

**THE EFFECT OF ISIZULU/ENGLISH CODE SWITCHING
AS A MEDIUM OF INSTRUCTION ON STUDENTS'
PERFORMANCE IN AND ATTITUDES TOWARDS
BIOLOGY**

BY

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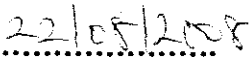
DECLARATION

I hereby declare that **THE EFFECT OF ISIZULU/ENGLISH CODE SWITCHING AS A MEDIUM OF INSTRUCTION ON STUDENTS' PERFORMANCE IN AND ATTITUDES TOWARDS BIOLOGY** is my own original work and has not previously been submitted to any other institution of higher education. I further declare that all sources cited or quoted are indicated and acknowledged by means of a comprehensive list of references.

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SIGNATURE

(CT Olugbara)

.....


DATE

DEDICATION

To my beloved husband

OLUDAYO OLUFOLORUNSO OLUGBARA

who has been my role model for success through hard work.

ACKNOWLEDGMENTS

This journey is never completed alone, and so I wish to acknowledge those who have in various ways helped me get here.

Firstly, I would like to acknowledge my Lord and Saviour Jesus Christ, in wonderful Mercies, through his mighty hand, has made it possible for me to finish this dissertation. Without Your incredible strength and abundant provision, this dissertation would never have been possible. I will forever praise your name.

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THIS IS THE LORD'S DOING; IT IS MARVELOUS IN MY EYES

(Psalm 118:23)

ABSTRACT

This study investigated the effect of IsiZulu/English code switching as a medium of instruction on Grade 10 students' performance and their attitudes towards biology. The increased failure rate of Black South African students in science subjects and the acute shortage of science personnel across many sciences-based professional affiliations were the motivations for the study. Four secondary schools in Esikhawini and KwaDlangezwa Townships in KwaZulu-Natal province of South Africa were randomly selected into experimental (IZECS) and comparison (EL) groups. Both quantitative and qualitative research approaches were used to collect data from these schools, in addition to a biology achievement test, a questionnaire and direct classroom observations. A pre-test and post-test non-equivalent comparison-group experimental design was used to measure the differences in the performance and attitudes of the students, following the IZECS and EL instructional interventions.

The students were taught the human breathing system using IsiZulu/English code switching in the experimental and the English language only in the comparison group as the two independent variables. The dependent variables were the students' performance in biology and their attitudes towards the subject. Two hypotheses were formulated and tested at $\alpha = 0.05$ level of significance. The t-test statistic was used to establish comparisons between the students' performance in biology and their attitudes towards biology between the two groups. The result of the comparisons showed a statistically significant difference between the two groups, in favour of the group that was taught using IsiZulu/English code switching on the

performance in the post test. The attitudes of students in IsiZulu/English code switching group improved more favourably towards biology than those in the English language group following the interventions. The majority of the students that preferred IsiZulu/English code switching to other languages in both groups explained that the method would make biology easier to understand. Consequently, these students recommended that teachers should use IsiZulu/English code switching to teach biology for better understanding. They felt strongly that the adoption of IsiZulu/English code switching, as an instructional approach for teaching biology in Grade 10, would improve the students' performance and their attitudes towards the subject. Overall, the results from this study can be of use to teachers, educational planners and policy makers as they address the complex issue of language choice in South African classrooms.

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LIST OF ABBREVIATIONS

AIDS	Acquired Immune Deficiency Syndrome
BAT	Biology Achievement Test
CODESET	Code Switching for Effective Teaching and Learning
DNA	Deoxyribonucleic acid
EL	English Language
HCI	Human Computer Interaction
HE	Higher Education
HG	Higher Grade
IZECS	IsiZulu/English Code Switching
LANTANG	Language Plan Task Group
ME	Monolingual Education
MST	Mathematics, Science and Technology
PanSALB	Pan South Africa Language Board
SABC	South Africa Broadcasting Corporation
SATBIO	Students Attitudes towards Biology
SBE	Strong Bilingual Education
SESS	Science Education in Secondary Schools
SET	Science, Engineering and Technology
SG	Standard Grade
SPSS	Statistical Package for Social Sciences
TIMMS-R	Third International Mathematics and Science Study Repeat
USA	United States of America
WBE	Weak Bilingual Education
ZPD	Vygotsky Zone of Proximal Development

CHAPTER 1

INTRODUCTION AND BACKGROUND TO THE STUDY

1.0 INTRODUCTION

This study is an investigation of effect of IsiZulu/English code switching as a medium of instruction on students' performance in and attitudes towards biology for Black students in the KwaZulu-Natal province of South Africa. This chapter includes the statement of the problem, the research objectives and questions, the limitation of the study, a brief introduction to the methodology used, and the general overview of the dissertation.

1.1 BACKGROUND TO THE STUDY

The success of any country throughout the world depends quite importantly on the underlying skills the country has in mathematics, science and technology (MST). The fields of Science, Engineering and Technology (SET), are understood to have a direct influence on people's quality of life. It is principally for this reason that SET forms part of South Africa's development priority agenda (Department of National Education, 1995).

With specific reference to science, scientific knowledge and skills are absolutely essential in a developing country like South Africa. Accordingly, one would understand why the government has embarked on a number of measures to motivate students through awards of bursaries, amongst others, to have a positive attitude to science subjects.

Biology is one of the core science subjects in the high school curriculum in South Africa. Each senior Further Education and Training level science student is expected to study biology, chemistry and physics so as to acquire a sound foundation for SET related courses offered at Higher Education (HE) institutions. However, evidence has shown that students are not performing well in biology and other science subjects in South African matriculation examinations.

According to Abdullahi (1980), one of the impediments to effective science teaching and learning is the use of a foreign language as a medium of instruction. Language is an important tool for learning, and learning can be facilitated by having adequate background in the language being used for instruction. For instance, students from non-English language speaking backgrounds struggle with their lessons delivered in the English language as a medium of instruction. They spend all their efforts in learning by rote to get through the examinations and consequently lose out on real learning. This problem manifests itself in science subjects like biology, which is often taught to Black students through the medium of the English language, which is invariably not their mother tongue.

The worst part of the problem is that a student is unable to discuss his/her experiences and learning difficulties with his/her parents at home. Moreover, neither the student nor the parent has adequate linguistic ability in the English language to understand the true scope of the syllabus. The issue is not about students' mental competence, but the linguistic mismatch between the natural language of their thought processes and the imposed language on their lessons. The content of the human brain is obviously the same irrespective of the colour of their skin, but the mastery of the language of instruction can definitely play a significant role in the learning process.

South Africa is a multilingual country with eleven official languages namely: Afrikaans, English, IsiNdebele, Sepedi, Sesotho, SiSwati, Setswana, Xitsonga, Tshivenda, IsiXhosa and IsiZulu, but English remains the most powerful language used as a medium of instruction. Despite the fact that the government of South Africa has adopted a multilingual policy, giving official recognition to all the eleven languages following the demise of apartheid in 1994, much progress has not been made to implement the policy, especially in encouraging communities to use the mother tongue as a medium of instruction. The South Africa 1996 Census revealed that English (9%) and Afrikaans (14%) were widely spoken in all nine provinces, but they were less frequently used as first home languages than the indigenous languages such as IsiXhosa (18%) and IsiZulu (23%) (Kamwangamalu, 2000).

Using a mother tongue as a medium of instruction can definitely bridge the gap between home and school. Parents can assist their children by supplying useful information related to their studies. Historically, Black schools in South Africa were taught in their mother tongues for the first four years of primary education, after which English took over from fifth grade onwards as a medium of instruction. This abrupt switch from the mother tongue to a foreign language, as a medium of teaching, coupled with inadequate linguistic preparation of the pupils in the foreign language prior to its use as the medium of teaching, and the pupils' lack of exposure to the foreign language outside the classroom generally, resulted in high failure and dropout rates (Kamwangamalu, 2000).

There is a good set of records of where a mother tongue language as a medium of instruction has been successful. In Germany, for example, millions of people are using German, which is their mother tongue, for instruction. Within Germany, children from families which speak German have been shown to perform better at

school than those who speak a different dialect (Dekker, 1995:60). Research has also shown that children whose mother tongue is not German stand less chance of success at school, since in their case the principle of education in one's mother tongue cannot be applied (Dekker, 1995:60). In another real-life scenario, Lao and Krashen (1999) point out that primary education in Hong Kong was conducted in the mother tongue (Cantonese). When a great deal of secondary and university education involved a considerable amount of English language, there was a protest from parents, students, teachers and administrators to increase the use of Cantonese in schools. Furthermore, research findings reported by the Hong Kong department of education have shown that students in classes using the English language medium of instruction were more passive while those in classrooms where the Chinese-medium of instruction was used were more active and creative in class discussions. It was further reported that the Hong Kong department of education defended its decision on the use of mother tongue teaching that students in the Chinese-medium classes performed better in both Chinese and English than those in English-medium classes on the Hong Kong Certificate of Examination (Lao & Krashen, 1999).

A similar study conducted by Kocakulah, Ustunluoglu and Kocakulah (2005) in Turkey indicated that students who were taught "energy" in a foreign language had more misconceptions than those taught in the Turkish-medium of instruction. Thus, this led to the contention that mother tongue language for learning seemed to be more effective in comprehension and application of science concepts than a foreign language. Stretching this concept further, Akinwumi and Olarewaju (cited in Makinde & Olabode, 2006) report that instruction in mother tongue facilitates more meaningful learning than instruction received in a foreign language. They conducted a research where they exposed some Junior Secondary School (JSS) students to a

treatment of teaching Integrated Science in Yoruba and English languages. The students in the experimental group (Yoruba language) significantly performed better than those in the control group (English language).

