2: lheeli

bood
lleekool
leekiwo

Sizwe learners

L3: Use anezi byon sport play
Amya mapu sopa
Uouka Wrhes onhla Ukmule
Maya have hoves

L4: Tito nezi esinamso
Titeti enzi etomeni
Titeti enzi asiomci
Titeti eoji omelonci

Question 2: Name more ways in which plants can differ from one another and therefore not compete with one another:

L1 (Zama: same learner as above) responded as follows to the above question:

Lokezukiwo
Zulokiwolokiwo
Leekiwolowo
Kiwokiezuliwo cekiwo

Question 3: Mention three ways in which seeds can be distributed. Also mention which is the method that you believe most seeds have been adapted to and why you think so.

A third learner (Sizwe: L3) responded in this way to the above question:

Wheesnees da aneemus
Wheesness da wheend
Wheesnees dawhat
Whend motst owas weatstheliwo

L4: it bespecti animals
it bespecti water
it bespecti by food

Interestingly, I never came across any learners in the experimental group who responded in English, either verbally or in writing. They wrote their answers in isiXhosa except for measurement units (e.g. cm, mm, ml, etc.) which were left in English. Some of the

pictures that were collected by the learners (e.g. from the libraries or magazines) and pasted in their books had English labels, but some of the learners put isiXhosa labels next to the English labels. But all the sketches that were drawn by learners themselves had isiXhosa labels.

Writing scientific measurements in English is understandable because there is no appropriate vocabulary, let alone corresponding abbreviations for the scientific measurements (cm, ml, etc.) in isiXhosa. Also, the content of learners' work was meaningful and coherent with idiomatic expressions to illustrate certain concepts (e.g. *Amanzi nombane yinyoka nesele/Water and electricity are enemies*). Learners could make use of complex sentences although some had minor spelling mistakes and problems relating to word division.

On the other hand, out of the five essays of the control group, only one essay was well written and outstanding. The rest were worse when compared to the experimental group reports. For instance, it took time to get the meaning of Learner 1's report. Apart from grammatical and spelling mistakes, the sentence construction is poor. The first sentence (1) is poorly structured with incorrect use of tense, wrong spelling. All these errors distort the meaning of the sentences completely. Considering the fact that the report was written by one of the best learners in the Grade 6 control class, it makes one think that things must have been worse for the weaker learners.

In view of the above, the (experimental group) learners' performance could be an indication that learners had rich linguistic competence in their mother tongue which the control group learners lacked in English. The experimental group learners could express their thoughts and creativity better in isiXhosa, while there were no signs of understanding and creativity in the work of the control group learners. In other words, learners (experimental) could use isiXhosa for introspective and communicative purposes (Champagne & Kouba, 2000), while control group learners appeared to have difficulties in communicating in English (verbally and in writing).

The learners' initiatives and enthusiasm in putting isiXhosa labels next to English labels could be interpreted in terms of lack of science materials in isiXhosa. They could also indicate learners' interest in science which, in turn can be associated with their good performance in it. In other words, learners showed eagerness to do more work in order to make meaning of the science lessons and to enrich their science knowledge. Such enthusiasm and creativity can also be seen along the lines of knowledge construction by learners. The notion of constructivism sees learners as active participants in the teaching-learning situation. They are constructors of their own knowledge (RNCS, 2002; Leach & Scott, 2000).

In short, learners who were taught science through the medium of isiXhosa seemed to have better confidence, positive attitudes towards their work and better understanding of science work than those who were taught through the medium of English. They could express their views clearly and logically, and their written work made more sense than the work of some of the control group learners. The work of the experimental group learners showed signs of creativity unlike the work of the control group learners. They could use isiXhosa meaningfully in rich and complex sentences while the control group learners struggled to form meaningful sentences in their science work. In the following section I focus on the analysis of learners' performance in science tests that were given to them as part of data collection.

7.4.2 IsiXhosa and better performance in Science

The graphical presentation of data in Chapter 6 shows that the general performance of the experimental group learners in science at both schools was better than the performance of the control group learners for the three years of this study. For example, data reflected in Graph 1 in Chapter 6 show that at Zama Primary School the Grade 4 results (2003) were better in the experimental group (N = 33) than in the control group (N = 41). The pass rate of the experimental group in 2003 was 78,8%. The majority of the learners (10) obtained marks between 50 – 59%, and the lowest marks that were obtained by some learners (about 5 of them) ranged between 20% – 29%. Out of the 33 experimental group

learners 8 of them scored between 60% and 69%, and only 2 of the learners scored above 70%. There were no learners who obtained marks higher than 79%.

On the other hand, the pass rate for the control group (N = 41) at Zama Primary School in 2003 was 48,7%. The majority of the learners (13) scored between 40% - 49%. The 40 – 49% category marked the lowest pass mark and from 50% the performance was at least satisfactory. In the 50% – 59% mark category only 4 of the learners made it, while 3 of them managed to get between 60% and 69%. Only 1 of the learners scored between 70% – 79%, and none of the learners scored higher than 79%. The average mark for the experimental group was 49,6%, while it was 35% for the control group.

The Grade 5 results (Graph 3) show improvement in both groups at Zama Primary School. The pass rate for the experimental group learners increased from 78,8% in 2003 to 86,4% in 2004. Twenty two (22) Grade 5 experimental group learners wrote the test, and nineteen (19) of them passed. Most learners (7) scored between 60% and 69%. Six of the learners obtained between 40% and 49%, four scored between 50 – 59% while two scored over 70%. None of the experimental group learners obtained less than 19%. The three failures' marks ranged between 20% and 39%: one (1) learner obtained over 20%, while two (2) learners scored between 30% and 39%. There was also a slight improvement in average mark which moved from 49,6% in 2003 to 52,7% in 2004.

There was also a slight improvement in the performance of the control group learners in 2004. Although there was a big gap between the pass rates of the experimental and control groups (86,4% for the experimental group, and 52,6% for the control group), at least more than 50% of the control group learners passed the test. That is, out of 38 learners, 20 of them scored between 40% and 69%, while 18 of them failed. Data shows that some of the learners (5) obtained less than 10%, and 4 of them scored between 10% and 19%. The majority of the control group learners (9) scored between 40% and 49% while the majority of the experimental group learners scored between 60% and 69%. Unlike the experimental group learners, none of the control group learners obtained more than 69%. The control group's average mark increased from 35% to 44,5% in 2004.

The Grade 6 results at Zama Primary School (Graph 5) show a decline in pass rate for both groups when compared to Grade 5 results. For the experimental group learners, the pass rate dropped from 86,4% in 2004 to 73% in 2005. Out of the twenty two (22) learners who wrote the test, sixteen (16) of them were successful, while six (6) of them failed. The lowest marks ranged between 20% and 29%, while the highest mark scores were between 70% and 79%. Most of the learners scored between 40% and 59%. The Grade 6 experimental group learners' average mark was 45%.

While more than 50% of the control group learners passed the test in 2004, only 41,9% of them (N = 31) passed in 2005. In other words, the pass rate dropped from 52,6% in 2004 to 41,9% in 2005. The learners' marks ranged between 0 and 69%, and the majority of learners scored between 40% and 49%. None of the learners scored over 69%, and the total average mark of the learners was 36%.

What emerges from the scores of Zama Primary School learners is that there is consistency in terms of the pass rate in the three years of this research. In other words, data shows that the experimental group learners performed better than the control group learners in all the tests which were administered to them from 2003 to 2005. Although the experimental group learners got better scores for the three years, data shows a correlation in terms of fluctuations in pass and failure rates of both groups of learners. For example, Grade 5 results show an improvement in pass rates for both groups, while Grade 6 results show a decline in pass rates in both groups.

Concerning Sizwe Primary School scores, the experimental group learners outperformed the control group learners in 2003 and 2004 (Graphs 4 and 5). Although the grades of the experimental group learners were low when compared to Zama Primary School, the number of passes in the experimental group was higher than in the control group. For instance, in 2003 the pass rate was 50% (N = 24) in the experimental group and 14,3% (N = 21) in the control group. In other words, only 3 learners passed the test in the control group (with 40% - 49%) while 18 of them failed. Many control group learners (9)

obtained scores between 10% - 19%. In the experimental group 12 learners passed with 8 obtaining marks between 40% – 49%. Two (2) of the learners obtained marks in the 50 – 59% category while 2 learners scored in the 60 – 69% category.

In the following year (2004), the experimental group learners (N = 41) also showed better results than the control group learners (N = 37) at Sizwe Primary School (Graph 4). There was a slight increase in pass rate for both the experimental and control groups from 50% to 51,2% and from 14,3% to 17,9% respectively. In both instances the experimental group learners did better than the control group learners. In terms of the quality of marks obtained by learners, the majority of experimental group learners (13) obtained more than 40% which is the lowest pass mark. Three (3) of the learners obtained more than 50%, while 5 of them got more than 60%. The majority of the control group learners (75,7%) failed the test i.e. scored below 40%. Only eight (8) of them scored in the 40% - 49% mark category, one (1) of them got more than 50% and none obtained more than 60%.

Looking at the scores of the two schools, one sees that the experimental group learners obtained better scores than the control group learners. Better performance by experimental group learners can be explained in terms of better understanding when learners are taught in their mother tongue, isiXhosa. Conversely, poor performance could be an indication that learners do not understand well when taught in English. Data shows that the experimental group learners expressed themselves better in isiXhosa, and could explain science concepts better than the control group learners who expressed many misconceptions in science.

Apart from struggling to express themselves and write well in English, the control group learners expressed misconceptions with regard to scientific phenomena. Misconceptions could be an indication that learners did not understand some of the abstract concepts (e.g. atoms) in science as is shown in data presented in the previous chapter. Also, scientific terminology which has different meanings could also be seen as a source of misconception to learners (e.g. the confusion of female plants and female human beings, plants as consumers, energy, etc.). The misconceptions were exacerbated by the fact that

science concepts were never explained in isiXhosa although teaching occurred mostly in isiXhosa through code switching. In code-switching, teachers kept the key science concepts in English as data shows in the previous chapter. Given the fact that learners were struggling with English, it is logical to link learners' misconceptions with learners' lack of understanding in English. Although code switching into isiXhosa facilitated learning, learners had to answer in English in their tests and examinations. So they learnt some of the science concepts in English without understanding. Hence their poor performance in science can be attributed to their rote learning through English.

The poor results by the control group learners seem to correlate with their classroom behaviour which made them to keep silent because of their lack of competence in English. Data showed that experimental group learners showed more interest in learning science through the medium of isiXhosa. They also showed creativity and better confidence than control group learners in their classroom intercations. Obviously, a positive self esteem leads to better performance than negative self esteem. In this case, learners' positive self esteem can be associated with learning through the medium of their mother tongue, isiXhosa, while lack of learners' confidence can be linked to their lack of competence in English.

What is also apparent is that Sizwe Primary School scores are very low when compared to Zama Primary School scores. Although it is not the aim of this research to compare the two schools, it is worth noting that school management seems to have had an effect on learners' performance at Sizwe Primary School. School management at Zama Primary School was stable and better than at Sizwe Primary School. I also noticed good human relations among teachers. Good human relations among employees and good management obviously improve efficiency and effectiveness in any organization. So it is not surprising that academic achievement at Zama Primary School was better than at Sizwe Primary School, despite problems relating to language of instruction in the two schools.

Regular teacher absenteeism (due to various reasons such as sickness) at Sizwe Primary School could also have affected learners' performance. In the absence of their teachers, learners were left with other teachers who had other responsibilities in their own classes. The teachers would just keep an eye on the learners by keeping them inside the classrooms, without teaching them the prescribed work. The 2003 data also show poor school attendance by learners at Sizwe Primary School. In the experimental group, for example, out of 34 learners 24 of them wrote the test, while 21 control group learners wrote the test and 14 of them were absent. Actually, at both schools the number of learners who did not write the tests ranged between 4 and 14 learners at a time in the three years of this study. That is, the lowest number of learners who missed one of the tests was 4, while the highest number was 14 at a given time.

Learner absenteeism can be linked to various socio-economic factors. Such factors could be related to sickness, taking care of siblings or sick parents, insufficient money to take a bus to school, laziness, and many others. Of importance is that absenteeism from school affects learners' academic progress in a negative way.

Overall, the analysis of test scores for the three consecutive years (2003 – 2005) indicates that learners who were taught through the medium of isiXhosa outperformed the learners who were taught through the medium of English at both schools. They scored better grades than the control group learners. The test results seem to relate to consulted literature which points to the fact that learning through one's mother tongue is better than learning through a second language (Bamgbose, 2005; McKay & De Klerk, 1996, Rollnick & Rutherford, 1996; Sentson, 1994). In actual fact, the test results correlate with the analysis of the learners' work which shows that learners expressed themselves better and logically in their mother tongue (verbally and in writing) than learners who were taught through the English medium. Of course, I must acknowledge the influence of other variables on the study such as lack of teaching and learning resources, the teaching styles, level of commitment and motivation of teachers and learners, and others.

In spite of positive attitudes which many control group learners displayed towards English, it can be argued that positive attitudes do not necessarily go hand-in-hand with better academic performance. But they can be associated with the high status of English. In the context of this study, the positive attitudes that the learners displayed towards English had no correlation with their performance in science. That is, their attitudes were positive while test scores reflected negatively on their academic performance.

7.5 Parental support

In this section data analysis is based on responses from teachers, learners and parents collected by means of interviews and informal conversations. The discussion reflects the kind of relationship which exists between parents and teachers, as well as the role played by parents in their children's education.

7.5.1 Inadequate parental support

Although all the parents claimed to be supportive of their children, their responses revealed that the largest number of parents were not directly or actively involved in the work of their children. In their responses some of the parents indicated that they helped the children with homework, but when asked how they helped, they could not elaborate. They would only say: *"Siyabancedisa" (we help them*)", and when asked how and which sections of the learners' work they found interesting, they could not explain. Instead the majority of parents (19 of the 24 parents) at both schools mentioned other people who were helping the children with their work e.g. older siblings, parents' relatives and neighbours.

This kind of cooperation between parents and their neighbours can be understood within the traditional African cultural context which used to be more societal than individualistic. That is, taking care of children, educating and moulding the behaviour of children used to be the role of every adult in the African traditional society. This practice could be interpreted in terms of mediation and scaffolding where adults use their

experience and expertise to educate children. So the kind of cooperation that existed between parents and other groups of people (e.g. neighbours) somehow reflects the spirit of togetherness and shared responsibility which is not as common among black middle-class groups nowadays.

From the presented data, it is apparent that the majority of parents lacked adequate science content knowledge and English to assist their children with their schoolwork. This could be attributed to parents' low educational qualifications. For example, the presented data shows that 91,6% of the parents had gone up to Grade 5 or below in terms of educational standards. So they did not have adequate academic competence to assist their children with Grades 4, 5 and 6 science tasks, especially in English.

The other factor that came out of parents' responses was their lack of confidence in dealing with their children's school work. Parents' lack of confidence was aggravated by their perception that their children's education was better than what they received. This kind of attitude could be associated with democracy and Education for All (EFA) in South Africa which gives all children equal access and rights to education.

Due to the fact that many of the black parents who were interviewed suffered under apartheid education, their way of thinking seemed to show that the new education system under the democratic government is providing better education[22] to their children. Of course, such thoughts are valid and reasonable given the political history of this country, but the main challenge is linguistic inequality which still exists in education under democracy. The challenge ties in with the question that this study seeks to answer i.e. looking at whether teaching and learning can take place effectively if there is a mismatch between the learner's mother tongue and the language of instruction, with special reference to science.

[22] Democracy in South Africa is associated with equality in terms of race, gender, religion and many other aspects of life such as education, health, law, justice, etc. Many people have high expectations in this democratic era, given the fact that there was discrimination in South Africa before the democratic government took over in 1994. So parents associate democracy with better education because they believe that their education during apartheid was inferior to the education of white children.

It was interesting to note that the younger parents with better education (Grades 10 and 11) were those who gave evidence of helping their children. For example, out of the 24 interviewed parents, only two parents (8%) from Zama Primary School (with children in the experimental group) cited evidence that they were indeed helping their children on their own. They quoted some work in the learners' books and how they tried to help the children. The sections they mentioned formed part of the learner activities that were required in the first Module of Grade 5 Science, e.g. seeds, plants, leaves, etc. Parental involvement in this case could be linked to the parents' competence in the language of instruction (isiXhosa). Parents could read and understand their children's workbooks in isiXhosa hence they were able to assist them.

Concerning academic progress of learners in science, hardly any of the parents could comment on the children's strengths and weaknesses in this subject, but they mentioned general problems experienced by their children such as reading. Two of the parents, for example, complained of their children who could not read in their own language (isiXhosa), although they could read in English. Their children were in the control group. Unfortunately, I could not make a follow-up of this claim (in terms of reading) because I was restricted by the research focus and time constraints. However, I noted learners with reading difficulties during my classroom observations, but my assumption regarding the parents' claim above is that parents were trying to justify their choice of English as a medium of instruction which was influenced by the high status of English.

On the whole, very few parents seemed to help learners with their school-work. Due to their lack of academic knowledge and low competence in English, the majority of the parents could not assist their children and had to seek the help of other siblings or neighbours. Parents seemed not to be actively involved in other school activities either, but were mainly concerned about the end results of their children's learning at the end of the year. At this juncture, Schollum's and Osborne's (1997:54) comment about parental support is relevant: "If parents do not show an interest in their children's work in science, the child's view of the subject and its relevance to the world outside the school can only suffer".

7.5.2 Parents' limited knowledge of English

From the teachers' interviews it transpired that none of the parents at any of the schools had ever visited the schools voluntarily except by invitation by the teachers for special events such as parents' meetings, for cases involving their children's misbehaviour or when they had to collect their children's progress reports at the end of the year.

I also had the impression from one of the teachers at Zama Primary School that a few parents with children in the experimental group were assisting their children with schoolwork, while there was no evidence of parental support in the control group. I also learnt that lots of parents would come in large numbers to collect their children's school reports at the end of the year. This practice can be analyzed in terms of education as a process and as a product. That is, parents seemed to attach more importance to the final product of their children's learning than on the process of learning.

In relation to parents' low education profile, parents lacked confidence to assist with schoolwork. Parents could not relate and respond to school events that had to do with teaching and learning because they felt they lacked certain skills. They probably suffered from an inferiority complex. They trusted the teachers (with high qualifications) were doing their best, without themselves being involved. Hence they showed interest in knowing whether their children had passed or failed, despite the fact that they had never checked their progress during the course of the year.

However, I noted that there was some kind of relationship between the school and some parents at Zama Primary School. For instance, during my regular classroom observations at Zama Primary School in 2004 I noticed that two of the parents whom I interviewed used to be approached by the school to replace teachers who were absent from school for various reasons. For instance, I once sat with a parent in the control class at Zama, and her two children were in the same class. She kept the children busy with some work like Mathematics and reading while the teacher was away from school. I was impressed with the kind of relationship between the teachers and parents at this school because it was an

indication that the school tried to draw parents in so that they could play a role in the education of their children.

7.5.3 Accessibility of isiXhosa to parents

From learners' responses, it became evident that the experimental group learners received parental assistance in their work. For instance, one of the teachers confessed that there were signs that parents helped their children with schoolwork. The learners themselves claimed that their mothers helped them in different ways such as asking questions on the work, letting them read and write on their own, explaining difficult concepts to them, etc.

As highlighted in the parents' responses in the previous chapter, the parents could understand what was needed by their children because the learning materials were in isiXhosa. As part of an informal conversation with one of the parents, I was told that the parent used to read her child's science workbooks in her leisure time as if she were reading a magazine. That is, she found the work interesting. She could understand the language (isiXhosa) used in the book, and could make connections with what they used to be taught at school during their time when teaching was in isiXhosa from Grade 1 through Grade 8. In this case, isiXhosa was accessible to the parents, and therefore they could help their children with their schoolwork.

Parental support or lack of it seemed to be influenced by the dearth of materials, especially reading materials in isiXhosa. Hardly any of the learners had any reading books at home. Apart from sharing three reading books (as per my observation in both classes at Zama Primary School) the learners were mainly dependent on the workbooks that were supplied by the LOITASA project for reading. As stated above, for many parents, reading and understanding English were major challenges. The lack of reading materials can have a negative impact on the learners' reading skills, hence some of the learners experienced reading difficulties because they could not practise reading with their parents at home.

On the basis of the above analysis, it appears that the experimental group learners received more support from their parents than the control group learners. This had to do with the accessibility of the language of instruction to parents. Parents are able to assist if the schoolwork is in a language they understand.

7.6 Language-in-Education Policy awareness

In order to understand the use of English and isiXhosa as languages of instruction in this study, data on language policy issues focuses on awareness and implementation of language related activities at schools. My analysis in this section touches on teachers' and parents' awareness and views on language policy issues. It responds to the fifth research question which reads as follows: To what extent are teachers and parents aware of the Language-in-Education Policy that guides teaching and learning?

7.6.1 Teachers' and parents' limited awareness of the Language-in-Education Policy

Regarding the teachers' awareness of the South African Language-in-Education Policy, it seemed that none of the four teachers had an in-depth knowledge of the policy which guides teaching and learning in schools. The teachers' responses revealed that all the teachers had heard about the policy, but had never seen the document nor did they have details and knowledge about how the policy works.

Asking about the availability of the school's language policy (i.e. whether the schools had their own language policies), it was apparent that the two schools (Zama and Sizwe Primary Schools) did not have formal language policies during the time of the interviews in 2004 and 2005. This response was confirmed by Z2's principal in 2005 who confirmed that the school was following the same language policy which was used by the school before 1994 (i.e. before the release of the current Language-in-Education Policy). When asked why the school was using an old policy, he mentioned that they wanted the

children to get exposure to English earlier at Grade 3 level. This response did not only elevate English as a high status language, but it also contradicted my observations in the school as I noted that there was very little English used in the school even in the higher grades (i.e. Grades 6 and 7) and even during English language lessons.

In relation to the fact that the two schools did not have language policies, teachers also lacked awareness and understanding of the current language-in-education policy. Instead of referring to the School's Language Policy, one of the teachers (S2) emphasized code-switching as one of the aims of the language-in-education policy. The impression I got from the teachers at this school (Sizwe Primary School) was that they had absolutely no idea about the aims and content of the present language-in-education policy.

The deduction that can be made from teachers' responses is that the teachers were protecting English as the legitimate language of instruction in schools. There was no recognition of isiXhosa as a medium of instruction. Instead one of the teachers felt strongly that English was the most important language in education. My own analysis of the situation was that the teachers were ignorant about the South African language-in-education policy which aims at developing African languages in schools. The teachers also lacked sound knowledge of the psychological and cognitive benefits of mother tongue education.

Given the fact that the Language-in-Education Policy was finalized and released in 1997, it was surprising that teachers had never seen the document and were not even aware of its content seven years after its release. This implies that the two schools had no guidelines regarding which languages to be used for learning and teaching, and which other languages were to be learnt as additional languages. In this case, it appears that there is limited monitoring of the implementation of education policies at schools by the Department of Education, despite the fact that the national and provincial departments of education have officials who specialize in various fields, including education policy and languages. Obviously, lack of monitoring will impact negatively on transformation and progress in education.

Concerning parents, hardly any of them had any knowledge about the general language policy at either school. Two (2) of the parents (N = 21) who claimed to know about the language policy indicated that they gathered such knowledge from the media, especially the television, but they didn't have a deep understanding of the language-in-education policy which was supposed to guide their children's education. Actually, they had knowledge of the eleven (11) official languages as stated in the RSA Constitution.

The parents, however, showed awareness of linguistic inequality in education which resulted in the disparity between the matric (Grade 12) examination results of former white and black schools. The good results of many white children were associated with the use of their home languages (English and Afrikaans) as media of instruction in their schools, while the poor examination results of many black schools were associated with the use of English instead of the learners' mother tongue as the medium of instruction.

It was also evident that none of the interviewed parents was ever informed about the school's language policy. As the schools operated without language policies, it makes sense that parents would never have been involved in the formulation of schools' language policy. The parents confessed too that they were never involved nor consulted in language-related issues by the schools. Some of the parents mentioned that they were first made aware of their rights to choose a language of instruction for their children by the letter[23] they received from the LOITASA Project.

Concerning language-in-education policy awareness, the presented data reveals that the teachers, parents and their children lacked sufficient knowledge of their rights in education, including language rights. Seemingly, the most important official documents such as the language-in-education policy, the Constitution of the Republic of South Africa, etc. that should inform the people of their rights are not accessible to all the

[23] The letter was written in isiXhosa to parents to ask their permission to involve their children in the study as part of the LOITASA Project as discussed in Chapter 5. It is reflected in Appendix 1.

citizens of the country, especially the masses. These documents are available in all the South African official languages, but people on the ground do not get them or do not feel motivated to read them. The inaccessibility of these documents to the masses can be attributed to illiteracy and the low culture of reading among African people, especially the working class group. The high rates of unemployment which leave people in poverty and the escalating rates of sickness due to the AIDS pandemic put a strain on people's lives. Reading for pleasure instead of hunting for a job or food, and taking care of the sick becomes the last priority among disadvantaged groups. As a result, illiteracy rates remain high despite the fact that the government provides services to reduce it.

It also appears that although the South African National Government or the National Department of Education issues policies that guide teaching and learning, some of the policies are not implemented at schools. For instance, the fact that some schools are operating without language policies defeats the purpose of redressing inequalities of the previous education system. This could be an indication that such schools do not recognize the parents' and learners' language rights in education. The LOITASA letter that asked parents to choose the medium of instruction for their children seemed to be the first of its kind to let the parents exercise their rights in the education of their children in the two schools which participated in this research.

I now look at the choices that parents made with regard to the use of English and isiXhosa as languages of learning and teaching in their children's school. I am aware of the fact that parents' choice of the media of instruction is not addressed in the research questions given in the first chapter of this study, but I believe that in order to understand parental involvement within the context of this study, one has to link it with how parents viewed and understood the issue of languages of instruction in relation to their children's education.

7.7 Parents' choice of medium of instruction in science

In Chapter 5 it was mentioned that parents had to choose on behalf of their children the language they preferred in the teaching of science from Grade 4 to Grade 6. Responding to the question of why they chose English as a medium of instruction in science, many responses suggested that English was the best language for the education of their children.

7.7.1 English and Globalization

Firstly, English was perceived as an international or global language that would enable the children to communicate with other racial groups, locally and internationally. That is, English was regarded as an international language and a means of interaction or communication between different racial and linguistic groups. It was seen as the only language to accommodate non-native speakers of isiXhosa.

Secondly, English was associated with socio-economic mobility in terms of better job opportunities and advancement in life that the majority of the parents could not get in their life time. As the majority of the parents had low levels of education, some were unemployed and they viewed English as the only means through which their children could advance in the global market.

Thirdly, parents felt that their children needed to be exposed to English early at school because they (parents and their children) were not speaking English at home. The implication was that the earlier they got exposure to English, the more proficient they would be in English. In making their choice, parents did not take into consideration nor realized the amount of exposure to English that their children had at school. That is, they were not aware of the fact that teaching in English was only there in name and there was very little English used in the classroom which left their children "semi-lingual" in the two languages (English and isiXhosa).

Some of the parents also didn't see any point in learning through the medium of isiXhosa as they were of the belief that their children were already competent in their home language, and as such there was no need to continue learning through its medium at school. The parents' comments seemed to reveal their misunderstanding or confusion of the concepts of learning a language as a subject and using it as a medium of instruction. According to them, children achieved greater proficiency in a language if that language was used as a medium of instruction. What the parents seemed to miss was whether the children understood the content of what was taught through the medium of English. The parents seemed not to be aware of the realities of the classroom situation and the effects of learning through a language that one does not understand. They seemed to be concerned or obsessed with the high status of English as a language of globalization without considering its effects on their children's academic performance.

The fourth reason for opting for English as a medium of instruction was that parents perceived English as a means of sharpening the learners' intellect or making them more clever. Also, learning through the medium of English was seen as a way of getting better competence or proficiency in English. English was also perceived as having richer, simpler and more polite terminology than isiXhosa. According to the parents' responses some of the isiXhosa terms could sound rude and impolite, so parents associated English with respect and politeness while isiXhosa medium of instruction was labelled as a way of lowering educational standards and a stumbling block in their children's competence in English. The parents' perception in this regard revealed their lack of understanding of how language is acquired, its functional value and the effects of learning through one's mother tongue or through a foreign language. It also showed the denigration of their own language and culture.

From the reasons given by parents above, it can be deduced that parents expressed high expectations of seeing their children moving to other countries, and English was seen as the only language that could be the means of communication outside South Africa. What the parents did not understand was that in many developed countries (e.g. the Netherlands, Norway, France, Germany, and others) that they aspire to visit, people use

their own home languages in education and for intra-communication, and English is learned effectively as a foreign language.

The parents' perceptions could also be due to the fact that they often hear English spoken by educated people who sometimes occupy high positions in society (e.g. teachers, doctors, lawyers, politicians, etc.). The media (e.g. newspapers, television) also strengthen this kind of perception because most of the television programmes and newspapers are in English (and very few in African languages). Given the fact that some of the parents who were interviewed in this study had low levels of education, they seemed to look at themselves as people with low intelligence, and who could not make it in education. Then they perceived those people who succeeded educationally as intelligent people. In other words, they associated English with better intelligence and high socio-economic status.