There are several advantages of learning in a mother tongue, but this can as well pose major challenges in some subjects like sciences due to its limited expressive power. For example, Duminy (1980:50) opines that Blacks will continue to suffer as they cannot use their mother tongue in school throughout the period of schooling (especially in science subjects) because mother tongue does not contain and explain the necessary scientific concepts and technical terminologies, which the English language adequately contains and explains. It is principally for this reason, for instance, that IsiZulu may not be regarded as a language suitable for use as a medium of instruction after the first four years of schooling. There is also a perceived financial constraint. Fasold (1984 cited in Kamwangamalu, 2000) points out that due to financial constraints, countries cannot provide each student with education in his or her mother tongue.

Besides the language problem, another factor that has been identified as affecting the performance of students to science subjects is the attitude. According to Osborne, Simon and Collins (2003 in Trumper, 2006), the investigation of students' attitudes towards studying sciences has been a substantive feature of the work of the science education research community for the past 30-40 years. The importance of this type of investigation is stretched because of the persistent decline in high school science enrolments over the last two decades. Attitude could be positive or negative. Trumper (2006) notes that positive attitude to science subject leads to a positive commitment to science that influences life long interest and learning in science, while

negative attitude leads to lack of interest which make students to avoid the subject in senior high school.

1.2 MOTIVATION FOR THE STUDY

The findings on drop-out rates of Black South African high school students in science subjects and the low performance in the matriculation/senior certificate examination in mathematics, science and technology compared to other disciplines have led the researcher to undertake this study (Department of National Education, 1995; Heugh, 2005).

Muwanga-Zake (2001) reports that fewer students are opting for biology, which is an important subject towards understanding environmental and conservation issues, as well as health, especially in this era of the acquired immune deficiency syndrome (AIDS), genetic engineering and environmental degradation. Muwanga-Zake (2001) notes also in his/her survey that there is a decline in the percentage pass rate for physical science and biology at matriculation examinations at both the Standard Grade (SG) and Higher Grade (HG) in the Eastern Cape province of South Africa.

It has been observed that one out of five Black South African students chooses physical science and mathematics in high school (Department of National Education, 1995). Science programmes in universities and colleges have a shortage of high quality Black students. This has led to low numbers of science and mathematics teachers graduating from Faculties of Education compared to the demand in high school. The teacher subject knowledge and professional confidence is generally poor. To mitigate some of these problems, the Ministry of Education has, for instance,

introduced a student recovery programme in science to motivate students (Department of National Education, 1995).

Therefore, there is a need to find out some of the reasons for this problem among Black students and provide useful remedy(ies) that will considerably mitigate the problem in the schools.

1.3 STATEMENT OF THE PROBLEM

The development and improvement of science subjects in schools is a challenge facing most educators and the Ministry of Education in South Africa. This is against the backdrop of a critical shortage of science personnel across many sciences-based professional affiliations. A case in point is the Ministry of Health, which has been forced to recruit Cuban Doctors in order to alleviate the critical shortage in the hospitals. As a result of this, the Mission of the Ministry of Education is to improve and promote a positive attitude towards science subjects in students. The Ministry has introduced a number of programmes in schools such as bursary awards to science students in schools so as to motivate the interest of the students towards studying science subjects.

An important factor for the apparent negative attitudes by students towards science subjects can be attributed to the medium of instruction used in teaching. The choice of a language that is used by any school is of paramount importance and can affect the performance of students. The medium of instruction currently adopted by Black schools in South Africa is presently predominantly the English language. However, Block and Alexander (1991 in Berrington, 2000) report that the poor performance in examinations amongst Black students has been attributed mainly to the medium of instruction.

Howie (2001 cited in Maree, Aldous, Hattingh, Swanepoel, & Van der Linde, 2006) points out that South African students' performance was significantly poorer than the other participating countries in mathematics and science tests carried out in the Third International Mathematics and Science Study Repeat Survey (TIMMS-R), because the students experienced many problems communicating their answers in the language of the test (English). Maphalala (1999) argues that South Africa will always have poor matriculation result unless students are taught in their first languages. For example, the Sunday Times reported that in 1998 the province of KwaZulu-Natal, which has the highest population in South Africa among other provinces, had the lowest pass rate of students in the country due to the problem of the English language.

Moreover, Gabela (1999) believes that mother tongue instruction may not be adequate for academic relevance. He argues that the choice of the medium of instruction does not rest entirely with the community as it is dictated by the perceived requirements of the academic pursuit. If Maphalala's (1999) arguments about first language as a medium of instruction are to be followed, the sociolinguistic position of the province has to be taken into consideration, i.e. in Kwazulu-Natal, 80% of the population is reported to speak IsiZulu natively and about 16% speak English as their first language. This means that less than 5% of the population actually speaks other languages. Additionally, many people have altogether questioned the use of the English language as the medium of instruction in South African schools. Martin (1997:4) has suggested a move towards bilingual education involving the English language and IsiZulu in Kwazulu-Natal. This suggestion is in support of a New Language in Education Policy (1997), which advocates the promotion multilingualism in schools, thereby giving official recognition not only to English and Afrikaans, but

to nine African languages, with an implicit intent of using them as media of instruction. This policy was also supported by Makoni (1999 cited in Ncoko, Osman, & Cockcroft, 2000) about the interconnectedness of languages. He cautions against adopting a monolingual orientation to understanding a multilingual phenomenon in South Africa's multilingual situation where code switching is the norm and pure IsiZulu is rare.

The goal of the present study is to investigate whether the performance of high school students in biology can be significantly improved when IsiZulu/English code switching is used as a medium of instruction. In addition, the study investigates the attitudes of high school students to biology when IsiZulu/English code switching is used as a medium of instruction.

1.4 AIMS AND OBJECTIVES OF THE STUDY

The aim of this research is to investigate whether high school students in rural communities of Kwazulu-Natal, South Africa, will perform better in biology when IsiZulu/English code switching is used as a medium of instruction. Specifically, the objectives to accomplish the aims of this research are to find out whether IsiZulu/English code switching, as a medium of instruction, has any significant effect on:

- (a) Student performance in biology at the further education and training level
- (b) The attitudes of further education and training students towards biology.

1.5 RESEARCH QUESTIONS

This study attempted to answer the following research questions:

- (1) Does IsiZulu/English code switching have any significant effect on the performance of high school students in Grade 10 biology?
- (2) Does IsiZulu/English code switching have any effect on Grade 10 biology students' attitudes towards the subject?

In pursuit of the research problems and to realize the objective of this research, the following hypotheses were tested.

1.6 RESEARCH HYPOTHESES

1.6.1. There is no statistically significant difference in performance of students taught biology using IsiZulu/English code switching versus those taught using only the English language.

1.6.2. There is no statistically significant difference in attitudes towards biology of students taught using IsiZulu/English code switching versus those taught using only the English language.

1.7 SIGNIFICANCE OF THE STUDY

It is envisaged that the outcomes of this study will:

- (1) inform language practice in relation to the medium of instruction appropriate for teaching biology at the high school level; and
- (2) inform both policy and practice as to whether or not the medium of instruction has any relationship with the performance of students in biology, as well as the students' attitude towards the subject.

1.8 LIMITATION OF THE STUDY

The study was limited to four secondary schools in KwaDlangezwa and Esikhawini Townships of Uthungulu district in Kwazulu–Natal province. The main criterion for selecting these schools was because of their accessibility in terms of distance from the University of Zululand where the researcher was based. This limited the extent to which the findings of the study may be generalized to the target population.

1.9 RESEARCH METHODOLOGY

This study combined both quantitative and qualitative research approaches in an attempt to obtain accurate results and adequate information from the respondents. The advantages of both approaches provided a basis for accuracy and completeness of data captured. A pre-test, post-test nonequivalent comparison (control) group quasi-experimental design was used (Imenda & Muyangwa, 2006:42). Intact classes of students were used – giving a research sample size of approximately 400 students. In addition, a random sample of four (4) biology teachers in four co-educational secondary schools in KwaDlangezwa and Esikhawini Townships of Uthungulu District in Kwazulu-Natal province of South Africa were selected to take charge of two Experimental classes (IsiZulu/English Code Switching – IZECS; and two classes of the English Language – EL only, Comparison (Control) group. Two (2) biology teachers who presented their biology lessons in IsiZulu/English Code Switching in each school (i.e. allowing interpretations and discussions in both languages to progress concurrently), and two (2) biology teachers who presented their biology lessons in the English Language only in the other two schools and two hundred and thirty eight (238) students in all the schools, were involved in the study.

A biology achievement test was used for the students in both groups to measure their performance. The test was administered for the two groups in the English language because biology in matriculation examinations is written only in the English language. A student questionnaire based on the students' experiences in the study of biology was administered to the students to measure their attitudes towards biology, before the instruction – and after. The final data collected were analyzed using tables, percentages and the t-test statistic to measure the differences in the performance and attitudes of the two groups, and appropriate results were reported.

1.10 DEFINITION OF TERMS

In preparing the reader to understand the aims of this study and the problem, it is necessary to identify and clarify the meaning of key concepts used in this study.