Another factor for associating English with better intelligence could be linked to the quality of examination results and pass rates of African (black) and white children. The matric (Grade 12) results in the Western Cape always show top students as white students who are speakers of English and Afrikaans. These students learn through their mother tongue, and in the eyes of parents who might not be knowledgeable of the situation in ex-white and black schools, English and Afrikaans learners appear to be more intelligent than African or black students. Hence they associated English proficiency with being more intelligent.

Although the majority of parents showed love and respect for English, some of their responses contradicted their positive attitudes towards English. It appeared that parents were torn between English for its high status and its association with socio-economic benefits on the one hand, and isiXhosa as the home language and a transmitter of cultural values on the other hand. For instance, some of the responses indicated that parents acknowledged the importance of isiXhosa as the mother tongue of the learners that they could identify with, although they regarded English as the best language for their children

in terms of globalization. The responses also revealed the parents' loyalty to their home language as a carrier of their culture and identity.

Despite the fact that parents chose English for socio-economic and cognitive benefits as mentioned above, some of them acknowledged the fact that the children learn better in their mother tongue (isiXhosa). For example, when the parents were asked to say what they thought was happening in their children's classrooms, they responded that children understood better and performed better academically when teaching occurred in their own language. Obviously, such a response promotes isiXhosa as an effective language in teaching and learning.

Finally, it became evident too that some of the parents were not that firm on the issue of English as a medium of instruction. Although earlier on parents showed strong attachment to English, there were indications that they would prefer isiXhosa if the government would make isiXhosa compulsory as a medium of instruction. Seemimgly, the parents' choices were not only influenced by socio-economic factors, but they were influenced by political factors as well.

All the above responses show that the parents' positive attitudes towards English as a language of learning and teaching has something to do with economic advancement, language status (i.e. high status of English), acceptance and accommodation to other racial and language groups. Early exposure to English was also equated with better proficiency in the language and better intelligence.

7.7.2 Pride and loyalty towards isiXhosa

As the parents had to choose between English and isiXhosa as media of instruction, the data presented in Chapter 6 shows that the general perception that all black parents want English as the only medium of instruction for their children is not true. The number of parents who agreed to isiXhosa medium of instruction (40/48 at Zama and 36/41 at

Sizwe)[24] confirms the fact that not all parents had negative attitudes towards the use of African languages as media of instruction. Many parents showed pride and loyalty to isiXhosa as a better language for education and as a transmitter of culture and identity.

Some parents showed an awareness of their language rights and how the previous language policy benefited other racial groups other than blacks (e.g. the speakers of English and Afrikaans). Therefore, their choice of isiXhosa as a medium of instruction could be linked to their awareness of language rights and democracy.

The data also shows that some of the parents with children in the experimental group were young, and had better educational qualifications than the majority of parents who had children in the control group. For instance, one of the teachers[25] at Zama Primary School had a child in the experimental class at Sizwe Primary School. This could imply that the younger and educated parents were aware of the political and linguistic inequalities that had been prevailing in the education system during the apartheid regime as they went through the same system in their schooling days. These parents seemed to be conscious of the need for additive bilingualism/multilingualism instead of subtractive bilingualism.

The same parents also seemed to be aware of the importance of the children's mother tongue in learning a second language. In learning an additional language one can draw on first language skills for second language acquisition. In Chapter 1, Cummins' (1979; 1981) explanation of the importance of BICS in strengthening CALP has been stated. Such an explanation is also relevant in this regard as the parents showed an understanding that children learn better when they have acquired basic language skills in the mother tongue before they learn an additional language.

[24] At Zama Primary School 98 letters were sent out, and 48 parents returned the letters with 40 of them giving permission to have their children taught science through the medium of isiXhosa. There were 101 letters that were sent out to Sizwe Primary School parents, and 41 letters were returned with 36 parents who agreed to isiXhosa medium of instruction in science (Desai, 2004).
[25] The teacher was not involved in the project, but he was one of the parents who agreed to isiXhosa medium of instruction.

All the parents with children in the experimental group also showed awareness of the benefits of mother tongue education in terms of cultural identity, better conceptual development and academic achievement. Their enthusiasm towards the use of isiXhosa beyond Grade 6 could be attributed to the current good results they experienced in their children's work (not only in science), and their wishes for maintaining the same academic standards in the future.

The current moves to the development of African languages, specifically isiXhosa in this case, seemed to be a source of pride and joy for some of the parents. For example, isiXhosa and isiZulu now appear as a language of communication in Autobank Teller Machines (ATMs) in addition to English and Afrikaans that were the only languages used in the ATMs. One of the parents voiced her excitement with the inclusion of isiXhosa in bank transactions. She saw it as development of isiXhosa, and as an effort which could perhaps influence or change other people's attitudes that undermine African languages as having no potential for economic use.

All the interviewed parents associated the use of isiXhosa as a medium of instruction with better academic achievement. So the use of isiXhosa as a medium of instruction, like English and Afrikaans, raised their hopes for better examination results (at Grade 12) among isiXhosa-speaking parents. Parents were aware of the inequality that occurred in the education system as a result of the use of English and Afrikaans as the only two media of instruction, to the disadvantage of African learners.

IsiXhosa was perceived as a great necessity in maintaining cultural identity. Parents wanted their children to be in touch with their cultural roots by learning through the medium of their home language. In other words, they wanted their children to maintain their home languages, even if they had to learn English. IsiXhosa was chosen mainly for cultural maintenance and better education achievement while the status of English as an international language was also acknowledged. Parents were aware of the low status accorded to African languages by speakers of African languages themselves, i.e. African people who undermine isiXhosa. They felt that if the native speakers of isiXhosa hold

negative attitudes towards it, it will take time for this language to be on par with English and Afrikaans.

Judging from the responses given by the parents above, some of the parents were not aware of the language rights of their children in education. In fact, as indicated in 7.6.1 above none of the interviewed parents knew anything about the Language-in-Education Policy, nor were they involved in the formulation of the schools' language policies. But those who associated English with better life opportunities chose English as a medium of instruction in Science. Although the hegemony of English is still apparent, isiXhosa was chosen by other parents as a medium of instruction so that children could learn better and to maintain their children's home language, culture and identity.

In the light of the above analysis, my argument is that if there is a mismatch between the learner's home language and the language of instruction, scientific literacy cannot be attained to its fullest. In other words, if the learners are taught science in a foreign language with lack of resources and parental support, and more use of traditional teaching methods, it may be difficult for them to construct meaningful scientific knowledge. Similarly, if the teachers are not competent in the language of instruction, it may be difficult for them to impart meaningful science information to the learners.

In the context of this study, the use of isiXhosa as a medium of instruction beyond Grade 3 should be seen as a move not only towards its development, but also as an educational right for all learners who are mother tongue speakers of this language. It is also a means of redressing the imbalances that resulted from the previous education system that did not recognize the status of African languages in education. English is still regarded as a language of power because it is used in formal organizations of power such as education and government.

7.8 Summary

With regard to science teaching, the analyzed data shows that the teachers' approaches (control and experimental) were more teacher-centred than learner-centred, with more teacher-talk and less learner-involvement for both groups. The teachers asked short questions in most cases, with less emphasis on critical thinking and activities that encouraged creativity, self-discovery and knowledge construction by learners. Learners were not adequately exposed to scientific investigations (Learning Outcome 1).

All the teachers exercised group work in their science lessons. For the control group, groupwork activities were conducted in isiXhosa, and presented in English. The experimental group learners and teachers communicated in isiXhosa and showed better confidence in expressing their views than the control group learners. They also showed confidence in presenting their work in English. They showed better understanding of scientific concepts than the control group learners.

There was more code-switching and mixing in the control groups, while the experimental groups used mainly isiXhosa to present their lessons. The experimental groups, however, used loan words in instances where such words were not available or inaccessible in isiXhosa. In the control group lessons, all the key concepts were kept in English and the learners were drilled in those words in English.

Although the teaching process occurred mainly in isiXhosa in the experimental group, most of the questions which were asked by the teacher were factual as in the control group. The learners would respond in one-word sentences (in isiXhosa) in such cases, but where the questions needed an elaborated answer, the experimental group learners did better than the control group learners as shown in the data presented in the previous chapter. They could express themselves clearly and confidently, and in most cases they showed good understanding of science concepts. Their written answers also showed better understanding than the control group learners' written responses as indicated in the analysis of workbooks.

Concerning learning strategies, repetition and rote learning seemed to be the most dominant strategies for both groups of learners. Repetition was stimulated by the teacher-centred approaches which were employed by the teachers. However, learning through the mother tongue (isiXhosa) seemed to be of benefit to the experimental group learners in terms of communication and in making sense of the subject matter. On the other hand, English seemed to be a barrier to effective communication in the class as well as to understanding science concepts.

With regard to academic performance, data analysis shows that isiXhosa as a medium of instruction resulted in learners' better academic achievement in science than English. That is, the experimental group learners scored better marks in science tests than the control group learners.

Data analysis revealed that the younger parents with better schooling supported their children in their school work. These parents had children in the experimental group. So, parental support can be associated with parents' education as well as their proficiency in the language used in education. If parents understand the language of instruction, they are more likely to assist their children with school work. But parental support can be very limited in cases where parents have limited or no competence in the language of instruction.

Finally, teachers and parents showed limited awareness and knowledge of the language-in-education policy. The schools also functioned without new language policies. This state of affairs impacts negatively on the implementation of the current language-in-education policy, which in turn affects the schools' choice of language(s) of instruction.

On the basis of the above analysis and discussion, the next chapter summarizes the general findings of the study and gives some recommendations with special reference to the teaching and learning of science in primary schools using English and isiXhosa.

CHAPTER 8

SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

8.1 Introduction

The present study set out to compare the teaching and learning of science in the Intermediate Phase through the medium of English and isiXhosa over a period of three years (2003 – 2005). The study aimed at investigating whether a shift to isiXhosa medium of instruction from Grade 4 would lead to effective teaching and learning of science from Grades 4 –6. It addressed the following research question: What are the effects of English and isiXhosa as languages of instruction on the teaching and learning of science in the Intermediate Phase?

The different research techniques that were employed in this study aimed at addressing the research sub-questions outlined in the first chapter. For example, the research process examined the different teaching approaches that were employed by the teachers in teaching science in the Intermediate Phase through the media of English and isiXhosa. Secondly, the study looked at the learning strategies that were used by learners in science lessons. Thirdly, the learners' academic performance was examined in relation to the two languages that were used as media of instruction (English and isiXhosa). Parental support was also investigated in terms of science teaching through the media of English and isiXhosa. Lastly, the teachers' and parents' awareness of the language-in-education policy was investigated in order to see whether or not there was any relationship between the teachers' classroom practices and parental support on the one hand and the use of the two languages in science teaching and learning on the other hand.

Literature on medium of instruction policies and second language acquisition has been consulted in conjunction with literature on science teaching and learning. From the survey of related literature, it is clear that many African countries are still struggling to implement mother tongue education due to many factors such as economic, social and

political factors (Bamgbose, 2005; Brock-Utne, 2005; Bunyi, 1997; Prah, 2003; Mazrui, 2002; Hameso, 1997; Chumbow, 1990). For example, the low status that is accorded African languages in education and the lack of teaching and learning materials in African languages seems to retard the progress of implementing mother tongue education in African languages.

Related literature on science teaching and learning has informed me that science is an inquiry-based subject, and therefore, the teachers' teaching approaches should facilitate active learning that will enhance the learners to construct or generate their own scientific knowledge. What emerged from the consulted literature and data analysis was that mother tongue education is a key to learners' success especially when it occurs in an environment that fosters active learning with innovative teaching and learning styles.

In order to compare the use of the two media of instruction in science, classroom observations were conducted. The classroom observations were backed up by analyzing the learners' work in science and through tests. For triangulation purposes, interviews with the teachers, parents and learners were also conducted.

This chapter aims at developing a coherent viewpoint on the insights that have been gained from this research. Firstly, it gives an overall summary of the main findings that emanate from the analyzed data. The discussion of findings forms a logical basis for a final conclusion and some recommendations. The following discussion highlights the key findings of my research.

8.2 Summary of findings

In view of the analyzed data pertaining to science teaching and learning through the media of English and isiXhosa in the Intermediate Phase from 2003 – 2005, I would like to present the following brief summary of the study results or findings. As a point of departure I will highlight some findings relating to the actual teaching practices that were employed by the teachers in the science classrooms. This will be followed by a summary

of findings of science teaching and learning from teachers', learners' and parents' points of view. Lastly, I will present findings relating to language-in-education policy issues.

8.2.1 Science teaching

In the light of the analyzed data, what emerged from the teachers' classroom practices were the following: use of traditional teaching methods, limited science content knowledge, frequent code switching and lack of teaching resources. Each of these findings is discussed below.

8.2.1.1 Use of traditional teaching methods

From the analyzed data, it appears that the use of traditional methods was more common among teachers than modern teaching methods that promote learner-centredness. Most of the lessons were characterized by teacher-talk and there were very few cases where the learners were required to observe, predict or analyze any science data. That is, the learners were not encouraged to be creative and to think independently by making use of the science process skills. The questions that the teachers asked were also not challenging and they did not stimulate the learners' critical thinking and creativity. The learners, in most instances were required to retrieve science facts in the form of short answers. Such interaction goes with rote learning instead of active learning. Concerning teacher-centredness, Roden and Ward (2004:14) write thus:

> There is a need to move away from the view that promotes science as a stuffy subject full of facts to be learned ... The challenge for today's primary teacher is to break from the traditional mould and to teach science in a creative way making it more relevant to the future generation of 'could be' scientists.

The traditional or teacher-centred approaches that were employed by the teachers appear to emerge from their lack of reflection on their teaching practices. Pollard (2005:14 - 15) describes reflective teaching in terms of seven key characteristics as follows:

1. Reflective teaching is an active concern with aims and consequences, as well as means and technical efficiency.

2. It is applied in a cyclical process in which teachers monitor, evaluate and revise their own practice continuously.
3. It requires competence in methods of evidence-based classroom enquiry to support the progressive development of higher standards of teaching.
4. It requires attitudes of open-mindedness, responsibility and wholeheartedness.
5. It is based on teacher judgment informed by evidence-based enquiry and insights from other research.
6. Reflective teaching, professional learning and personal fulfillment are enhanced through collaboration and dialogue with colleagues.
7. Reflective teaching enables teachers to creatively mediate externally developed frameworks for teaching and learning.

In relation to reflective teaching, the new outcomes-based (OBE) curriculum envisages a learner who will be confident and independent, literate, numerate, multi-skilled and who will be able to participate in society in critical and meaningful ways (RNCS, 2002:3). This implies that the teachers have to play a number of roles in creating such learners (e.g. as mediators of learning, researchers, leaders, interpreters and designers of learning programmes, pastors, assessors, etc.). Such roles may require the teachers to look critically or reflect on their teaching approaches and the way they interact with their learners. Carrying out some of the roles may also require well-equipped classrooms, libraries and laboratories.

As mentioned above, the science curriculum aims at stimulating the learners' curiosity about the world around them. To construct such an understanding of the world, it is important to develop the learners' creativity to use their knowledge and process skills. Creative learning then requires creative teaching that takes into consideration the learners' ideas and enthusiasm (Harlen & Qualter, 2004:90). In other words, it is unlikely that a teacher who lacks creativity can enable his learners to be creative.

The role of the teacher in the learners' affective development is very important. One of the roles of the teacher is to mediate learning as discussed in Chapter 3. Such a role requires the teacher to first show interest in what the learners are doing and provide a

supportive learning environment with high expectations that reinforce positive attitudes. Teachers' mediation has implications for how the teachers present lesson information. For instance, Harlen and Quarlter (2004:116) claim that scientific attitudes can be reinforced by stimulating the learners' willingness to consider and collect scientific evidence from the environment. In a case where teachers lack motivation themselves, obviously their attitudes cannot have a positive influence on children's learning; instead the teachers' lack of motivation might influence children's learning in a negative way.

In the context of constructivism, in science teaching, learners' curiosity and creativity can be developed by encouraging the learners to construct their own knowledge by interacting with the world and society around them to create new meanings. This is possible if the teacher makes use of different approaches where the learner will play an active role in his learning, e.g. co-operative learning strategies and inquiry-based strategies.

The effectiveness of co-operative and inquiry-based strategies in science teaching and learning cannot be disputed. For well resourced schools, inquiry-based learning can be implemented effectively. But what is worrying is that the majority of poor schools (black schools) have no resources and facilities to carry out the suggested science activities and experiments. For example, in the schools where this research was conducted, none of them had a science laboratory and a library.

The RNCS (2002) requires the teachers to be researchers, designers of materials, mediators of learning, etc. But it is unlikely that such roles can be carried out effectively under poorly resourced and stressful conditions. Also teaching and learning cannot be effective if it occurs under conditions that are surrounded by crime, violence and poverty. Although this study did not focus on socio-economic factors, the impact of these factors on the results of this study cannot be disputed.

8.2.1.2 Lack of in-service training

Data shows that the teachers had never received in-service courses in science, despite the fact that there were many workshops that were conducted by the Department of Education to implement the new curriculum (Curriculum 2005 and RNCS) and programmes on HIV/AIDS. These workshops concentrated on the new curriculum changes, with no emphasis on subject content.

The teachers had never attended any science refresher courses during the three year period of this study, besides the workshops that were organized through the LOITASA Project. So the teachers' lack of innovativeness and creativity can be attributed to the fact that they were not exposed deeply to science content and approaches in science teaching, although they were empowered with strategies to implement OBE in their classrooms. Considering the fact that three of the four teachers who participated in the research study were trained to teach in primary schools in the 1970s, without any courses to refresh their knowledge and practices, it is not surprising that some of them were still using traditional teaching methods in their classes.

8.2.1.3 Teachers' limited knowledge of science content

Knowledge of the subject content is very important in teaching as it does not only determine the quality of knowledge that is imparted to the learners, but also relates to the way the teacher conducts herself in terms of confidence or self esteem and discipline in the classroom. Graaff and Davidoff (1997), for example, claim that good teachers know their subjects and they have confidence that enable them to handle the learners' questions without feeling threatened or defensive. In contrast, a teacher who is not sure of what she is talking about will tend to be hostile and authoritative towards learners. A hostile and threatening environment is not conducive to learning.

Although all four teachers who participated in the study had professional certificates and extensive teaching experiences that ranged from ten to thirty years and above, it appeared that all of them did not have sufficient knowledge of the science content. As a result, all

the teachers displayed lack of confidence in science teaching, especially in the first year of this research, as they claimed that they never specialized in it. Their professional training (i.e. Primary Teachers' Certificate - PTC), that used to follow immediately after Grade 10 in the old apartheid education system, prepared them to teach in primary schools. The curriculum focused more on teaching methodology for the lower grades than on content. By the time the teachers went out to teach in schools, their academic knowledge of content subjects (e.g. History, Geography, Science, etc.) was at a Grade 10 level. Although one may argue that the PTC teachers were trained to teach the lower grades (Sub A – Std 1 or Grades 1 – 3), it may be argued that Grade 10 academic knowledge was a bit limited to face the challenges of the classroom at the intermediate level. Obviously, lack of teachers' confidence may have negative effects on the quality of information that is imparted to the learners and the way in which the teachers interact with the learners in the classroom.

The Primary Teachers' Certificate (PTC) was replaced with a three-year teachers' diploma (Primary Teachers' Diploma - PTD and Senior Teachers' Diploma - STD) in the 1990s. One of the admission requirements for the PTD or STD was a senior certificate (Std 10) which is equivalent to Grade 12 today. The diploma prepared the teachers to teach at higher primary and lower secondary schools. Of the four teachers who participated in the study, only Z2 had this qualification and a university degree. She proved to be innovative and creative over the time of her involvement in the study, although she neither had any confidence in terms of science content knowledge at the start of the project.

In view of the above, the lack of confidence of the teachers can be attributed to their lack of knowledge or expertise in science as a subject. Apart from challenges that came with the new curriculum (OBE), the teachers had to start learning new science concepts and phenomena themselves before they could impart them to the learners. The lack of subject knowledge did not only impact negatively on the teachers' confidence, but also on their attitudes towards the subject. The teachers' attitudes affect their teaching practices and their learners' attitudes as well. "Teachers cannot enthuse and mobilize learners if they

themselves do not have a basic enthusiasm for their subjects" (Graaff & Davidoff, 1997:105). In the case of this study, however, the teachers seemed not to dislike science, but they were not very confident with their extent of knowledge in science, and that became apparent during discussions in the LOITASA workshops.

8.2.1.4 Lack of teaching and learning resources

When one describes the teaching and learning process, the description is incomplete without certain aspects such as assessment and teaching and learning resources. As the focus of this study is on science teaching and learning, the interaction or mediation between teachers and learners has been discussed within the framework of language(s) of instruction, pedagogy or teaching approaches and assessment. The interaction or communication between the teacher and the learner is usually bridged by using teaching resources. Thus I have included teaching and learning resources to substantiate my findings, although they are not reflected in the actual research questions.

Teaching resources, when used appropriately, are of great advantage both to the teacher and the learner. They help the teacher to give more meaning to the lesson content while they also attract the learners' attention and interest in the lesson. In science teaching and learning, the use of teaching resources can help to clarify certain abstract concepts that may be difficult for the learners to conceptualize.

Besides overcrowding, the lack of teaching resources (including buildings) remains one of the biggest problems in many black South African schools. The schools which were involved in the study had a severe lack of teaching resources in general (i.e. in all the subjects). In both schools some of the learners had any textbooks and other learning materials. The schools were mainly dependent on science materials that were supplied to them by the LOITASA Project. Although each of the teachers in one of the schools had a copy of a science textbook (Grade 6), they claimed that they were mainly using the learners' workbooks (LOITASA books) for their teaching as they were detailed in terms of information, and they had interesting and challenging activities for the learners as well.

Due to a lack of scientific apparatus or science laboratories the learners in both groups (English and isiXhosa) could not conduct a good number of experiments. Most of the teaching occurred in a theoretical way, with only two experiments at Zama Primary School and one at Sizwe Primary School being conducted during the period of my classroom observations. The learners at Zama Primary School (both groups) used to make drawings relating to certain science lessons, and these pictures were placed on the walls of the classrooms.

According to the RNCS (2002), teachers are supposed to design their own teaching materials. But considering the education training system (that was also poorly resourced) where many of the black teachers come from, such expertise is lacking in many black teachers. Poverty and crime in the school surroundings (especially in black townships) have an effect too on the level of teachers' commitment. The rate of unemployment is high in South Africa, and some of the black parents are jobless. Therefore, they cannot afford high fees and children's books, hence the children depend mainly on the limited materials they get from schools.

It is an indisputable fact that poverty often leads to crime because people engage in unlawful acts to feed themselves or their families. Robbery and break-ins at schools is very common, especially in township schools. The schools where I did my research have been victims of crime as mentioned in Chapter 5. This creates a tense atmosphere in schools which affects the teaching-learning environment in different ways e.g. schools lose the limited resources they already have and struggle to recover them, both the teachers and learners live in fear of losing their personal belongings and their lives through crime and violence. An environment that is not safe creates a state of anxiety that can have detrimental effects on the teaching-learning process. With respect to poverty and meaningful education in South Africa, Meerkotter (2003:40) writes thus:

> The gap between the reality of what life has to offer for the majority of our citizens and what schools could provide is proving to be unbridgeable. Without referring to examples where students have to learn under trees without the necessary resources to acquire skills to compete with those who come from more privileged backgrounds, I think it is ludicrous to expect of those who come out of shacks without running water, electricity or sanitation, braving cold and wet winters and do not have one decent meal per day to cope with the demands of formal schooling – even if the school building is three storeys high,

> modern and brand new. What meaning could such a building, with teachers – often living under completely different circumstances in comfortable homes – have for the students and their (in many instances) unemployed parents?

The above scenario describes clearly the conditions under which the majority of black people live in Cape Town, including the participants in this resarch. Actually, it highlights poverty as one of the factors that have detrimental effects on teaching and learning.

The National Department of Education (South Africa) seems to be aware of the disparity between township and former model C schools in terms of resources. When the National Minister of Education, Naledi Pandor (2005) was asked in a television interview about how she intends to bridge the gap between the township and ex-model C schools, she responded thus:

> …. We need to look at teacher development, at the resources for learning. I don't know how we expect to improve science performance if there is no laboratory and scientific equipment, or maths when there is no maths teacher.

Kabali-Kagwa (1997:77), however, sees a potential in teachers to explore their own talents regarding the development of teaching and learning materials. Her view is in line with the perception that teachers are mediators of learning, and therefore, should design teaching and learning materials. In other words, her view is a challenge to teachers to carry out their role as designers of learning materials.

8.2.1.5 Lack of parental support

Data analysis shows that parents did not give sufficient support to teachers and learners. With the introduction of isiXhosa as a medium of instruction in science, an improvement was observed in the class where parents started to assist their children with schoolwork since the start of the LOITASA project. The involvement of parents in their children's work was more visible with the children who were taught in isiXhosa than those who were taught in English. This can be linked to the parents' proficiency in the language of instruction that enabled them to help their children with schoolwork. On the other hand,

those parents who lacked competence in English could not assist their children with their schoolwork. Holmarsdottir's (2005) study in Cape Town township schools also revealed that parents' illiteracy in English was one of the factors that prevented parents from giving academic support to their children.

Apparently the younger parents had better levels of education (e.g. Grade 8 – 10) than the older parents, and were able to assist their children with schoolwork. The younger parents also seemed to have a better understanding of the need to learn through isiXhosa in order to develop the status of the language and to improve their children's academic performance.

Lack of parental support in academic matters can also be linked to social class. Some of the children of the educated black parents upper middle class or elites) perform better in English medium schools because the parents can give the necessary support in terms of help with schoolwork and money. But there is a small group of black elites compared to the masses. Linked to high illiteracy rates in South Africa, this implies that a large percentage of children of the poor masses suffer educationally as they do not get adequate support from their parents.

According to Kabali-Kagwa (1997:75), however, there is a large range of human resources within our communities that can be used to support teaching and learning. She mentions parents as valuable human resources with good experience in different areas. Although they may not have formal education, they may possess some skills that the teachers and learners do not have (e.g. proficiency in the mother tongue, social values, etc.) that can be shared with the learners in the classroom. So the schools should also make efforts to involve parents in various ways, especially in language (home language) and cultural issues that do not necessarily have to do with academic or educational knowledge.

8.2.1.6 Code-switching and mixing

Concerning the use of languages in science teaching, the teachers in the English (control) groups made more use of isiXhosa in the form of code-switching and mixing to interact with their learners, while the teachers in the isiXhosa groups interacted with their learners mainly in isiXhosa except for a few words that were borrowed from English (e.g. “imatha” for matter, instead of “inkqunto”). In fact, they borrowed the words from English and coined them into isiXhosa when teaching.

During code-switching, the control group teachers retained the key concepts of the lesson in English, while whole sentences would be expressed in the learners’ mother tongue (isiXhosa). Although the learners were partly taught in isiXhosa, the learners were required to respond and write their examinations in English. This kind of practice did not encourage learners to use English effectively.

In a similar manner, the learners in the English group interacted in isiXhosa in their groups, and they used to answer the teachers’ English questions in isiXhosa, especially when they had to answer in full sentences. The learners answered in English only when they gave “one-word” answers. In a way, the learners were imitating their teachers in terms of responding in isiXhosa to English questions, and giving one-word English answers.

It was apparent that learners remained passive in the English classroom because they could not express themselves in English and therefore could not even ask questions when they did not understand. On the other hand, the learners in the isiXhosa group made use of their mother tongue in their groups and to answer the teachers’ questions, without mixing codes. Their answers were longer and made more sense than those made in English.

As mentioned in the previous sections, code-switching and mixing is advantageous because it facilitates teaching and learning through the language that both teachers and

learners understand. The use of regular code-switching, however, has some disadvantages because it does not encourage the learners to use English appropriately in order to improve their communicative competence. The other disabling exercise of code-switching is that the teachers teach in isiXhosa, and require the learners to write or answer in English. This practice puts the learners in a difficult situation because they must translate what is written in English to isiXhosa to get its meaning first before they can give answers. Sometimes they fail to understand what is required by the question, and that shows in the poor results that some of them get in examinations or tests, (as reflected in Chapter 6). In the following section the findings focus on science learning, and the findings emerge from the interactions between teachers and learners (i.e. from the teaching and learning process).

8.2.2 Science learning

With regard to science learning, what seemed to be emerging was the learners' limited proficiency in English, and various strategies that learners used to cope in science lessons. As mentioned above, the teaching strategies that were used by the teachers were more teacher-centred than learner-centred. In other words, learners were less involved in the lessons. The findings of this study which are discussed below have to do with the effects of the two media of instruction (English and isiXhosa) on children's learning. They include the learners' competence in the medium of instruction, and how the learners tried to make sense of science lessons.

8.2.2.1 High status of English

What emerged from the analyzed data was that English is perceived as a high status language in education. Data analysis shows that some control group learners and their parents regarded English as the only language of socio-economic advancement. That is, they showed more positive attitudes towards English than isiXhosa as a medium of instruction.

Harlen and Qualter (2004:110) refer to attitudes as part of affective development which have an influence on learning. According to them affective development refers to feelings and emotions that are outcomes of learning. For example, positive attitudes can enhance learning as they promote learners' motivation while negative attitudes can hinder learning. Motivation can be intrinsic or extrinsic. Learners who have intrinsic motivation usually become interested in their learning and take more responsibility in the learning process. On the other hand, extrinsically motivated learners learn because there are some incentives. That is they "put effort into learning the things not because they have value for developing understanding, but in order to gain praise, reward or privilege" (Harlen and Qualter (2004:111).