1.10.1 Education

A systematic instruction, schooling or training given to the young in preparation for work of life by extension of similar instruction or training obtained in adult age (Simpton & Weiner, 1989).

1.10.2 Teaching

This is the process of instruction or knowledge from a teacher to students in a school situation for effective learning (Simpton & Weiner, 1989).

1.10.3 Learning

This is the process of acquiring knowledge or skills through study, experience or teaching. It is a process that depends on experience and leads to long-term changes in behaviour potential. Behaviour potential describes the possible behaviour of an

individual (not actual behaviour) in a given situation in order to achieve a goal (ExSEL, 2006).

1.10.4 Language

A language is considered to be a system of communicating with other people using sounds, symbols or words in expressing a meaning, idea or thought. It can be used in many forms, primarily through oral and written communication as well as using expression through body language (UniXL, 2007).

1.10.5 Mother Tongue

This is the language one has learned first (provided it is a language one can express oneself fully in) and or (voluntarily) identifies with. (Terralingual Definition, 2007).

1.10.6 Medium of Instruction

This is the language that is used in teaching/learning. It may or may not be the official language of the territory. For instance in South Africa, English and Afrikaans are used as the media of instruction in many schools, although they are minority languages in terms of their mother tongue status (Wikipedia, 2007).

1.10.7 Attitude

This is a set of beliefs that students possess about language learning, the target culture, their culture, the teacher and the learning tasks e.t.c. These beliefs influence learning in a number of ways (TEFL glossary, 2007).

1.10.8 Bilingualism

Williams and Snipper (1990:33) define bilingualism as a person's ability to process two languages in each of the same four skills of language (i.e. listening, speaking, reading and writing).

1.10.9 Code Switching

This is a system whereby teachers alternate between two languages in a bilingual classroom setting, by starting the lesson in the first language and then moving into the second and back, especially during important concepts (Cook, 1991, in Skiba, 1997).

1.11 OVERVIEW OF THE STUDY

Chapter 1 provides the background to the study and described the nature of the problem; motivation of the study; statement of the problem; aims and objectives of the study; significance of the study; limitations of the study; methodology and finally definition of terms.

Chapter 2 begins with an introduction to the literature review and discusses the South African language policy, concepts of bilingualism and multilingualism, fundamental theories of second language acquisition. The chapter also discusses views on code switching, effect of code switching on students' performance in science subjects, and functions. It continues with a discussion of students' attitudes to science. A conceptualized model for effective teaching and learning in a code switching classroom is presented. It concludes with a summary of the chapter.

Chapter 3 describes the research methodology, research designs, population and sampling technique, the data collection instruments, procedures for the analysis of data and ethical considerations.

Chapter 4 deals with data presentation, analysis and interpretation. Data is presented in tables under several headings. The hypotheses formulated in chapter one is tested in this chapter and findings are discussed.

Chapter 5 presents the summary of the study, draws conclusions and provides recommendations. This chapter also provides suggestions for future research.

1.12 CONCLUSION

Chapter one has provided an overview of the study. A background to the study, the research problem, motivation, aim, research objectives and significance of the study were discussed. It is hoped that the study might enable the South Africa government to take appropriate measure to address the language problem for enjoyment of teaching and learning to be fully resuscitated. The next chapter of the study focuses on literature review.

CHAPTER 2

LITERATURE REVIEW

1.0 INTRODUCTION

Language is a very powerful tool for transmitting information, representing thought, shaping ideas and, generally as a medium of communication. For example, a *person can interact with a computer by instructing the computer to perform a given task*. The interaction is facilitated by the use of more than one language. In this case, the computer has its own language that every human may not understand and the human has his/her own language that the computer does not understand, so an interpreter that understands both languages is involved. In another scenario, while a biologist communicates his/her ideas using a combination of botanical and IsiZulu languages, a mathematician can communicate his/her concepts in mathematics and IsiZulu languages. In both these examples, more than one language is required for effective communication.

Language is very important in learning science and other subject in general. Learning the language of science is an important aspect of learning science. The language used in science enables students to understand the information presented to them in the classroom. Additionally, it enables the students to be able to solve practical problems, communicate effectively and think in a more scientific way.

A person acquires language skills by learning. A child first acquires language in the informal situation of the home where parents are the primary teachers. The child uses a particular language to express his/her feelings. Furthermore, the child probes and experiments into the world of thought, way of life, his/her outlook and

his/her society as s/he grows into the world of the language of his/her immediate environment (Duminy, 1980:52).

This chapter comprises four main sections. Section 2.1 overviews the new language in education policy in South Africa - as well as, the concepts of bilingualism and multilingualism in general. Section 2.2 gives the fundamental theories of second language acquisition. Section 2.3 discusses code switching, reasons for code switching, functions of code switching, its effect on students' performance in science subjects and constraints. Section 2.4 lists the aims of teaching biology. In addition, a conceptualized model for effective teaching and learning in a code switching classroom is presented. Finally, Section 2.5 contains a discussion of students' attitudes to science, and in relation to code switching. The chapter concludes with a summary of each major section.

2.1 THE NEW LANGUAGE IN EDUCATION POLICY

African indigenous languages were erased from the linguistic map by the apartheid government before the emergence of democracy in 1994 in South Africa. The country was officially considered bilingual, only with regards to English and Afrikaans as the sole recognized official languages. The Nationalist government introduced a 50/50 language policy in 1976 for African students that were first promulgated in 1953. This policy prescribed that all African children at secondary school should learn 50% of their subjects in Afrikaans, the other 50% in English and the mother tongue for non- academic subjects (Setati, 2002).

Hartshorne (1987, cited in Setati, 2002) points out that African opinion never became reconciled to the extension of first language learning beyond Grade four or the dual medium policy of English and Afrikaans in secondary schools. The policy

created a linguistic imbalance in all South Africa languages as English and Afrikaans were regarded as mother tongues of a relatively small minority of the country's population. In the light of this situation, Black South Africans protested against the Bantu Education Act and successive apartheid governments for imposing this policy, resulting in the bloody student uprising of June 16, 1976 (Kamwangamalu, 2000; Setati, 2002; Probyn, 2001). This marked the end of Afrikaans as a language of learning and teaching in Black schools and concomitantly increased the status of English not only in these schools, but also in the Black communities (Kamwangamalu, 2000).

South Africa became a democratic nation in 1994 and this brought about the recognition that South Africa is a multilingual rather than a bilingual country that it was assumed to be in the apartheid era (Kamwangamalu, 2000). The democratic government initiated multiple policies across all social services by considering the sociolinguistic situation in the country, which was neglected by the apartheid government. This marked a process that fully recognized the rich multilingual nature of South Africa (Setati, 2002). Moreover, the Constitution adopted in 1996 attempted to promote language equality through the recognition of eleven official languages and for the first time nine African languages received official status in addition to English and Afrikaans (Setati, 2002; Probyn, 2001). The Constitution in S6 (3) (a) stipulates that:

The national government and provincial governments may use any particular official languages for the purposes of government, taking into account usage, practicality, expense, regional circumstances and the balance of the needs and preferences of the population as a whole or in the province concerned; but the

national government and each provincial government must use at least two official languages (South African Constitution, 1996:4).

A Language Plan Task Group (LANGTAG) was set up to produce a framework for the development of a comprehensive national language policy (Webb, 2007). In 1997, the erstwhile Minister of Education formally announced the New Language in Education Policy (Department of Education, 1997). This policy aimed at promoting multilingualism in South Africa's education system where all the eleven languages would enjoy equal status, thus allowing schools to determine their own language policy in consultation with parents and the school communities (Ncoko, *et al.*, 2000). That is, a student has the right to receive education in his/ her mother tongue and the school must fulfil this right where convenient. This in essence means that if the school's policy is for the use of English and there is an IsiZulu student whose parents would like him/her to be taught in IsiZulu, the school cannot compel this student against his/her request, if this is not practical for the school (Ncoko, *et al.*, 2000).

Not only can South African schools and students now choose their language(s) of learning and teaching, there is also a policy environment supportive of multilingual education and bilingual language practices like code switching. Students are to add new language(s) to their repertoires, and not subtract their first language as the policy advocates for an additive approach to language education (Setati, *et al.*, 2002). The New Language in Education Policy is captured below to support this statement:

Subject to any law dealing with language-in-education and the constitutional rights of learners, 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 of language maintenance programmes (Department of Education, 1997:8).

In this context, van der Walt and Mabule (2001) point out that the study of assessment criteria and range statements for grades 1 to 9 described in a discussion document by the Department of Education (1997), reveals that students are actively encouraged to code switch, mainly, it seems, to facilitate learning.

However, some people have claimed that this exercise has been reported to be very costly as it involves translation of textbooks into nine African languages (Fasold in Kamwangamalu, 2000; Biseth, 2005; Vivian in Webb, 2007; Probyn, 2001). On the contrary, the Revised Curriculum Statement gives a possibility to overcome this problem. Teachers are no longer heavily dependent on textbooks and they can make use of low cost resources to reach the set learning goals even in African languages. Consequently, the issue of the dominance of English in South Africa is not easy to resolve as it remains the main medium of instruction in Black schools.