With regard to motivation, some of the control group learners seemed to be aware of the hegemony of English in South Africa, and they seemed to be more interested in English for its socio-economic benefits than for its academic benefits. That is, learners appeared to be more extrinsically motivated than intrinsically motivated to learn through the medium of English. In terms of academic knowledge, many of them seemed not to benefit a lot because they did not show good understanding of science concepts nor good performance in science taught through the medium of English. Literature cited in Chapter 2 shows that the high status of English, especially in many black South African schools is associated with the students' aspirations for socio-economic mobility as the current economic climate seems to reward English speakers over African language speakers. Thus the learners perceived English as a language that enables a person to climb the socio-economic ladder.

Parents also chose English as a medium of instruction because they perceived it as an international language and a means of social and economic advancement. In fact, the parents were torn between isiXhosa as a language to be retained by their children for cultural values, and English as a language of globalization and as a means of getting access to better life opportunities. Both groups confused learning a language with a language of learning, thinking that one learns English best by having it as a language of instruction, which is not true (Bamgbose, 2005; Brock-Utne, 2000).

Apparently, the positive attitudes towards English were perpetuated by historical and political factors such as colonialism and apartheid in South Africa. The legacy of colonialism and apartheid entrenched feelings of inferiority among many African speakers with respect to their own languages. Hence English is treated with prestige and African languages are accorded low status.

8.2.2.2 Positive attitudes towards isiXhosa

The parents and the children of the experimental group showed positive attitudes towards isiXhosa as their home language and as a medium of instruction. They perceived the use of isiXhosa in education as a start towards its development socially and in the economic world. They showed pride and loyalty to their mother tongue not only as a carrier of their culture, but of having potential to develop like English and Afrikaans through its use in education. The parents also seemed to be aware of the academic benefits of learning through one's first language, and how the first language skills facilitate the acquisition of other languages.

According to Harlen and Qualter (2004:116) scientific attitudes include curiosity, perseverance and flexibility. It was interesting to note that some of the experimental group learners perceived the use of their mother tongue in science as a means of climbing the academic ladder and providing them with better life chances (as musicians, social workers, doctors, astronauts[26]). These children had better hopes for the future through the maintenance of their mother tongue while they were learning additional languages.

[26] In an interview which was conducted with learners to produce a DVD on mother tongue education in science as part of the LOITASA Project in 2005, some of the Grade 6 children of the experimental class showed more confidence as they supported the use of isiXhosa in science teaching, and wished that they could learn through it in other subjects up to Grade 12. The song that one of the girls sang (aspiring musician) stresses their willingness to persevere in spite of all the hardships they encounter in learning.

Some of the parents showed enthusiasm towards multilingualism that is advocated by the new Language Policy in South Africa. This implies that the parents were not against the learning or acquisition of English, but they wanted their children to retain their mother tongue while learning other languages. This kind of thinking correlates with additive multilingualism which is at the centre of the current Language-in-Education Policy.

Interestingly, parents and children who chose English as a medium of instruction in science also displayed positive attitudes towards isiXhosa. They chose English for economic advancement while they wanted to retain their mother tongue (isiXhosa) for socio-cultural benefits. Actually they confessed that their children could perform better at school if they were to learn through the medium of isiXhosa. But they seemed to confuse the use of English as a medium of instruction and its teaching and learning as a subject. That is, they felt that their children would only acquire English better when it was used as a medium of instruction. Their understanding of isiXhosa as a medium of instruction was that isiXhosa would block their children's acquisition of English.

8.2.2.3 Learners' limited proficiency in English

The data presented in Chapter 6 reveals that the control group learners were not spontaneous in answering the teachers' questions. The data also show that the learners remained silent when the questions were asked in English. They would start raising their hands after the teacher had translated the question into isiXhosa. In some instances the learners would answer in their mother tongue although the teachers' questions were in English or give one-word answers in English. This situation could be linked to the learners' lack of proficiency in English.

Secondly, data presentation reveals that despite the learners' positive attitudes towards English, many of them lacked competence in it, especially the control group learners. The analyzed data also shows that the learners' lack of competence in English influenced their comprehension and interpretation of scientific concepts. The learners' workbooks, for example, showed that they could not understand instructions in English, and they

could not express themselves well in English. Some of the learners had underdeveloped reading and writing (literacy) skills which also showed up in their oral and written work. Also, some of the control group learners cited certain science misconceptions that could be interpreted in terms of a gap between their previous science knowledge and the new concepts that were introduced to them in the science lessons. These conceptions emerged as a result of learners' lack of understanding of certain concepts in science. Such misconceptions encouraged rote learning. Linked to Piaget's cognitive development theory, the misconceptions occurred as a result of disequilibration or an imbalance in the learning process because the learners could not assimilate and accommodate the new information to fit into their existing scientific knowledge. Thus there was no conceptual change in the learners' minds which involves the replacement of an existing conception by a new conception (Ping-Kee & Gunstone, 1999:861).

8.2.2.4 Limited exposure to English input

The learners' limited proficiency in English appeared to be aggravated by the fact that they had limited exposure to English. Data shows that English was used by teachers to drill the learners in the key concepts of their lessons; otherwise most of the teaching occurrred in isiXhosa. This practice impacted on the kind and quality of (English) language input that the learners received in the science classroom.

As noted in the presented data in Chapter 6, the learners who participated in the study were always speaking isiXhosa at home with parents and siblings, with teachers and friends at school, and the teachers frequently switched to isiXhosa in their teaching. The whole community where the research was conducted was dominated by isiXhosa-speaking people (i.e. businesses, churches, sports organizations, etc.). The language which was always spoken in the children's surroundings and on the play grounds was mainly isiXhosa. Actually, due to the frequency of code-switching and mixing by teachers, isiXhosa became the most dominant language even in the classroom. So the learners got a limited amount of English input in the classroom. Obviously, the limited

English language input would limit the learners' fluency and comprehension in the language.

Nel (2005:151) confirms that many learners in South Africa (especially in rural areas) are hardly exposed to English outside the classroom. Their chances of learning English are more limited than those who have exposure to it (e.g. in the ex-Model C or English medium schools) where communication inside and outside the classroom occurs in English. So it could be argued that if learners are expected to master English at a level where they can show a level of communicative competence in it, they need adequate exposure it (English).

In relation to language input exposure, from the analyzed data it is evident that learners showed more confidence in expressing themselves (verbally and in writing) in isiXhosa than in English. This can be attributed to the fact that they had access or more exposure to isiXhosa at home, at school, on the playgrounds, and in other domains. Also, data evidence shows some of the parents were able to assist their learners with their schoolwork in isiXhosa, (the language they understood well) than when the work was in English. In other words, all the learners have greater exposure to isiXhosa than English, and thus they showed better confidence in expressing themselves in it than in English. English is the language of the classroom only, and learners get very limited (English) input in the classroom.

8.2.2.5 Rote learning

On the basis of data analysis, it appears that the learning strategies that were used by the learners in science lessons were influenced by their teachers' teaching strategies. For instance, the learners made use of repetition to learn science, and in order to cope in the English medium of instruction they waited for mother tongue (isiXhosa) translations. Such behaviour was stimulated by the transmission teaching strategies (telling method or teacher talk) which were used to present science knowledge to learners.

Since learners were not greatly involved in the science lessons, in most cases they remained passive listeners who had to repeat certain concepts or words that were said by their teachers. The repetition did not encourage the learners to construct their own science knowledge; instead learners had to repeat words that confirmed their agreement with the teacher, and not their understanding (e.g. "Yes Miss"). The learners' process skills (e.g. observations, investigations, inferences, etc.) were not sharpened by the teachers in their way of teaching. In other words, learners were not exposed to situations in which they would be able to generate their own knowledge and apply it in different situations in most cases.

There were more learners with reading and writing difficulties in the control (English) class than in the experimental group. The number of such learners was much higher at Sizwe Primary School. Some of the problems seemed to stem from learners' mother tongue interference whereas others revealed the learners' lack of basic writing skills in English because they could not write one single word in English as shown in Chapter 6. In general, the majority of learners could write in isiXhosa, except for a very small number, who actually had spelling errors that were not expected from learners at that particular grade or level.

Data evidence also shows that learners who were learning science through the medium of isiXhosa had better understanding of concepts than those who were taught in English. They could explain scientific phenomena clearly in their home language, and their written statements were more coherent and logical when compared to those of their counterparts who were learning in English.

In relation to the above discussion, Boykin's (2000) Talent Development Model is of relevance. One of the themes of Boykin's (2000:11) Talent Development Model is constructivist and activist learning as opposed to passive, rote learning and drill. Boykin (2000:11) suggests that teaching should focus not only on developing the learners' basic skills, but should also target the development of higher order and critical thinking skills, problem-solving skills, critical analysis and self-reflection. In other words, the learners

should be actively involved in their learning in order to achieve better learning outcomes. This has implications for the teaching strategies, as well as the language used to impart knowledge to learners. The results of this study show that at both schools teachers did not encourage active learning as they made more use of transmission teaching, without challenging learners to think critically.

8.2.2.6 Learners' self esteem

Dednam (2005:130) mentions emotional factors which are language problems or which can affect the learners' communication. Anxiety, insecurity, lack of motivation and passive learning are some of these factors (Dednam, 2005:130). Learners may display some anxiety or insecurity if they are not competent in the language used in the classroom. As a result, they may become shy and avoid participation in the classroom. They can also develop low self-esteem that may lead to depression. Obviously, such behaviour can have a negative impact on the learners' academic achievement in general.

The present study shows that the learners in the experimental group had more confidence than those in the control group. They could express themselves fluently and clearly in their mother tongue, and surprisingly, in English as well. Regarding their future plans, the experimental group learners aspired for better jobs such as being the first black astronauts, medical doctors, social workers, musicians and their rationale for aspiring for such jobs made more sense and showed their open-mindedness and how positive they were about life. On the other hand, the majority of the control group learners were shy and they could not express themselves freely in English, (only a few could do so). They displayed less confidence than the experimental group learners.

8.2.2.7 Academic performance

When children enter the school, the only asset they bring to the classroom is their home language or mother tongue. Language, therefore, becomes the main regulator of thinking and comprehension of what has been taught. If the learner does not understand the

language of instruction, he cannot construct meaning on what is being said or taught (Bell & Freyberg, 1985:33).

Understanding of concepts involves the use of language (e.g. explanations, expressing views, making claims, etc.). The implication is that if the learner is not proficient in the language of instruction, misunderstandings may arise as he cannot explain or express views to make meaning of what has been learnt. Conversely, the more proficient one is in the language of instruction, the higher the level of understanding. This view is in line with Southerland, Smith's & Cummins (2000:72) claim that in conceptual building or formation, learners explain their understandings in their own words and apply that knowledge in selected tasks.

Following Piaget's (1959) theory of cognitive development, conceptualization characterizes the stage of formal operations where learners think formally and abstractly as they interact with the world. According to this theory, learners bring many ideas to the class from various sources such as school, play, media, etc. from which they construct their new knowledge. It becomes easy for the learner to connect new knowledge with prior knowledge which is usually in the learners' mother tongue.

In view of the above statements, the results of the present study show that learners who were taught science in isiXhosa performed better than those who were taught science in English. Data analysis shows that the gap was wide between the experimental and control group classes in the two schools that were involved in the project. Also, it is evident that at one of the schools, there was an improvement in the performance of the control group learners in the second and third years of the study. This can be attributed to the factors that have been mentioned in the previous chapters that are related to the teachers' professional development, enthusiasm, commitment and attitudes towards science teaching.

At Sizwe Primary school which participated for two years in the study, however, no significant improvement in learners' academic performance was noted. Although the experimental group learners performed better than the control group learners, their

average marks were poor when compared with the results of Zama Primary School. Such performance could be linked to the different conditions under which the schools operated (e.g. regular changes in school management, level of co-operation and support**).**

Academic performance in any subject is determined, among other things, by the learners' understanding or comprehension of concepts that form part of teaching and learning in that particular subject. Recent studies that compare the use of the learners' mother tongue and a foreign language (English) as media of instruction for African learners also show that learners perform better in their mother tongue (Brock-Utne & Desai, 2005; Galabawa & Lwaitama, 2005; Langenhoven, 2005; Mwishineke, 2003; Desai, 2003). So the results of the present study can be explained in terms of cognitive and affective development which appears to be positively influenced by the use of the learner's mother tongue in education.

8.3 CONCLUSIONS

In the light of the discussions of the preceding chapters and of the above research findings on the teaching and learning of science through the medium of English and isiXhosa, the following conclusions can be drawn:

Firstly, while parents and learners display positive attitudes towards English as a medium of instruction, they also show pride and loyalty towards isiXhosa as their mother tongue. Some African parents and learners seem to be torn between the status of English as a vehicle for socio-economic advancement on the one hand, and isiXhosa as a carrier of their cultural values on the other hand. The irony is that learners' positive attitudes towards English do not correspond with their performance in science lessons conducted through the medium of English. That is, learners do not comprehend lessons conducted through the medium of English, and this promotes rote learning among learners which in turn is likely to lead to academic failure. So it can be concluded that there appears to be no relationship between the high status of English in education and academic success in it.

Secondly, there appears to be a positive correlation between the use of the learner's mother tongue as a medium of instruction and learners' understanding and academic performance in science. That is, learning through the mother tongue (isiXhosa) seems to enhance better understanding of science concepts than learning through English (second language). So learning through the mother tongue can be associated with better understanding or conceptual development and better academic achievement (especially where there are supporting learning materials) than learning through a second language (English).

Thirdly, the more proficient the teacher and learners are in the language of instruction, the more effective the teaching and learning process will be. In other words, classroom interaction becomes effective, with no communication breakdowns or misunderstandings if both the teacher and the learners are speaking the same language. Teachers seem to mediate learning better in their mother tongue (L1), especially if the learners speak the same language with the teacher. So mediation through the teachers' and learners' L1 determines effectiveness of the teaching-learning process. Conversely, the lower the proficiency of both the teacher and learners in the language of instruction, the more difficulties will be experienced in the teaching and learning process. That is, teaching and learning through a second language is difficult for both the teachers and the learners if they are not proficient in it. Prinsloo (2005:36) mentions stress and uncertainty that usually arise from the mismatch between the language used at home and the language used at schools, which leads to more barriers to learning.

Linked to the above, it appears that the more competent a learner is in the language used in the classroom, the more positive the learner's self-concept will be. Such positive attitudes can also lead to better confidence and better academic performance. Hence the experimental group learners displayed more confidence and better academic achievement in science than the control group learners.