2.1.1 Bilingualism and Multilingualism

The terms bilingualism and multilingualism have been defined differently by many writers and researchers working in these fascinating areas. Although some researchers use the two concepts interchangeably, for the purpose of this study we shall focus on bilingualism. Williams and Snipper (1990:33) define bilingualism as a person's ability to process two languages in each of the four skills of language (i.e. listening, speaking, reading and writing). They elaborate further by making a distinction between being bilingual and biliterate. People are bilingual if they can process two languages with regards to understanding the message and being able to speak and respond in each of the languages in a manner that is appropriate to the

situation. They are considered biliterate if they can read and understand a written message and can write in two languages. William and Snipper (1990:34) assert that the more adept people are at processing the four skills in each of the languages, the greater their level of bilingualism.

According to Sridhar (1996:47) the term bilingualism refers to the knowledge or use of more than one language by an individual or a community. (Baker 1996:40) views bilingualism or multilingualism as an individual phenomenon, as well as a group or societal possession. Appel and Muysken (1990:1-2) explain that individual bilingualism refers to a state where one speaks two or more languages. On the other hand, societal bilingualism occurs when in a society, two or more languages are spoken. Moreover, Sridhar (1996:48) explains that societal multilingualism can be divided into two types in a country which is made up of several language groups. These are personality and territorial principles of multilingualism. The personality principle occurs in a situation where bilingualism is the official language policy of a country and nearly all individuals in the country are multilingual. In South Africa for example, some provinces like Gauteng and North West are multilingual. The territorial principle of multilingualism refers to a situation that the whole nation is multilingual, but not all the individuals are necessarily multilingual (Sridhar1996:48). For example, in KwaZulu-Natal province the majority are predominantly IsiZulu speaking.

Hall (1995:10) defines bilinguals, in the context of schooling, as pupils who live in two languages, who have access to or need to use two or more languages at home and at school. He goes on to describe the categories of bilingual pupils from a large group learning a second language because the schools offer it as a more prestigious since it is a world language. An example is *English* in South Africa which is a

minority first language, and is considered as a prestigious language than the indigenous African languages.

Garcia (1997) cited by Du Plessis (2003:102) adapted Baker's (1993) typology of bilingual education to distinguish between three forms of bilingual education as follows.

1. Monolingual Education (ME) is a situation in which the minority language is completely replaced by the majority language.
2. Weak Bilingual Education (WBE) is when the schools aim to transfer language minority students to use the majority language almost in their schooling. He equates weak bilingualism to subtractive bilingualism, a situation in which a second language is learnt at the expense of the first language, and gradually replaces the first language.
3. Strong Bilingual Education (SBE) is when the schools aim to give students full bilingualism whereas two languages and cultures are seen as mutually enriching. He equates strong bilingualism to additive bilingualism, a situation where a second language is learnt by an individual or a group without detracting from the maintenance and development of the first language.

Du Plessis (2003:102) points out four variables in different programmes that are identifiable within these forms of bilingual educations. That is,

- The type of children in the programmes (minority or majority children).
- The language used in the classroom (minority or majority language or both).
- The educational or societal aims (assimilation, enrichment).
- The linguistic aims of the programmes (monolingual, limited bilingualism or bilingualism).

Within the scope of this study, the type of children used is Black high schools students in KwaZulu-Natal province, which constitutes the largest part of South Africa's population. The language used is a combination of the minority language (English) and the majority language (IsiZulu). The educational aim of the study is to investigate whether the use of code switching in bilingual biology classrooms will enhance student performance and their attitudes towards the subject. Lastly, the linguistic aim of this study is to promote full additive programme, which will have a complementary effect on the students' cognitive development by switching from English to IsiZulu (i.e. within the same sentence, or from sentence to sentence) to explain the concept which may pose a problem in the students second language.

2.1.2 Bilingualism and Scholastic Performance

According to De Klerk (1995:54) there are various ways in which being a bilingual or multilingual could impact upon children's scholastic performance and their development. It is important to understand that there is no inherent or genetic difference between a monolingual and a multilingual. All children are born with the potential to be multilingual and have the potential to learn many languages without being confused. However if a child is born into a society that is predominantly monolingual s/he will certainly end up being monolingual. Similarly, if a child is born into a society that is multilingual s/he will equally end up being multilingual. Hence, environmental factors are important in determining whether a child will end up being monolingual or multilingual. Some of the issues attendant to this argument are discussed below.

2.1.2.1 Bilingualism and Abstract Thinking

Bilingual children are different from monolingual children in that they can distance themselves from a language and clearly see things from different points of view. The child is less bound or constrained by limited words. S/he is more versatile and elastic in thinking due to his/her proficiency in the languages acquired; s/he can loosen the link between words and the semantics associated with these words (De Klerk, 1995:54)

Research findings by (Lanco-Worral, 1972; Ben-Zeev, 1977; Doyle, 1978; Bialystok, 1987; all in Baker, 1996:132-135) show that bilingual children aged four to nine possess the following characteristics.

- Have the ability to think more analytically about things than the monolingual child, especially when it comes to school work. For example, in mathematics where X stands for any number of things, a multilingual child will not find it difficult to understand that X can be replaced by U to convey the same meaning.
- Can respond to the meaning rather than the sound of a word and reach a stage of semantic development faster than their monolingual peers. For example, cat, rat and hat have a similar sound, but different semantics.
- Are more flexible and analytic in language skills.
- Have the ability to effectively relate stories and express concepts within those stories when compared with monolinguals.
- Are better in counting words in a sentence, as this may facilitate earlier reading acquisition and can lead to higher level of academic achievement.

It can be concluded from the above findings that bilingual students are better resourced than monolingual students because of the possession of two languages.

The two languages give the students extra advantages because they have a wider and more varied range of experience than monolinguals. They can draw from the experiences, meanings and modes of thinking that the two languages provide.

2.1.2.2 Bilingualism and Creative Thinking

A child is regarded as being creative, imaginative, supple, versatile and free in thinking when s/he can conveniently provide varieties of valid answers to a given question. However, educational styles are dynamic and the most modern forms of education lays solid emphasis on creativity and analytical thinking, flexibility, problem-solving skills and meta-cognitive awareness. For example, the centre for Education policy development in South Africa cites critical thinking as a crucial skill that needs to be developed in children (De Klerk 1995:55).

In a modern approach of an intelligence quotient (IQ) test, Torrance (1974, cited in Baker, 1996:129-130) conducted a test on the uses of an object, between bilingual and monolingual children. The children were asked questions such as how many interesting and unusual uses they could think of for a tin can? Torrance analyzed the answers in four categories.

- Children's fluency for different acceptable answers they gave.
- Flexibility score for different categories the answer can be placed.
- Statistical infrequency (originality) of each response.
- Extent of extra details that a person gives beyond the basic use of an object.

The bilingual children scored better than monolingual children on all. Consequently, Baker (1996:130) surmises on the underlying hypothesis concerning creative thinking

and bilingualism that the ownership of two or more languages may increase fluency, flexibility, originality and elaboration in thinking.

This research finding shows that, (a) the knowledge of more than one language gives students access to extensive knowledge and skills available among the millions of speakers of those languages, especially in an educational setting where students are expected to discover knowledge, rather than having knowledge being passed on to them by the teachers, (b) the ability of the students to think creatively will put the students at an advantage.

2.1.2.3 Bilingualism and Communication

De Klerk (1995:55) indicates that bilingual children have to be more sensitive to social situations that require careful communication. Baker (1996) explains this concept as follows. Bilingual children need to be aware of the language to use at a particular situation or time and how to appropriately use it in a conversation (e.g. on the telephone, answering a question in a classroom or speaking to a superior). They should avoid interference between their two languages, and pick up clues and cues when to switch languages. This can give bilingual children increased sensitivity to the social nature and communicative functions of language. De Klerk (1995:55) points to an experiment that was carried out by Genesee, Tucker and Lambert (1975) where children had to explain a board game to a blindfolded and a sighted player. The bilingual children gave more information to the player than the monolingual children. This led the researchers to conclude that bilingual children are better at perceiving other people's communicative needs by putting themselves in their shoes and giving them appropriate responses.

Overall, it would appear from the above literature, that increased communication sensitivity enhances bilingual children's critical thinking skills; helps them to function better in cooperative learning situations by assisting their peers, processing and responding to teachers' input and gives them the ability to communicate across different cultures.

2.1.3 Bilingualism or Multilingualism in South Africa Context

Bilingual or more generally multilingual education in South Africa means the provision of effective education where mother tongue receives higher priority and value as the main language of learning. Additionally, a high degree of proficiency in a second language receives serious attention either as a subject only or as a second language of learning alongside the first language (PanSALB, 2001 cited in Desai, 2003).

South Africa is regarded as a multilingual country with the official recognition of eleven languages spoken by different individuals in the society. But, in KwaZulu-Natal, which is the largest province in South Africa, there is no evidence of many cases of individual multilingualism that involves English and IsiZulu because many people do not speak English. What is evident in this province is societal multilingualism due to the existence of many languages that are related to each other (Kieswetter, 1995:31). For instance, the Nguni languages are made up of IsiZulu, IsiXhosa, IsiNdebele and siSwati. In Nguni languages the word "language" directly translates to 'ulimi' in IsiZulu, 'ulwimi' in IsiXhosa, 'ilimi' in siSwati. So it is relatively easy for speakers of the Nguni languages to communicate with one another (Ncoko, *et al.*, 2000).