Fourthly, code-switching and mixing are inevitable in situations where the teachers and/or learners have limited proficiency in the language of instruction. In other words, code-switching and mixing are coping strategies that facilitate teaching and learning where there is a mismatch between the learners' mother tongue and the medium of instruction. Although such a strategy aims at facilitating teaching and learning, Holmarsdottir (2005:379) is concerned that teachers do not make effective use of these strategies. As they are not dealt with in pre-service and in-service training in South Africa, their use occurs in a disorganized manner (Holmarsdottir, 2005:379). He main problem is, however, that learners are not allowed to code-switch or use their most familiar language in examinations.

My fifth conclusion is that reflective teaching determines the teachers' growth and improvement in the field. Reflection entails looking at the strengths and weaknesses of one's teaching practices with the aim of improving teaching. It has to do with being innovative and creative in order to mediate or scaffold learning effectively. On the other hand, lack of reflection may lead to impoverished teaching approaches which may affect the teachers' innovativeness. Science teaching, therefore, like any other subject is not likely to improve if teachers do not reflect on their classroom practices. Reflective practices in teaching relate to the seven roles of a teacher (mediators; material designers and interpreters; leaders, administrators and managers; scholars; researchers and life long learners; community members; citizens and pastors, assessors and specialists) (RNCS' 2002) in that the teacher has to play different roles for efficiency and effectiveness in her work.

As a sixth conclusion of this research, parental support is still a problem in African schools, especially with working class parents. The problem, in most cases is perpetuated by the gap between the languages used in schools and the learners' and parents' home languages. Because of the parents' lack of competence in the language(s) used in teaching and learning, many parents are unable to assist their children with schoolwork. Prinsloo (2005: 37) comments thus:

> Children who attend schools where the language of learning and teaching (LoLT) is English and their parents can speak only the vernaculars cause anger, shame and low self-esteem in parents and caregivers. This encourages the non-involvement of parents/caregivers and worsens the fact that they cannot assist their children with schoolwork.

Prinsloo's (2005) comment implies that parents' lack of competence in English goes beyond non-participation in school activities to reduced self esteem. The current society operates within Western cultural values which place more value on competence in English as a language of science and technology. There is often a clash between Western cultural values and African traditional values, and those who do not understand the Western values are labelled as being primitive. So those who cannot speak Western languages such as English usually suffer from an inferiority complex because they are marginalized in the society.

Lemmer, Meier and van Wyk (2006:144) mention different kinds of barriers to effective parental involvement: feelings of intimidation, difficult work schedule, cultural and socio-economic barriers. Related to cultural and socio-economic barriers, schools tend to undermine the expertise and academic wealth of parents, especially those from low socio-economic backgrounds. Although these parents may be willing to support the education of their children, they may be restricted by financial resources, and schools should understand such cases. Also, some parents who cannot speak English are often excluded from participation in school activities because they cannot communicate with the teaching staff.

It should be remembered that even if the parents have low educational levels, they have linguistic wealth (home language) that can be used as a resource in the classroom. Many schools with middle class parents, on the other hand, tend to capitalize on the support and expertise of parents in wealthier areas. As a result, there is more progress and greater parental involvement in such schools and school policies (including schools' language policies) are followed properly.

Concerning the implementation of the Language-in-Education Policy, if schools do not have proper language policies, it is unlikely for teachers to understand the debates and discussions around the use of African languages in education. Regarding the medium of instruction in schools, it appears that many schools do not recognize the linguistic rights of the parents and learners as they are not informed of what their rights are regarding the choice of languages to be used in education. Hence there is very little currently happening at school level in terms of extending the use of African languages as languages of learning and teaching beyond Grade 3. The concerns and efforts with regard to the development of African languages as languages of learning and teaching remain in the hands of researchers and institutions of higher learning which do not have much of an impact on the education system.

In view of the above observation, it may be concluded that the lower the education level of the parents, the more limited their awareness of language policy issues, and the less their involvement in school activities. As a result they are left out of contemporary debates and discussions relating to the use of languages in the education of their children.

Lastly, support in any organizational situation often leads to effectiveness, efficiency, improved productivity and better self-esteem. If the teachers lack support of any kind, obviously their work in terms of decision making and problem solving will be affected in a negative way. Likewise, if the learners do not get the necessary support in their learning, it is likely for them to perform well in their schoolwork. In other words, if teachers and learners are expected to be more committed and effective in their work, they need a supportive working environment.

In short, the research findings show that teachers feel more comfortable in using their mother tongue, isiXhosa as a medium of instruction than English. Also, learners learn science better in isiXhosa than in English. Moreover, learning through the medium of isiXhosa does not instill any feelings of inferiority complex in learners, instead they display more confidence than their counterparts taught through the medium of English. Despite the fact that some parents and learners prefer English as a medium of instruction,

it is apparent that they still hold positive attitudes and loyalty towards isiXhosa as their mother tongue.

8.4 RECOMMENDATIONS

My research has raised a number of issues and questions, and some could not be answered due to the focus of this study. Hence there is a need for further research in the areas of language policy implementation and science teaching and learning. Based on the findings of my research, this section makes recommendations on issues that can form the scope for further research within the context of mother tongue education in African languages.

8.4.1 Teacher Development

One of the findings of this study is the teachers' limited science content knowledge. The findings also show that the teachers still make use of traditional teaching methods which are teacher-centred, and they are not reflective in their teaching practices. It is against this background that I recommend educational programmes that focus on teacher development.

The new outcomes-based curriculum is a challenge to all the teachers as it envisages teachers who are "qualified, competent, dedicated and caring" (RNCS, 2002:3). Pre-service and in-service training, therefore, should aim at empowering the teachers with skills that will enable them to fulfill their roles as mediators of learning in this era. Training should focus on innovative teaching strategies so that teaching and learning can be effective. This may involve the revision of curricula in teacher-training institutions to meet the demands of the present world.

Teaching should be viewed as a reflective process and cycle that needs to be supported with classroom research. Without reflection and innovative teaching practices, teaching

and learning will be ineffective regardless of which language is used as a medium of instruction.

Teacher development can also occur in the form of workshops and seminars where teachers can share experiences about science teaching in the form of reports and papers. Teachers can also be encouraged to write reports and articles on science teaching and learning that can be published in a Teachers' Journal (e.g. the American Journal of Science Teachers) for the benefit of other teachers in the same field or in other fields. Hopefully, the production of a journal can motivate teachers to see their work as an invaluable asset in developing the science curriculum.

As part of teacher development, the government should sponsor primary school teachers to take upgrading courses in science (and mathematics), especially those that do not have Matric (Grade 12) qualifications in science (and mathematics). The current upgrading course, the Advanced Certificate in Education (ACE) in Science and Mathematics Education and in languages which are offered to practising teachers in many South African universities should form the basis for teacher development, and they should be evaluated and revised regularly to suit the needs of our communities.

As the National Department of Education plans to improve the teaching of science and mathematics and to make them compulsory for all learners, in-service training for teachers is necessary. Such training programmes will be of great value in developing local human resources instead of relying on teachers from outside the country to teach science and mathematics. This undertaking will be a life-long investment for South Africa.

Exchange programmes for science teachers can be started locally and internationally. Teachers can visit other developed countries to observe how science is taught, especially where learning occurs through the learners' mother tongue in science (e.g. Holland, France, Norway, etc.). I am aware that such a step has financial implications for a developing country like South Africa, but spending money in developing human capital

for the country is a good undertaking and future investment. Developing our own youth as scientists who will have a tremendous contribution in the economy and development of this country is a good step towards the spirit of "education for all".

Lastly, local cluster programmes can also develop science teachers in the short term. Science teachers can form clusters or associations in which they can share views pertaining to science teaching. Such clusters can be slots for identifying learners' common problems in science and how such problems can be handled, materials development in science, how to cope with the new curriculum changes, and many other issues. But such clusters need teachers' commitment and passion, and they must be supported and monitored by science curriculum experts for their effectiveness.

8.4.2 Innovative teaching methods in isiXhosa

Interactive teaching strategies are more effective than transmission teaching methods that are teacher-centred. In relation to this study, science is an inquiry-based subject, so it requires learners to be actively involved in their learning. In other words, children learn better through active engagement in science activities that encourage them to use their science process skills. With motivation and activities that challenge critical thinking and self-discovery, learners can be able to make sense of what they are learning, (i.e. they can construct their own knowledge). That is, for learners to develop scientific literacy, they need challenging activities that will stimulate them to think in order to construct meaningful knowledge of science. But if the learners are not stimulated to think and to do things on their own, learning will not be effective even if it occurs through the learners' mother tongue.

With the introduction of the new curriculum in South Africa, teachers have been involved in workshops pertaining to the implementation of the new curriculum. For effective implementation of mother tongue education, specifically isiXhosa, further training is necessary as it will be a mistake to assume that all teachers are ready to teach in the learners' home languages (even if they are speakers of those languages). They need to be

trained in new and innovative methods that will provide effective practices on the use of isiXhosa as languages of learning and teaching. Such an undertaking will need to address the following:

1. The teaching of isiXhosa as a subject in primary schools. Is it taught in a way that stimulates the learners' critical thinking skills and conceptual development or is it taught in a structured way where learners have to memorize grammar rules?
2. The integration of other Learning Areas in isiXhosa teaching. If isiXhosa is perceived to be the future medium of instruction in primary schools, the teachers should at least be aware of and familiar with the curriculum content of other Learning Areas (science, mathematics, commerce, etc.) so that they can incorporate some concepts as part of their teaching in isiXhosa. This will be of assistance in clarifying certain abstract concepts that the learners might encounter in subjects such as science and mathematics. This also needs close co-operation between the teachers of the different Learning Areas.
3. Development of terminology that is relevant to the 21st century classroom. The teachers should see to it that the terminology they use in the classroom is not far removed from what the learners are exposed to, without eradicating the original isiXhosa terminology. They should rather use it as a rich source base for building up new terms. There is a general misconception that there is no scientific terminology in isiXhosa, but the materials that were used in the Bantu Education system can be accessed and evaluated in terms of the new curriculum. Mahlalela-Thusi & Heugh (2004:195 -199) in their analysis of texts of primary school textbooks that were used during the Bantu Education system found that the subject matter and terminology that was used in those texts did not differ much from the contemporary primary school textbooks. I am aware that many people may not want anything to do with Bantu Education, but the materials are there already with all the terminology for different subjects which can be evaluated or modified to suit the classrooms of the 21st century.

4. Teachers should be trained in materials development for all the Learning Areas. This implies that isiXhosa teachers should be greatly involved in translation and editing work.
5. The teachers' qualifications in isiXhosa should be considered. It will be misleading to think that any teacher can teach isiXhosa and can teach in isiXhosa only because s/he is the mother tongue speaker of isiXhosa without an appropriate qualification or training in isiXhosa.

Teacher development which should stress learner-centred and innovative teaching strategies can be a means of providing quality education to learners who will learn through the medium of isiXhosa from the Intermediate Phase. By acknowledging the cognitive benefits of the learners' mother tongue in education, while improving the teaching of isiXhosa at schools, the status of isiXhosa in education can be elevated.

8.4.3 Making English accessible to all learners

The promotion of isiXhosa as a medium of instruction is not a means of undermining the importance of knowing English for communication purposes globally. Currently, the problem is that the majority of African people mistakenly think that if isiXhosa is used as a medium of instruction, their children will not learn English. They also think that if their children are taught through the medium of English or are introduced earlier to English, they will gain full competence in English than when they learn it as a subject. This is a big mistake because learning English is influenced by many factors which are mentioned in the previous chapters (e.g. amount of exposure, the quality of English input, learners' motivational level, etc.).

What parents do not consider are the human resources involved in teaching English to their children and how it is taught. Linked to the lack of proficiency of many (African) teachers in English, it is necessary that the Department of Education looks seriously at the teaching of English in schools. With the popularity of English as an international language, it will be worthwhile that each and every learner gets good English, not only

for bilingual purposes but to be able to interact globally. Therefore, there is a need to revisit the way English is taught to African learners which does not help the majority to attain proficiency in it. This has implications for retraining of the current personnel in English or hiring new teachers who are at least proficient in the language to be English specialists.

It is envisaged that if all the learners can acquire reasonable competence in English, the current attitudes towards African languages as media of instruction can improve. Presently, people seek English at the expense of African languages. Hence I suggest that the teaching of English as a subject should be improved so that parents can see that learning through one's mother tongue and learning English as a subject are not in conflict, instead they serve as a good basis for additive bilingualism.

8.4.4 Supply of teaching and learning resources

As argued above, if there are no resources in schools, teaching and learning may not be effective regardless of what language is used as a medium of instruction. The South African National Department of Education should see education as a priority for the development of this country, and provide schools with appropriate resources for teaching and learning to take place.

Debates and discussions around mother tongue teaching in isiXhosa in the Western Cape are currently taking place. This should be a challenge to the Western Cape Department of Education to take an initiative in making preparations for the new undertaking. Provision of teaching and learning resources in township schools should be a priority in order to facilitate mother tongue education. This will have to involve the teachers and other stakeholders who should undergo training for materials development (e.g. translation of existing materials into isiXhosa). The LOITASA Project, for example, has translated Geography and Science workbooks for Grades 4 to 6, and such a practice has worked well. Of course, there is a need for training and editing to make sure that the language and content are not distorted.

Some of the schools, especially ex-white schools have resources in abundance while the poor schools in the townships and in the rural areas have absolutely nothing. The government should play an active role and devise means of sharing the available resources among needy schools. Such work can be channelled through the Provincial Departments of Education who work closely with schools. Priority should be given to poor schools, and the Department of Education should also encourage fund-raising events in schools in order to meet the government halfway. Raised funds can be used to purchase books and other resources.

8.4.5 Parental involvement

Lemmer, et al. (2006:132) define parental involvement as a dynamic process whereby educators and parents work together for the ultimate benefit of the learner. It is a process that involves collaboration in terms of setting common goals, finding solutions, implementing and evaluating the set goals. In other words, it is a partnership that aims at mutual planning and reflecting on school activities for effective teaching and learning to take place. Swart and Phasha (2005:218) relate parental involvement to Epstein's Model for partnership. This model outlines six types or aspects of involvement between the school and the parents, namely, 1) parenting, 2) communicating, 3) volunteering, 4) extending learning at home, 5) decision making and 6) collaborating with the community.

In the light of the above, one must not lose sight of the barriers to effective and successful parental involvement. Some of the barriers centre around the accessibility of the language used in schools to communicate with parents. The language of school has implications not only in terms of communication between the parents and teachers, but also for other aspects such as assisting children with homework, being part of decision-making in schools, volunteering, etc. The results of the present study, for example, have shown parents' limited proficiency in English prevents them from helping their children with schoolwork. So in building up the school-parent partnerships, an effort should be made to eliminate such barriers.