The majority of Black South African students are said to be coordinate bilinguals (Williams & Snipper, 1990:39). This means that most of the students grow up speaking IsiZulu from birth and subsequently they are exposed to English at school. Although, mass media such as radio and television may provide opportunities for some of the students to be exposed to English much earlier, there is little or no opportunity for the student to use the language in natural communication situations (Ringborn 1987, cited in Setati, *et. al.*, 2002). Additionally, most Black South Africans in KwaZulu-Natal province do not develop into balanced bilinguals (Williams & Snipper, 1990:40) because of their inability to have equal proficiency in both languages since IsiZulu is a major language in the province.

Furthermore, Sridhar (1996:52) describes the asymmetric principle of multilingualism as a phenomenon where all the languages in the speaker's repertoire are not equally distributed in terms of prestige, power and attitude. For example, in South Africa, English and Afrikaans are still valued more than the African languages; as a result of which many South African parents seem to have the perception that access to English is what their children need in order to succeed in the society and internationally (Graville, Janks, Joseph, Ramani, Reed & Watson, 1997; Mawasha, 1995 in Ncoko, *et al.*, 2000). In other words, most parents demand for English as a medium of instruction for their children from the beginning of their school experiences, even if their children do not know the language before they go to school.

Mazrui (2004, in Biseth, 2005) points out that in spite of the extensive spread of English language in South Africa to the earliest levels of education and the tremendous resources invested in its promotion, there are numerous claims of falling standards of English in the education institutions as well as in the society at large.

Rakgokong (1994, in Setati, 2002) argues that using English language for learning and teaching in a multilingual classroom in South Africa where English is not the first language of the students has a negative effect on the students' "meaning making" and problem solving. Varughese and Glencross (1996 in Setati, 2002) support this argument based on the study they conducted among first year mathematics students in a South African university which taught mathematics in English, which was not the students' first language. They found that students at the university level had difficulty in understanding mathematical terms such as integer, perimeter and multiple. By encouraging students to use their own languages, one is helping them to feel accepted and it's an acknowledgement of the importance of first language development, which is central to second language development.

Lambert (1974, in Baker, 1996:102) made a distinction between additive and subtractive bilingualism. Additive bilingualism occurs when an individual adds a second language to his/her first language, while the first language is not in danger of being replaced with the second language. It is associated with accomplishments and positive feelings. In developing multilingualism in South Africa, an important approach like additive bilingualism has to be implemented which helps the students retain their cultural identities. This implies that indigenous languages should not be sheepishly deserted at the expense of English and Afrikaans.

Subtractive bilingualism occurs when second language learning is a part of a process of language shift away from the first language. This is associated with feelings of inferiority or punishment. In Black South African schools English has been used to replace the indigenous African languages, as a result of which most Black South African students have developed feelings of inferiority, loss of cultural

identity and low self esteem towards their first language, which is not helpful for academic performance and achievement (Mc Groaty, 1996:3-4).

For children who speak African languages, a full additive programme is likely to improve their academic performance dramatically. Heugh (1995:83-85) asserts that bilingual education in the classroom enhances teaching and learning opportunities and it should not be limited to Afrikaans and English, but should apply to at least all the eleven South African languages. This observation is corroborated by LANGTAG (1996) in their report, identifying the promotion of additive multilingualism as an important goal in South African schools and other educational institutions. It was recommended that additional languages be added without replacing the first language. A climate of value for first languages needs to be created at school, and at home and teaching in first language (L1) needs to be continued for as long as possible while English as a language of learning and teaching (ELoLT) is being added.

Within the scope of this study, IsiZulu and English bilingualism was offered for possible effective teaching and learning. This is in line with the requirements for the implementation of the new policy that teachers in public schools should also be trained to use more than one language of learning and teaching (Department of Education, 1999:17)

2.1.4 Diglossia

The term Diglossia refers to a situation that exists in a society where two distinct codes are used and shows a clear functional separation. That is, one code is employed in a set of circumstances and another in an entirely different set (Wardburgh 2006:89). Ferguson (cited in Wardburgh, 2006:89) defines diglossia as follows:

Diglossia is a relatively stable language situation in which, in addition to the primary dialects of the language (which may include a standard or regional standards), there is a very divergent, highly codified (often grammatically more complex) superposed variety, the vehicle of a large and respected body of written literature, either of an earlier period or in another speech community, which is learned largely by formal education and is used for most written and formal spoken purposes but is not used by any sector of the community for ordinary conversation.

He identifies four language situations that show the major characteristics of the diglossic phenomenon as Arabic, Swiss German, Haitian and Greek. In each situation there is a high variety (H) and low variety (L) of language. For example, in Switzerland the two varieties are Standard German (H) and Swiss German (L). The other example is in Haiti, where there is Standard French (H) and Haitian Creole (L). In South Africa, the high variety that is regarded as prestigious and powerful is the English language, which is used for formal purposes, like inside the classroom. Low varieties are the African indigenous languages that lack prestige and power which are used outside the classroom and in the surrounding community. The New Language in Education Policy aims to promote multilingualism by giving equal status to the eleven

languages. This is a shift from diglossia once the Department of Education and schools begin to implement the New Language in Education Policy.

2.2 THEORIES OF SECOND LANGUAGE ACQUISITION

There are different theories of second language acquisition that have been researched over the years. Of all these theories, the Krashen's theory is widely known and well accepted (Schutz, 2007).

2.2.1 Krashen's Monitor Model

This theory is the most widely used in all areas of second language research and teaching in the United States and Canada (Schutz, 2007). Krashen's theory comprises five main hypotheses, namely, the Acquisition-Learning, Monitor, Input, Natural order and Affective Filter.

2.2.1.1 The Acquisition Learning Hypothesis

This is the most fundamental and essential component of Krashen's theory (Ellis in Nolan, 2001). Krashen maintains that an adult second language student has two different ways to develop competence in the language, namely language acquisition and language learning.

Language acquisition is the product of a subconscious process that is similar to the process that children undergo when they acquire their first language (Schutz, 2007). Acquirers are not consciously aware of the grammatical rules of the language, but rather develop a feel for correctness (Wilson, 2000). The second one is language learning, which is a conscious process that results in conscious knowledge of a second language, knowing the rules, being aware of them and being able to talk about them

(Wilson 2000). In other words, acquisition requires meaningful interaction in the second language (natural communication) while learning is a result of instruction given in the classroom.

Krashen's main argument in this hypothesis is whether learning becomes acquisition and his stand point is that learning is less important than acquisition. Some people are competent in a second language, but do not know the rules that guide it consciously. Some may know the rules and break them. What is important is that it is possible to forget some of the rules previously learnt in the second language and still remember others. In a situation where one has forgotten completely what was learnt, knowledge has not been effectively acquired. On the other hand, when one constantly remembers what was learnt it is not easy to disprove that it has become part of one's acquired knowledge.

2.2.1.2 The Monitor Hypothesis

The Monitor hypothesis explains the relationship between acquisition and learning in second language performance and defines the influence of the latter on the former (Schutz, 2007). The acquisition system is the utterance initiator, that is to say, the language one has subconsciously acquired (first language) initiates or develops our utterances in the second language. Learning on the other hand performs the role of monitor or editor. This occurs in a situation where a second language student knows the rules, and has enough time to edit or think about correctness especially in a classroom setting. Krashen (1988, in Schutz, 2007) explains further that the role of the monitor is minor; it does not help acquisition, but only helps the student to polish what has been acquired through communication.

2.2.1.3 The Input Hypothesis

According to (Nolan, 2001), the Input hypothesis is similar to Vygotsky's Zone of Proximal Development (ZPD), which is the difference between the child's capacity to solve problems on his/her own and his/her capacity to solve them with assistance. This hypothesis postulates that students acquire language in only one way. This is, by understanding messages or receiving comprehensive inputs.

Krashen (1994, in Nolan, 2001) believes that students move from beyond i (his current level) to $i+1$ (the next level) along the natural order by understanding input containing $i+1$. This hypothesis answers the question of how students acquire a second language or develop competency in second language over time. In other words, we acquire only when we understand language that contains structure that is a little beyond where we were before. The comprehensive input in this hypothesis simply refers to words, phrases and sentences, which a language student may understand due to using the context of the language s/he is hearing from a speaker of the second language or reading a text and his/her knowledge of the world around him/her.

This hypothesis contains three fundamental elements listed as follows.

- Language is acquired, not learned because a student has received comprehensive input that contains structures beyond his/her current level of mastery ($i+1$).
- Communication should be allowed to emerge on its own as a result of the confidence that the student has built through the comprehensive input.
- The input should not deliberately contain grammatically programmed structures. If the input is understood and there is enough of it, $i+1$ is automatically provided (Krashen, 1994 in Nolan, 2001).

What can be deduced from this hypothesis is that a comprehensive input may be acquired in spite of whether it consists of mixing one or two codes together (code mixing). With respect to learners, they cannot acquire a comprehensive input without the assistance of others. Thus, some cases of code switching might be the result of the comprehensive input they received from the teachers and peers. For instance, a teacher may code switch in order for the students to understand the language or if a student exercises great effort to express him/herself, the other student can assist by providing the comprehensive language in a meaningful context. Children have a rapid and natural way of communicating their meaning to their peers.

2.2.1.4 The Natural Order Hypothesis

This hypothesis states that students acquire, but not learn, grammatical structures in a predictable order with certain items being learned in sequence. The hypothesis seems to be independent of the student's age, first language background and the conditions of exposure (Krashen, 1994 cited in Nolan, 2001). However, Krashen posits that natural patterns of second language acquisition do not follow those of the first language acquisition pattern.