The parents as primary educators of the child should play an active role in schools, and they should be seen as assets as some of them possess rich linguistic (L1) and traditional cultural knowledge that some of the academics may not possess. The parents should feel accepted at schools, and must not see schools as "no go areas". Schools should devise means of encouraging parents to participate in school activities in more active and visible ways. The parents' knowledge and expertise in various areas, not necessarily academic knowledge, should be recognized and acknowledged in order to develop in them a sense of acceptance as valuable human resources in the education of their children. Therefore, schools should strengthen their relations with parents so that the parents can develop a sense of ownership of the schools, and that might also lead to improved safety and security measures, especially in township schools. Parents should also be sensitized about the theories of language learning in terms of language(s) of instruction and the teaching of additional language(s) (Qorro, 2005:118).

8.4.6 Create awareness of Language-in-Education Policy

As a starting point, it is necessary that policies that guide teaching and learning in schools should be made accessible to parents and learners. One would argue that policy documents are available in schools, but the question is whether they are accessible to all the teachers. Do the teachers understand what the documents involve? Are the parents and their children made aware of such policies? Can such documents be made available to teachers, parents and learners in a language they understand well? If all the parties (teachers, parents and learners) are made aware of such documents and the role they have to play in the implementation of such policies, collaboration between the teachers and parents can be strengthened. Such awareness can foster the spirit of ownership at the school by both the teachers and parents; and that can lead to improved parental involvement in black schools. Parents' awareness of the Language-in-Education Policy can also inform them of their language rights and those of their children in education. It is envisaged that such awareness can have an impact on how schools choose the languages of instruction to suit the linguistic needs of the communities they serve.

The politicians have the most access to the masses of people. Their voices are usually heard and taken seriously by the majority of people. Therefore, the politicians need to be involved in language-in-education issues. They should be used as instruments to sell mother tongue education to the government and to the people.

All the schools, with the help of the Department of Education and language experts should be encouraged to formulate language policies that guide teaching and learning. The Department of Education should also monitor the implementation of such policies in schools.

Pre-service training should be seen as a foundation for teacher development. Students in pre-service training should be introduced to the current Language-in-Education debates and discussions and how they impact on teaching and learning. Without brainwashing them, they should be empowered with skills to critique and challenge the current policies and practices that undermine the use of other languages in education, specifically African languages. Also, pre-service teacher training, especially in the Western Cape, should consider building in the development of isiXhosa as a medium of instruction in their curricula. Given the fact that there are debates and discussions that are taking place currently in this province around extending the use isiXhosa as a medium of instruction up to Grade 6, it is proper to prepare pre-service teachers for this challenge.

The development of isiXhosa should be done in collaboration with other learning areas or subjects in order to understand the concepts and terminology used in the other subjects which are currently taught through the medium of English. Without the knowledge or awareness of the Language-in-Education Policy the teachers, parents and learners will not be able to fight for their language rights in education. The current practices that force learners to receive tuition in a language they do not fully understand will remain in force if the teachers, parents and learners are not informed about contemporary issues and debates on Language-in Education Policy.

8.4.7 Collaboration with institutions of higher education

The institutions of higher learning (e.g. technical colleges and universities) have research capacity that could help in investigating issues of concern. It is therefore, wise that the schools form partnerships with these institutions that will aid them with research strategies and resources (physical and human) to investigate problems relating to their teaching and learning. Research can be invaluable to teachers as a means of reflecting on classroom practices and management styles. It can also serve as a means of capacity building or professional development to teachers who are perceived as life long learners and researchers in their own classrooms (RNCS, 2002).

Schools can benefit from the work of college or university students if they can be allowed an opportunity to conduct research in schools. Such opportunities can be of benefit to students too as they can learn to apply theories they have learned in real-life situations (Swart & Phasha, 2005:232). At the end of the research, schools should ensure that the researchers disseminate their research findings widely, so that they can be accessed by all the people. This is only possible when they use the languages of the masses (African languages) and not only the languages of the elite. The research findings can be used to inform the government and other stakeholders about empirical findings that can guide teaching and learning in a developing country like South Africa.

8.5 Concluding remarks

This study has been conducted with the aim of comparing science teaching and learning through the media of English and isiXhosa. Mother tongue education in isiXhosa was extended by three years from Grade 4 until the end of the Intermediate Phase (Grade 6) which is normally the transition phase to English medium of instruction in many African schools. There are some misconceptions, especially by those who do not favour the use of African languages in education that African parents do not support mother tongue education. Of course, data has shown that some parents are still torn between English

and isiXhosa for reasons that are mentioned in the study. The results also show that parents need English for socio-economic reasons, while they also see an academic advantage (cognitive) in learning through the medium of the mother tongue (isiXhosa), hence some of them would like isiXhosa to be used as a medium of instruction up to Grade 12.

In fact, this study shows that not all African people are against the use of isiXhosa as a medium of instruction. It shows that our communities need to be educated about the benefits of mother tongue and additive bilingual education which our language policy promotes. The study lays a good ground for other researchers and the government to go further with research on the use of African languages as languages of learning and teaching in a wider context.

It must be acknowledged that South Africa, through its progressive language policy has made various efforts to bring about linguistic equality in this country. But the implementation and monitoring of the language policy in schools needs immediate attention. For example, the use of African languages in education still remains a controversial and sensitive issue, and that occurs at the expense of African children's future, who suffer (academically, cognitively, emotionally, and otherwise) as a result of being educated in a foreign language (English).

Our children are the future of this country, and we need to invest in them, in the spirit of "Education for all" by providing quality education that is accessible and relevant to them in the languages they understand. Children need to be empowered with scientific knowledge and technological skills in order to participate actively in the advancement of their communities. Regarding language and science teaching, I would like to draw from Ogunniyi's (1986:56) wisdom that a bridge needs to be built between personal, creative language and the abstract language of science. Such a challenge needs teachers' understanding of pedagogical implications of the language of instruction and its role in promoting thinking and learning. On this note I would like to reiterate Nomlomo's (2005:278) concern thus:

If learners are not actively involved in their own learning, it is unlikely that they will develop critical thinking skills that enhance conceptualization even if they learn through their own language. … Unless accompanied by a shift to contemporary teaching and learning approaches, the use of African languages on its own in education will undermine the cognitive benefits associated with mother tongue education. The greatest challenge is to use African languages as media of instruction in order to produce creative and independent critical thinkers who will participate in a meaningful way in the scientifically and technologically advanced world of the 21st century.

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APPENDICES

APPENDIX 1: LETTER TO PARENTS

University of the Western Cape

Private Bag X17 Bellville 7535 South Africa
Tel. 021-9592650/2442
Fax: 021-959 3358
Email: vnomlomo@uwc.ac.za

02 December 2002

Bazali ababekekileyo

Njengoko sisazi ukuba iilwimi zabantu abamnyama bezisoloko zingasetyenziswa njengeelwimi zokufundisa ezikolweni emva kebanga lesithathu (Greyidi 3), oku kubonakala kunegalelo kwindlela abaqhuba ngayo nabaphumelela ngayo abantwana ezikolweni. Uphando olwenziwe ziingcali zemfundo nezeelwimi lubonakalisa ukuba ukufunda ngolwimi lwasemzini ngaphandle kwenkxaso esisiseko solwimi lweenkobe luyabadobelela abafundi ezifundweni zabo. Kaloku bafunda ngeelwimi zasemzini abangaziqondi kakuhle, nezingathethwayo kwamanye amakhaya, ngoko ke bagqwidize ukuvelisa nokucacisa iingcamango zabo ngokuthe gca amathuba amaninzi. Loo nto ke ikhokelela ekubeni bambi bangaqhubi kakuhle kakhulu ezifundweni zabo njengoko bekuya kubanjalo xa bephendula ngolwabo ulwimi.

Ukuhlangabezana nale meko, iqela eliphuma kwisetyana lezemfundo ledyunivesithi yaseNtshona-Koloni, nelikhokelwa nguNjingalwazi Zubeida Desai likwiphulo lokukhulisa ukusetyenziswa kolwimi lweenkobe lomfundi ngokulusebenzisa kwizifundo ezithile esikolweni. Oku kuza kwenziwa ngophando oluya kuthi lwenziwe ngemvume yabazali, iititshala kunye nabafundi besi sikolo. Injongo yolu phando kukubona ukuba iziphumo zabafundi azinakuqaqamba na xa befunda ngolwimi lwabo. Oku ke kuthetha ukuba kukhuliswa ukusetyenziswa kwesiXhosa ekufundiseni isifundo sezendalo (Science) nesifundo sezentlalo (Geography) ukusukela kwibanga lesine, elinguGreyidi 4 njengoko ukutshintshela kulwimi lwesibini ekufundiseni ezinye izifundo luqala kweli banga.

Ngokwezicwangciso, olu phando luza kuthabatha iminyaka emithathu, ukusukela ku-2003 ukuya ku-2005. Loo nto ithetha ukuba abafundi nabo baza kuthabatha inxaxheba ukusukela kwigreyidi esine (Grade 40 bade babe bakwigreyidi yesithandathu (Grade 6). Ekupheleni konyaka ka-2003 le projekthi iza kuvavanywa ukuqonda ukuba iqhuba njani na, ukuze kulungiswe apho kusilela khona. Abo bafundi baza kufunda ezi zifundo zibini (iScience neGeography) ngesiXhosa baza

kufumana iincwadi zezi zifundo zibini ngesiXhosa nangesiNgesi ngaphandle kwentlawulo. Abo bafunda ngesiNgesi baza kufumana ezesiNgesi kuphela ngaphandle kwentlawulo nabo, kwaye la maqela mabini aza kuxhaswa kangangoko ngabaququzeleli bolu phando nezinye iingcaphephe zemfundo kwezi zifundo zibini. Iititshala nazo ziza kufumana inkxaso emsebenzini wazo ukuze zikwazi ukumelana nale meko.

Eli qela licela imvume nenkxaso yabazali, ootitshala kunye nabafundi ukuphumeza iinjongo zalo. Ngoko ke niyacelwa ningabazali bomntwana ukuba nibonakalise isigqibo senu ngokugcwalisa eli phetshana lihamba nale leta, nilithumele esikolweni phambi komhla wethoba kuDisemba.

Sovuyiswa kakhulu yinkxaso yenu.

Abenu abazithobileyo.

Ms Vuyokazi Nomlomo …….

Profesa Z. Desai …….
(umququzeleli)

Profesa Mbulelo Jokweni …….

IPHEPHA ELIZA KUGCWALISWA NGUMZALI

QAPHELA: BEKA OLU PHAWU (X) UKUBONISA ISIGQIBO SAKHO ECALENI KWEBLOKO EBONISA UKUVUMA OKANYE UKUNGAVUMI.

Mna…….

Ndiyavuma
Andivumi

ukuba umntwana wam ongu……afundiswe isifundo iScience neGeograhy ngesiXhosa.

Intsayino-gama:…….

University of the Western Cape

Private Bag X17 Bellville 7535 South Africa
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02 December 2002

Dear Parents

As you know, African Languages have not been used as languages of instruction after Grade 3. This seems to have an impact on children's academic performance and success in schools. Research conducted by educationists and linguists shows that learning through a foreign language, without the fundamental support of the learners' mother tongue, puts learners at a disadvantage in their learning. The reason is that children learn through foreign languages which they do not understand very well, and which are not spoken in their homes, and therefore fail to express their views clearly in most cases. This leads to poor academic performance by these learners compared to those who are allowed to respond in their mother tongues.

To rescue this situation, a group of academics from the Faculty of Education at the University of the Western Cape, led by Professor Zubeida Desai, are trying to promote the use of the learners' mother tongue in certain subjects in some schools. This will be done through research that will be conducted, only if permission is granted by the parents, teachers and learners of this school. The aim of this research is to investigate whether the learners' academic performance can improve when they learn through the medium of their mother tongue. This is therefore an attempt to promote the use of isiXhosa to teach Science and Geography from Grade 4, since Grade 4 marks the start of the use of a second language as a medium of instruction.

According to plans, this research will take three years, from 2003 to 2005. This means that learners will participate in this research from Grade 4 to Grade 6. At the end of 2003 this project will be evaluated so that weaknesses can be improved. Those learners who will be taught Science and Geography through the medium of isiXhosa will receive English and Xhosa learner-support materials free of charge. Those who will be taught through the English medium will receive English materials free of charge as well, and these two groups will be given support as much as possible by the proponents of this research and by other education experts in these two subjects. Teachers will also be supported in their work so that they can cope with this situation.

This group would like to get permission and support from parents, teachers and learners in order to achieve their goals. Therefore, you are kindly requested as parents to show

your decision by completing the form attached to this letter, and sending it to school before 9 December 2002.

We will appreciate your support.

Yours faithfully

Ms Vuyokazi Nomlomo …….

Professor Z. Desai …….
(Co-ordinator)

Professor Mbulelo Jokweni …….

FORM TO BE COMPLETED BY PARENTS

PLEASE NOTE: PUT THIS SIGN (X) TO SHOW YOUR DECISION NEXT TO THE BLOCK THAT INDICATES WHETHER YOU AGREE OR DISAGREE.

I ……

agree	
disagree	

that my child ……be taught Science and Geography through the medium of Xhosa.

Signature:……

APPENDIX 2: INTERVIEW GUIDES

1. Teachers' Interviews: 2004

A. Teachers' personal details

(i) Age (31 – 35; 36 – 40; 41 – 45; 46 – 50; 51 – 55; 56 – 60; 61 and above)
(ii) Gender
(iii) Highest educational qualifications
(iv) Teaching experience
(v) Specialization subjects
(vi) Home language
(vii) Other languages

A. Iinkcukacha zootitshala

(i) Ubudala
(ii) Isini
(iii) Elona nqanaba liphezulu lemfundo
(iv) Amava obutitshala
(v) Ezona zifundo oqeqeshelwe ukuzifundisa
(vi) Ulwimi lwasekhaya
(vii) Ezinye iilwimi ozaziyo

B. Language-in-Education Policy

(i) To what extent are you aware of the South African Language-in-Education Policy?
(ii) Is there a language in your school? If yes, how does it work?
(iii) What role did teachers play in formulating this language policy?
(iv)What role did parents play in formulating this language policy?

B.Umgaqo-siseko olawula iilwimi kwezemfundo

(i) Ingaba unolwazi kangakanani malunga nomgaqo-siseko olawula iilwimi kwimfundo yaseMzantsi Afrika?
(ii) Ukhona umgaqo olawula ukusetyenziswa kweelwimi apha esikolweni? Ukuba ukhona, usebenza njani?
(iii) Yeyiphi indima edlalwe ziititshala ekuqulunqeni lo mgaqo-siseko?
(iv) Yeyiphi indima ethatyathwe ngabazali ekuqulunqeni lo mgaqo-siseko?

C. Teacher Training

(i) What is your highest educational qualification? When did you obtain it?
(ii) Up to which level did you do Science?
(ii) Did you get any special training in science teaching after leaving Teachers' Training College?

C. Uqeqesho lweetitshala

(i) Leliphi ibanga eliphezulu lezemfundo oliphumeleleyo? Nini?