The implication of this hypothesis is that basic elements of the language are taught first and then gradually progress to the more complex elements, which in many ways could be helpful to many students as it would provide a strong foundation in language mechanics. On the other hand, it may also hinder the students, that may be thinking about the appropriate rule to apply when speaking, thereby negatively affecting the proficiency and flow of communication.

2.2.1.5 Affective Filter Hypothesis

Dulay and Burt (1977, cited in Baker, 1996) posit that Affective Filter determines to what degree a person learns in a formal or an informal situation. Krashen's view (in Schurtz, 2007) is that a number of affective variables play a facilitative role in second language acquisition. He claims that if a student has low anxiety, high motivation and high self-confidence, s/he is said to have a low affective filter, which in turn will provide a fertile avenue for second language acquisition. On the other hand, if a student has high anxiety, lower motivation or a lower self-esteem of confidence, the affective filter will be higher and form a mental block that prevents comprehensive input from being used for acquisition. The five Krashen's hypotheses of second language acquisition are much interwoven and can be summarized as follows.

- Acquisition is more important than learning.
- In order to acquire, two conditions are necessary, namely, comprehensive input containing $i + 1$ and a weak affective filter to allow input.

2.3 CODE SWITCHING

The primary aim of any educational enterprise is to prepare students for life - including the present. To achieve this aim, the enterprise has to incorporate certain teaching approaches and strategies in the classroom. One of such approaches that can improve teaching and learning is code switching, which is a method for experimenting with multiple languages. For the purpose of this study we will look at people's views on code switching, types of code switching, reasons for code switching, functions of code switching, code switching in science classrooms and constraints related to code switching.

2.3.1 Views on Code Switching

Bilingual speakers are known for their ability to effectively code switch or mix their languages during communication. Code switching occurs when bilinguals substitute a word or a phrase in one language with a phrase or word in a second language (Heredia & Altarriba, 2001). According to (Skiba, 1997) code switching among bilinguals in a normal conversation consists of eighty four percent (84%) single word switches, ten percent (10%) phrase switches and six percent (6%) clause switching.

Myers-Scotton (1993:1) one of the authorities on code switching, defines it as the alternation of two or more languages within the same conversation. She makes a distinction between code switching and code mixing, and asserts that code switching occurs when bilinguals alternate between two languages during an interaction with another bilingual person. Instances of code mixing occur in the speech of the people who are not proficient in one of the two languages. For example, code switching between English and IsiZulu among Black South African students and teachers, where the students and the teachers are not proficient in English which is not their mother tongue, for the reason that they learnt English and acquired IsiZulu. Code mixing involves the use of affixes, words, phrases and clauses from more than one language within the same sentences and speech situation. She concludes that both code switching and code mixing occur within the same discourse.

Romaine (1989:186) makes a distinction between code switching and code mixing by saying that code switching occurs where a certain level of language competence is needed and code mixing occurs in the early stages of language acquisition. She attributes code mixing to language interference and transference. Skiba (1997) asserts that code switching is not language interference based on the fact

that it supplements speech. Unlike Romaine (1989) and Myers-Scotton (1993), Lehiste (in Mncwango, 2004) defines code switching as the alternation of two languages by the same speaker during the same speech event. However, he does not distinguish between mixing and switching and does not mention anything about the level of proficiency of the person.

Mati (2004) points out that the ability to code switch is an important tool for the individual in the learning process within the context of a multilingual and multicultural society. This author stressed further by citing Adendorff (1993) that 'switches are viewed as guiding the participant's interpretation of academic goals and intentions as well as guiding their interpretation of social relationships in the class' and he advocates that teachers be given instruction in the value of code switching in their training.

Historically, code switching has been seen as having inferior status. Many people regard it as a grammarless mixture of languages and equally believe that people who code-switch are not proficient to converse in either of the two languages (Setati, 2002). Moyo (2000) argues that most bilinguals are fairly capable of maintaining proficiency in their respective first languages. Moreover, some people hold the view that it lowers communication standards and students who do not share the same first language will be neglected (Cook, 2002 cited in Sert, 2005). The competence level of the teacher in the first language is also taken into consideration (Sert, 2005). The literature increasingly reflects the view that code switching in classrooms is normal, useful and provides continuity in speech when effectively used, used as a transference of meaning to weak learners. It helps the students and teachers with both communication and social interaction (Ncoko *et al.*, 2000; Rose & Dulm, 2006; Skiba, 1997; Setati, 2002).

2.3.2 Types of Code Switching

Code switching can either be intersentential or intrasentential. Intersentential code switching involves switches from one language to another between sentences. This is seen most often between fluent bilingual speakers (Myers-Scotton, 1993:4). For example, an IsiZulu speaking student talking about the weather conditions may code switch as follows. *“Winter here lasts until September. Ngesinye isikathi kuqale kubande ekuseni”* (sometimes it is only cold in the morning). In intrasentential code switching, the switch occurs within the same sentence, with no interruptions, hesitations or pauses indicating a shift. This type of code switching is also known as code mixing (Myers-Scotton, 1993:4). For example, an IsiZulu speaking student talking about township violence can code switch as follows. *“Uyabona ukuthi iviolence iyaspreada e East Rand instead of iphele?”* The meaning in English is *“Do you see that the violence is spreading in the East Rand instead of ending?”*

Lipski (1982, cited by Monte-Alcala, 2001:197) makes a distinction between intersentential and intrasentential code switching. He relates intersentential code switching to the so-called compound bilinguals (those who learned both languages at the same time or in the same context) and intrasentential code switching to coordinate bilinguals (those who learned their two languages in different times or contexts). For example, most Black South African students may possibly code switch intrasententially by switching from English to IsiZulu because they grow up speaking their first language from birth, used it to learn up to Grade four and subsequently switched to English in Grade five.

2.3.3 Reasons for Code Switching

Even though code switching has received considerable criticism from purists, there are other researchers who see it as a valuable communication medium. Leshite (1988, in Mncwango, 2004) claims that language code switching does not occur simply because the speaker does not know how to express him/herself very well in either of the languages. It is the most readily available word or phrase that comes out for some reasons at that particular moment.

Baker (1996) lists the varying reasons by which people code switch as follows: to emphasize a point, substitute a word or phrase not known in one language with a word in another language, reinforce a request or authority, repeat to clarify a point especially in the classroom, communicate friendship, interject in a conversation, ease tension and inject humour into a conversation, exclude people from a conversation and for easy and efficiency of expression.

Code switching can be associated with certain topics, setting and/or participants. Wardhaugh (2006:104), Myers-Scotton (1993:52), Monte-Alcala (2001:196) made a distinction between situational code switching and metaphorical code switching. Situational code switching occurs when the language changes according to the situation of the conversants, where people speak one language in one situation and another in a different one without change of topic, especially when one of the speakers does not understand the language. For example there are situations that demand a change in the code for clarifying and understanding the subject matter. An IsiZulu speaking student discussing a topic in genetics with his/her colleague in IsiZulu can be forced to switch over to English because of inappropriate technical terms in IsiZulu. It can be absolutely difficult to present some concepts such as chromosomes, meiosis and deoxyribonucleic acid (DNA) in IsiZulu.

Whiteley (cited in Wardhaugh, 2006:102-103) describes the kind of situation that can occur between a member of the public and members of the government bureaucracy:

A man wishing to see a government officer about renewing a license may state his request to the girl typist in Swahili as a suitably neutral language if he does not know her. To start off in English would be unfortunate if she did not know it, and on her good will depend on his gaining access to authority reasonably quickly. She may reply in Swahili, if she knows it as well as he does and wishes to be co-operative; or in English, if she is busy and not anxious to be disturbed; or in the local language, if she recognizes him and wishes to reduce the level of formality. If he, in return, knows little English, he may be put off at her use of it and decide to come back later; or, if he knows it well, he may demonstrate his importance by insisting on an early interview and gain his objective at the expense of the typist's goodwill. The interview with the officer may well follow a similar pattern, being shaped, on the other hand, by the total repertoire mutually available, and on the other by their respective positions in relation to the issue involved.

In metaphorical code switching, the language changes when a change of topic occurs. Myers-Scotton (1993:52) argues that metaphorical code switching is not related to topics alone, but presentation of self in relation to the topic, or changes in relationship to other participants. In this regard, she discussed the findings of an experiment where conversation occurred between two groups of local adults and one group of local university students. The motivation for metaphorical code switching in this case was not related to the topic alone, as the students switched to their local

dialect. Although a change of topic occurred, at the same time they used their dialect to involve the adult to share experiences as intellectuals.

Gumperz (1982, in Wardhaugh, 2006:104) cites examples of metaphorical code switching from three sets of languages (Hindi and English, Slovenian and German, and Spanish and English) as an indicator of ethnic identity and solidarity and to show how speakers employ particular languages to convey information that goes beyond their actual words, especially to define social situations. He discovered that some languages were expressed as “we-code” (language used within group members, which is suitable in informal settings such as home and family) and some as “they-code” (the language that is associated with formal and public interaction).

Duran (1994) citing Gibbon (1983) on the study carried out on language attitudes and code switching in Hong-Kong between Cantonese and English, reports on results that indicated that a Chinese speaker would code-switch to English so as to give an impression of status or westernization. Additionally, the Chinese speaker would code-switch to Cantonese in order to give an impression of humility and solidarity. However, a mixture of Cantonese and English was considered an ill-mannered, aggression, ignorance and pride from a Cantonese point of view. Furthermore, there are instances of spontaneous code switching in some of the entertainment programmes (Generation and 7 de Laan) showing on South Africa Broadcasting Corporation (SABC1 and SABC2) from IsiZulu to English, Afrikaans to English to carry the audience along or disseminate information to their heterogeneous audience (Moyo, 1996 cited in Mncwango, 2004).

2.3.4 Functions of Code Switching

The aim of research on code switching in classroom settings in South Africa is mainly to identify the incidence and function of code switching by teachers and students. Ncoko, *et al.* (2000) discuss the incidence of code switching between IsiZulu and English in a primary school, where learners used code switching for a variety of social functions such as defiance, invoke a sense of solidarity inclusion or exclusion, to maintain a position of neutrality and reiteration. Ncoko, *et al.* (2000) point out that the use of code switching as a teaching strategy can be effective for both language and content acquisition. Rose and Dulm (2006) focused on specific functions of code switching between English and Afrikaans in a multicultural and multilingual secondary school, where code switching was observed to be used for clarification, confirmation and expansion (to aid teachers and learners in attaining academic goals), as well as for social functions such as identity marking and humour.

2.3.5 Functions of Teacher Code Switching

Gumperz (cited in Setati, 2002) maintains that code switching is a verbal strategy whereby a teacher can, for instance use the first language of a student as a code for encouragement. Merritt, Cleghorn, Abagi, and Bungi (cited in Setati, 2002) claim that code switching could be motivated by cognitive and classroom management factors, which could help to regain students' attention or reinforce lesson materials. Meyer (1997) affirms that most Africa student has not been taught in their mother tongue, instead teachers use different model in class such as code- switching, to make student understand the content which is written in English.

Sert, (2005) citing Mattson and Bureenhult (1999) lists the functions of teacher code switching as topic switch, affective, and repetitive functions. In topic

switching, the teacher alters his/her language according to the topic being taught and shifts his/her language to the students' first language. In this case students' attention is directed towards the new knowledge. That is, a bridge from first language to second language is constructed to transfer new content to the student in a more meaningful way that will influence their academic success. Affective functions are important in the expression of emotions and to build solidarity and intimate relationships with students. In repetitive functions, a teacher code-switches to clarify the meaning of a word in the students' first language and stresses the importance of the second language for efficient comprehension.

2.3.6 Functions of Student Code Switching

Eldridge (1996, in Sert, 2005) outlines functions of student code switching as equivalence, floor-holding, reiteration and conflict control. Equivalence serves as a defensive mechanism for the student and gives him/her the opportunity to communicate without gaps resulting from incompetence in a second language. Floor-holding is used when a student cannot remember a word in the second language and s/he uses his/her first language to avoid a break in communication. Reiteration helps the student to understand the content of the subject by given meaning to it in his/her first language. S/he may not be able to transfer the meaning exactly into the second language. Conflict control can be used to avoid a misunderstanding when the student does not know the correct meaning of a word in a communication; the student code-switches to transfer the intended meaning.

2.3.7 Code Switching in the Science Classroom

Language is an indispensable tool in the promotion of learning. Lemmer and Squelch (1993:41) argue that language is a crucial means of gaining access to important knowledge and skills, therefore it is the key to cognitive development and it can promote or impede scholastic success. Any language can be effectively used to teach science and technology, provided a methodological approach is followed. If one wants to bring science and technology to the people, it must be done in a language that the people understand and can communicate well in (Brock-Utne, 2003).

Several works on the use of code switching for teaching and learning mathematics and science have been done in recent years in Africa. The result of a study carried out by Probyn (2001) on teacher perceptions on the medium of instruction used in grades eight and nine in selected township secondary schools in South Africa gives the following important information.

- (a) The teachers noted that students were confused and embarrassed when English was used for teaching. As a result, teachers and students were forced to code switch between English and IsiXhosa to build students' confidence, invite their participation and negotiate their cooperation in the lesson.
- (b) The science teachers, in particular, reported that they switched from English to IsiXhosa to explain new words or concepts and used IsiXhosa prefixes with some English words. Examples included: i-battery and i-asset so that students will understand the concept a bit better and emphasize that students must master the concept.
- (c) The mathematics teachers said they code-switched because the focus was on communicating mathematical concepts in the most comfortable language, so

as to help students to properly understand the important concepts and not with the sole aim of making them English language speakers.

Blake and Van Sickle (2001, cited in Vizconde, 2006) explain that in the United States of America several studies had shown that language of instruction is a predicament. They add that one strategy identified that can alleviate the dilemma of language of instruction is code-switching from the local dialect to standard teaching, which seemed to work well as it improved the academic achievement of students in science and mathematics.

Another study was conducted by Reinhard (1997) in chemistry on factors affecting conductivity, strong and weak electrolytes, involving Form Three classes in an urban Malawian secondary school. The Experimental group was taught using Chichewa and the Control group using English. It was found that pupils in the Control group were using a mixture of English and Chichewa to discuss the results of the practical sessions to further their understanding. The results of the examination show that both groups appear to have performed equally well. For example, some terms such as type of solution and depth of the electrodes were code-switched as “*mtundu wa solution*” and “*Kaviikidwe kwa ma electrodes*” respectively.

Furthermore, Setati (1997) carried out a similar study on whether code switching by a teacher in a second language Grade Five mathematics class will meet communicative and educational demands. She observes that the teacher code switched from English to Setswana in engaging the passive pupils, to improve pupils’ ways of working together in a group, to give clarity and direction to the whole class, to exercise control on how to carry out the task, and to probe further when pupils gave incorrect responses to questions. She concluded that code switching provided an

opportunity for the pupils to think of alternative ways of solving mathematical problem.

In a study conducted by Rollnick and Rutherford (1996) in Setati *et al.* (2002), they found that the use of students' first language was a powerful means of exploring ideas. They argue that without the use of code switching, some students' alternative conceptions would remain unexposed.

An investigation carried out by Biseth (2005) in a Grade Five science class involved a teacher code switching between IsiXhosa and English, especially when the material was new to the students. Questions were asked by the students both in IsiXhosa and English - and their understanding of the subject matter increased.

On 2nd July, 2007 during winter school for high school teachers at the University of Zululand. I sat at the back of the computer laboratory where the lecture took place, observing a lecturer who was teaching student teachers the use of Microsoft word package. Although the teacher tried as much as possible to use English throughout the lesson, at a point, she deliberately switched to IsiZulu to maintain contact and attract the attention of some students who were not following the lesson for one reason or another.

2.3.8 Constraints Related to Code Switching

Code switching is a common practice among bilingual speakers when they make use of any language within the same speech. Many people favour the use of code switching in the classrooms, while some vehemently oppose it. Some constraints of code switching in second language classrooms are as follows.

- (a) Code switching in bilingual classrooms where all the students do not share the same first language may create a serious problem because some of the students

(though few in number) will be somehow marginalized.

- (b) Code switching in second language learning is automatically referred to as third code. The student, in actual fact, has his/her first language and s/he is preparing to have competence in the second language. We cannot simply assert that the introduction of the mixed language will be of assistance in learning the second language. The reason is simply that the students may not have come across some of the mixed words before in the second language.
- (c) Teachers who are not competent in the first language of the students will not be able to adequately acquire knowledge of the subject matter using the code switching approach to teach. However, getting professional teachers that can fluently teach in the first language of the students might be costly.
- (d) Code switching can destroy first language development and promotion. The students who have relied totally on finding meanings for words in a second language may not be able to find corresponding meanings to the words in their first languages. So documenting and translating from one language to another might be economically expensive with little, if any, cognitive gains achieved.

2.4 AIMS OF TEACHING BIOLOGY

Biology is a content subject, which concerns itself with the study of living organisms and has a particular relevance and impact on young children. Dowdeswell (1981: 29 & 45) lists the aims of teaching biology as follows:

- (a) To familiarize students with common plants and animals and their vernacular names.
- (b) To provide elementary training in observation, the recording of information and simple manipulative skills.

- (c) To encourage students to ask questions about their environment and the living organisms that form part of it.
- (d) To give opportunities for problem-solving and the design of elementary experiments to test ideas.
- (e) To cultivate respect for living things
- (f) To show that science provides a way of thinking about living and non-living things and that it is closely related to other areas of study, for example literature, music and art.

Obviously, these aims cannot be achieved if students are still struggling with problems involving the language being used for teaching/learning. Hence, models that are based on code switching for teaching and learning need to be investigated, with a view to ascertaining their efficiency and effectiveness.

2.4.1 A Multi-Loop Code Switching Model for Teaching and Learning

The Human-Computer Interaction (HCI) scenario that was given in the introductory section of this chapter shows that more than one language is necessary for effective teaching and learning. The concept of bilingualism is very essential for teaching sciences because in many cases, the language of science is obviously different from that of the students. This implies that an interpreter who understands both the language of the subject and that of the students is needed. The teacher in a code switching classroom is simultaneously playing the roles of an interpreter and that of a teacher.

In this work, the researcher experiments with English/IsiZulu code switching in the teaching of biology, given that IsiZulu is the first language of most of the

students in Kwazulu-Natal province of South Africa, and English is their second language. To accomplish this task, the researcher has formalized the concepts earlier discussed into a model called multi-loop CODE Switching for Effective Teaching and Learning (CODESET). Figure 1 shows the block diagram of this envisioned model that will eventually be applied in the classroom situation.