(ii) Usenze wafikelela kweliphi ibanga isifundo seNzululwazi ngezeNdalo?
(iii) Ingaba ukhe wafumana uqeqesho olulodwa ekufundiseni iNzululwazi ngezeNdalo emva kokuba uphumile kwikholeji yoqeqesho-zititshala?

D. Science teaching

(i) Which language do you use in teaching Science? Why?
(ii) Which problems do you encounter in teaching science through the medium of English/Xhosa?
(iii) What do you think are the causes of these problems?
(iv) How do you solve these problems?
(v) Apart from the problems relating to the medium of learning and teaching, which other problems do you experience in Science teaching?
(v) How do you solve these problems?
(vi) How do you assess learners in this subject?

D. Ukufundiswa kweNzululwazi yezeNdalo

(i) Loluphi ulwimi olusebenzisayo ekufundiseni iNzululwazi ngezeNdalo? Ngoba?
(ii) Zeziphi iingxaki ojamelana nazo ngokufundisa ezeNzulwazi ngesiNgesi/ngesiXhosa?
(iii) Ucinga ukuba zibangelwa yintoni ezi ngxaki?
(iv) Uye wenze ntoni ukukhawulelana nezi ngxaki?
(v) Zeziphi ezinye iingxaki enithi nijongane nazo malunga nokufundiswa kwezeNzululwazi ngaphandle kwezo zolwimi lokufunda nokufundisa?
(vi) Nizisombulula njani ezi ngxaki?
(vii) Nibahlola njani abafundi kwesi sifundo?

E. Teaching resources

(i) Is there a science laboratory and a library in this school?
(ii) Do you have enough teaching resources for Science? If not, how do you cope in this situation?

E. Izixhobo zokufundisa

(i) Likhona ithala lezeNzululwazi neleencwadi apha esikolweni?
(ii) Ninazo ngokwaneleyo izixhobo zokufundisa ezeNzululwazi? Ukuba akunjalo, nikhawulelana njani nale meko?

F. Support

(i) What support do you get here at school (from the Principal and other teachers) as members of the LOITASA project?
(ii) Is the support sufficient? If not, what kind of support would you like to have?
(iii) What support do you get from parents?
(iv) How do you support children with learning difficulties?

F. Inkxaso

(i) Yeyiphi inkxaso eniyifumanayo apha esikolweni (kwinqununu nakwezinye iititshala) njengoko nikule Projekthi yeLOITASA?
(ii) Yanele inkxaso leyo? Ukuba akunjalo ninqwenela luphi uhlobo lwenkxaso?
(iii) Yeyiphi inkxaso eniyifumanayo kubazali?
(iv) Nibaxhasa kanjani nina abantwana abaneengxaki ngokwasezifundweni?

G. Suggestions

(i) What do you like most about this project?
(ii) What do you dislike about this project?
(iii) What suggestions do you have about the running and improvement of the LOITASA project?

G. Iingcebiso

(i) Yintoni encomekayo kule projekthi?
(ii) Yintoni eniyigxekayo kule projekthi?
(iii) Zeziphi iingcebiso eninazo malunga nokuqhutywa kwakunye nokuphuculwa kwale projekthi yeLOITASA?

2. Follow-up interviews: 2005

(i) In our last interview you were busy with your school's language policy. How does it work? What role did you play as teachers in its formulation?
(ii) As your learners started participating in the LOITASA project in 2003, have you observed any difference in terms of their conceptual development in Science? If there is any development, how does it manifest itself, and what influences it? If there is none, what could be the reason?
(iii) How do learners taught Science in English/isiXhosa perform? If they are doing well, what influences their performance? If they are not doing well, what could be the reason?
(iv) Do you feel that you have grown as a teacher during your three year participation in this project? Explain.
(v) What challenges have you encountered as a participant in this project which is concerned with Science teaching?
(vi) As the project comes to an end at the end of this year, would you like to participate if it were to continue? Why?

2. Follow-up interviews: 2005

(i) Kudliwano-ndlebe lwethu lokugqibela nanixakeke ngumgaqo-siseko olawula ezeelwimi apha esikolweni senu. Ingaba usebenza njani? Yeyiphi inxaxheba eniyidlalileyo njengeetitshala ekuyilweni kwawo?
(ii) Njengoko abafundi benu beqale ngonyaka wama-2003 ukuthabatha inxaxheba kule projekthi yeLOITASA, ingaba kukho mahluko eniwuphawulileyo malunga nokukhula kwabo ngengqiqo apha kwizifundo zeNzululwazi ngezeNdalo? Ukuba

kukhona ukukhula, kubonakala njani kwaye kuphenjelelwa yintoni? Ukuba akukho kukhula, inokuba kubangelwa yintoni oko?

(iii) Baqhuba njani abafundi abafundiswa iSayensi ngesiNgesi/Xhosa? Ukuba baqhuba kakuhle, yintoni unobangela? Ukuba abaqhubi kakuhle yintoni unobangela?

(iv) Ingaba wena uziva ukhulile njengotitshala kule minyaka mithathu ukule projekthi? Cacisa.

(v) Yeyiphi imiceli-mngeni ohlangene nayo njengomntu othabatha inxaxheba kule projekthi ibandakanya ukufundiswa kweSayensi?

(vi) Njengoko iprojekthi le iphela ekupheleni kwalo nyaka, ubungathanda ukuba yinxalenye yayo kwakhona ukuba ibinokuqhubeleka? Ngoba?

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1. Learners' interviews: 2004

A. Learners' personal details

(i) Gender
(ii) Age
(iii) Home Language
(iv) Language used at home with parents and friends

A. Iinkcukacha zomfundi

(i) Isini
(ii) Ubudala
(iii) Ulwimi lwasekhaya
(iv) Ulwimi olsetyenziswa ekhaya nabazali nezihlobo

B. Learning Science through the medium of English/isiXhosa

(i) As you are taught Science through the medium of English/isiXhosa, what do you like about that?
(ii) What problems do you encounter in learning Science through the medium of English/isiXhosa?
(iii) What support/help do you get in solving those problems in the classroom?
(iv) When do you understand better in Science?
(v) What do you do when you do not understand?

B. Ukufunda ezeNzululwazi ngesiNgesi/ngesiXhosa

(i) Njengoko nifundiswa ezeNzululwazi ngesiNgesi/ngesiXhosa, yintoni eniyithandayo ngaloo nto?

(ii) Zeziphi iingxaki enithi nihlangane nazo apha ekufundeni ezeNzululwazi ngesiNgesi/ngesiXhosa?

(iii) Loluphi uncedo eniluzuzayo ukusombulula ezo ngxaki apha eklasini?

(iv) Kuxa kutheni ukuze uqonde ngcono kwizifundo zeNzululwazi?

(v) Xa ungaqondi kakuhle wenza ntoni?

C. Learners' academic performace in Science

(i) How do you perform in Science taught through the medium of English/isiXhosa? What could be the reason for such performance?
(ii) How do you perform in English? What could be the reason?

C. Indlela abaqhuba ngayo abafundi kwezeNzululwazi

(iii) Uqhuba njani kwezeNzululwazi ozifundiswa ngesiNgesi/ngesiXhosa? Ucinga ukuba yintoni eyenza uqhube ngolu hlobo?
(iv) Uqhuba njani kwezifundo zesiNgesi? Kubangelwa yintoni oko?

D. Gaining knowledge

(i) Apart from the books that were supplied to you by the LOITASA Project, which other Science books do you have?
(ii) Do you ever going to the library? If not, why?
(iii) What do you like/dislike abou these books?

D. Ukuzuza ulwazi

(i) Ngaphandle kwezi ncwadi nazinikwa yiLOITASA, zeziphi ezinye iincwadi zeNzululwazi eninazo?
(ii) Ukhe uye kwithala leencwadi? Ukuba akunjalo, kutheni?
(iii) Zinto zini enizithandayo/eningazithandiyo ngezi ncwadi nizisebenzisayo zeNzululwazi?

E. Parental Support

(i) What assistance do you get from your parents in Science?
(ii) If your parent cannot help you, what do you do?

E. Inkxaso yabazali

(i) Loluphi uncedo olufumana ebazalini bakho apha kwezeNzululwazi?
(ii) Ukuba umzali wakho akakwazi ukukuncedisa, uye wenze ntoni?

F. General Comments

Can you comment on what you wish could be done with regard to the teaching of Science through the medium of English/isiXhosa.

F. Ukuphawula gabalala

(i) Khawuphawule malunga nezinto onqwenela ukuba zenzeke apha ekufundisweni kwezeNzululwazi ngesiNgesi/ngesiXhosa.

2. **Follow-up interviews: 2005**

(i) Do you like to be taught Science through the medium of English/isiXhosa? Support your answer.
(ii) Do you like/dislike Science? Why?
(iii) As you learn through the medium of English/isiXhosa, how competent are you in English? What could be the reason?
(iv) How do you feel now that you are learning Science for the last time in isiXhosa? Why?
(v) What would you like to be when you finish schooling?

2. **Follow-up interviews: 2005**

(i) Ingaba uyakuthanda ukufunda ezeNzululwazi ngesiNgesi/ngesiXhosa? Xhasa impendulo yakho.
(ii) Uyasithanda/akusithandi isifundo sezeNzululwazi? Ngoba?
(iii) Njengoko ufunda ngesiNgesi/ngesiXhosa, ukwazi kangakanani ukuthetha isiNgesi? Yintoni ebangela oko?
(iv) Uziva njani njengokuba ufunda ezeNzululwazi ngesiXhosa okokugqibela kulo nyaka? Kutheni kunjalo?
(v) Unqwenela ukuba yintoni xa sele ugqibile ukufunda?

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3. Parents' interviews: 2004

A. Parents' personal details

(i) Gender
(ii) Age (20 – 25; 26 – 30; 31 – 35; 36 – 40; 41 – 45; 46 – 50; 51 – 55; 56 - 60 and above)
(iii) Highest educational qualification
(iv) Occupation
(v) Place of birth
(vi) Home language
(vii) Language used at home with children

A. Iinkcukacha zabazali

(i) Isini
(ii) Ubudala (20 – 25; 26 – 30; 31 – 35; 36 – 40; 41 – 45; 46 – 50; 51 – 55; 56 -60 nangaphezulu)
(iii) Elona nqanaba liphezulu lemfundo
(iv) Umsebenzi
(v) Indawo yokuzalwa
(vi) Ulwimi lwasekhaya
(vii) Ulwimi olusetyenziswa ekhaya nabantwana

B. Language-in-Education Policy

(i) Do you know about the South African Language-in-Education Policy? If yes, how did you get such knowledge? How important is this language-in-education policy?
(ii) Have you been part of a group that formulates a language policy here at school? If yes, what role did you play?
(iii) When do you normally come to school as parents?
(iv) How did you know about the LOITASA Project?

B.Umgaqo-siseko olawula iilwimi kwezemfundo

(i) Ingaba ninalo ulwazi malunga nomgaqo-siseko olawula ukusetyenziswa kweelwimi kwezemfundo apha eMzantsi Afrika? Ukuba ninolwazi, nilufumene phi olo lwazi? Kwaye nicinga ukuba ubaluleke njani lo mgaqo-siseko weelwimi?
(ii) Nikhe nayinxalenye yegqiza eliqulunqa umgaqo-siseko weelwimi apha esikolweni? Ukuba kunjalo, yeyiphi indima enayidlalayo?
(iii) Niza xa kutheni apha esikolweni njengabazali?
(iv) Nazi njani ngale projekthi yeLOITASA?

C. Language of instruction in Science

(i) Why did you choose English/isixhosa as a medium of instruction for your child?
(ii) As your child learns through the medium of English/isiXhosa, how do you help him/her in Science work?
(iii) As your child is taught through the medium of English/isiXhosa, have you observed any change in her performance in Science?
(iv) What change(s) have you observed in other subjects? What do you think is the cause of such changes?
(v) What are your comments regarding the Science learners' workbooks written in English/isiXhosa?

C. Ulwimi lokufundisa ezeNzululwazi

(i) Kutheni ukhethe ukuba owakho umntwana afundiswe ezeNzululwazi ngesiNgesi/ngesiXhosa?
(ii) Njengoko umntwana wakho efunda ngesiNgesi/ngesiXhosa, umncedisa njani kumsebenzi wezeNzululwazi?
(iii) Njengoko umntwana wakho efunda ngesiNgesi/ngesiXhosa, ingaba ukhona umahluko owuqapheleyo kwindlela aqhuba ngayo ezifundweni zeNzululwazi?
(iv) Mahluko mni owuqaphelyo kwezinye izifundo? Ucinga ukuba wenziwa yintoni?
(v) Ungaphawula uthini ngezi ncwadi zeNzululwazi zabantwana zibhalwe ngesiNgesi/ngesiXhosa?

D. Suggestions

(i) As you know about the LOITASA project, what do you like/dislike about it?
(ii) How can it be improved?

E. Iingcebiso

(i) Njengoko nisazi ngale projekthi yeLOITASA, zeziphi izinto enizithandayo neningazithandiyo kuyo?
(ii) Ingaphuculwa njani?

2. Follow-up interviews: 2005

(i) Why did you choose English/isiXhosa as a medium of instruction in Science for your child?
(ii) As your child has been learning Science through the medium of English/isiXhosa for three years now, what are your positive/negative comments about this?
(iii) How proficient is your child in English? What causes that?
(iv) How do you support him/her in her studies?
(v) How does she perform in other subjects? What causes such performance?
(vi) What do you think happens when the teacher uses English/isiXhosa only in the classroom? Why?
(vii) How do you feel now that your child learns Science through the medium of isiXhosa for the last time this year? Why?
(viii) What role do you play as a parent at school?
(ix) What suggestions can you make with regard to this project which uses isiXhosa and English as media of instruction?

(i) Yintoni eyenze ukuba ukhethe isiNgesi /isiXhosa njengolwimi lokufundisa umntwana wakho ezeNzululwazi?
(ii) Njengoko umntwana wakho efunda ezeNzululwazi ngesiNgesi/ngesiXhosa kule minyaka mithathu, yintoni oyincomayo/ongayincomiyo?
(iii) Usazi kangakanani umntwana wakho isiNgesi? Kubangelwa yintoni oko?
(iv) Uqhuba njani kwezinye izifundo? Ucinga ukuba kwenziwa yintoni oko?
(v) Umxhasa njani kwizifundo zakhe?
(vi) Ucinga ukuba kwenzeka ntoni egumbini lokufundela apho utitshalakazi asebenzisa isiNgesi/isiXhosa kuphela xa efundisa? Ngoba?
(vii) Njengoko umntwana wakho efunda ezeNzululwazi ngesiXhosa okokugqibela kulo nyaka uziva njani? Ngoba?
(viii) Yeyiphi inxaxheba oyidlalayo njengomzali apha esikolweni?
(ix) Zeziphi iingcebiso onokuzinika malunga nale projekthi yokufundisa ezeNzululwazi ngesiNgesi/Xhosa?

APPENDIX 3: TEST SAMPLES