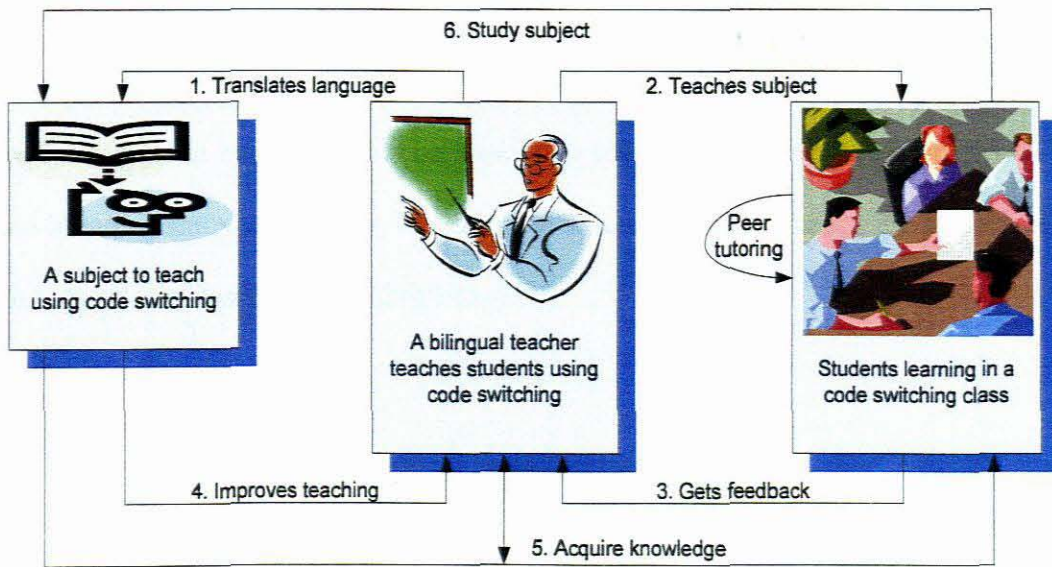


Figure 2.1: A Multi-loop CODESET Model

There are three entities in this model namely a subject (e.g. biology), a bilingual teacher and a group of students. The steps of the model are described as follows. A bilingual teacher studies and translates the subject (step 1). The teacher uses code switching to teach students in an effective way (step 2). The teacher gets feedback from the students and the feedback is facilitated by peer tutoring among students (step 3). Based on the feedback from the students, the teacher improves on teaching and learning (step 4). The teacher and students acquire deeper knowledge and understanding of the subject by constantly studying and interacting. This leads to the students acquiring basic knowledge of the subject from the teacher (step 5).

Finally, the students study the subject on their own to acquire additional knowledge and properly understand the subject (step 6).

An important characteristic of CODESET is the existence of an interactivity relationship between any two entities. Hence, the model is a multi-loop and enables us to evaluate the effectiveness of the code switching approach for teaching and learning. Lastly, the main goal of this research was to find out how CODESET could be useful for improving teaching and learning in high schools. The CODESET model is generic because it can be applied to teach any subject; however, it will be tested in this study to ascertain the extent to which it would enhance the performance and attitudes of students towards biology.

2.5 ATTITUDES OF STUDENTS TOWARDS BIOLOGY

Oppenheim (1992, cited in Young, 1998) states that an attitude is a state of readiness, a tendency to respond in a certain manner when confronted with certain stimuli. According to Lord (1997:222), attitudes contain three elementary components: cognitive, feeling or affective and actions or behaviour. These components are interrelated and are always present whenever a person holds an attitude. The cognitive component consists of the thoughts and knowledge the person has about the object. The affective component consists of the person's emotions, beliefs or evaluation toward the stimulus, that is, positive or negative evaluation. The behavioural component consists of how the person tends to act regarding the stimulus.

Students' attitudes and views about science subjects and science education affect their interest and motivation. Students' attitudes towards science subjects have long been regarded as one of the most important outcomes of science teaching. Over the years, one important goal of science education has been to develop scientifically

literate individuals who understand how science, technology, and society influence one another (Lin, 1998). Schwirian (1967, cited in Mustafa, 2007) states that attitude towards science is the basis of acceptance and support or rejection of science and scientific activities in a society. Trumper (2006) citing Simpson and Oliver (1990) asserts that student's attitudes towards different science subjects could be negative or positive. He notes that positive attitude to science subject leads to a positive commitment to science that influences life long interest and learning in science, while negative attitude leads to lack of interest which make students to avoid the subject in senior high school.

Many different factors that have been found to be related to the attitudes of students with regard to science are gender, age, teaching strategies, subject content, teacher attitudes, learning environment, pace of learning, self-concept and parental attitude (Young, 1998). Breakwell and Beardsell (cited in Jidesjo & Oscarsson, 2004) argue that it is not gender in itself that is the problem, but factors that relate to gender, like peers, friends, television and the film media.

A study conducted by Ajitha and Pushpam (2000), involving secondary school biology teachers revealed that the low willingness of the teachers to use teaching aids and other activities, such as field-trips, exhibitions, fairs and conducting demonstrations in the classroom to supplement classroom learning - might reduce the learners' attainment of learning outcomes and attitude. Further, the teachers were found to be satisfied with the traditional chalk-and-talk method.

Moreover, Lemke (1990, in Jidesjo and Oscarsson, 2004) and Setati (1997) emphasize that the use of language is a key factor and that we need to find new and different ways of talking and presenting science content. In support of this statement, Mwinsheihke (2002, in Brock-Ume, 2003) co-facilitated a training workshop in

Tanzania for science teachers of the SESS (Science Education in Secondary Schools) project with an American Peace Corp. The main objective was to train the teachers on the use of participatory methods to teach/ learn some topics on reproductive health. She related her experience as follows:

The intention was to conduct the workshop in English. However, it became evident that the low level of participation and the dull workshop atmosphere prevailing was partly due to teachers' problem with the English language. I agreed with the workshop co-ordinator to use both Kiswahili and English. The problem was immediately solved since we started switching between the two languages, and the working atmosphere was good, lively and conducive for learning. (Mwinsheihke, 2002).

On the other hand, Rubagumya, Jones, and Mwansoko (1999, cited in Brock-Utne, 2003) report that a science teacher was introducing a concept of evaporation in chemistry to his students. The teacher changed the language completely when he saw that his students did not understand his English. After an initial trial in English, and following a silence from the students, the teacher switched to Kiswahili and the students responded positively to every question that he asked them thereafter. In the final analysis, the most important thing is to get the subject matter across to the students in an effective way. Brock-Utne (2003) citing Rubagumya *et al* (1999) describes another scenario involving a Form One geography class, where the teacher mixed English words with Kiswahili in his sentences, but allowed the important words to be communicated in Kiswahili. The teacher was satisfied with the response from the students. Another study carried out by Smit (1996) on language attitudes found positive attitudes among Black students towards the use of other languages (IsiXhosa and Afrikaans) alongside English as media of instruction.

2.6 CONCLUSION

This chapter described the question of language in South Africa. The concept of bilingualism in general was discussed, both additive and subtractive, and some of the advantages of bilingualism on student scholastic performance were noted. The theories of Second Language Acquisition was discussed as a means of achieving bilingualism in individuals; the relationship between bilingualism and code switching was explored, with particular attention given to the fact that code switching only occurs among the bilingual people. The use and functions of Code Switching as an effective teaching and learning strategy in second language science classroom was explained in detail. Lastly, the language used for teaching science subjects was addressed as one of the key factors affecting the attitudes of students towards science. Based on this, a conceptualized model called Code Switching for Effective Teaching and Learning (CODESET) was developed to be tested in biology classrooms and determine the extent to which it would enhance the performance and attitudes of students towards biology. The next chapter presents the research methodologies used to collect the data for this research.

CHAPTER 3

RESEARCH METHODOLOGY

3.0 INTRODUCTION

This chapter discusses the research methodology used for data collection, the purpose of which was to answer the research questions and test the hypotheses formulated in chapter one of this study. Three research techniques that were used included: Questionnaires, a Biology Achievement Test (BAT), and Direct Observation.

The basis for using different research techniques was to gather enough information using different measures. It was envisaged that this would further enable full understanding of the problem, give accurate results from information captured and make it easier to directly solicit for certain answers that were relevant to the study.

3.1 RESEARCH APPROACHES

The research approaches used yielded both quantitative and qualitative data so as to enhance the accuracy of the final results. One main advantage of combining the two methodologies was that one compensated for the deficiencies of the other - hence the accuracy of the findings was enhanced.

3.1.1 Qualitative Research

Qualitative research seeks to describe, decode, translate, and otherwise come to terms with the meaning, not the frequency, of certain more or less naturally occurring phenomena in the social world (Van Maanen, in Imenda & Muyangwa, 2006:55). Qualitative research tries to address certain kinds of issues about the nature of human phenomena by focusing on meaning and understanding. Neuman (2006:115) state that in qualitative research, data are presented in the form of words, actions, sounds, symbols, and images from documents, observations and transcripts. Peshkin (1993 in Leedy & Ormrod, 2005:134-135) explains that qualitative research serves one or more of the following purposes:

- Description – it reveals the nature of certain situations, settings, processes, relationships, systems or people.
- Interpretation – it enables a researcher to gain new insights about a particular phenomenon; develop new concepts or theoretical perspectives about the phenomenon; discover the problems that exist within the phenomenon.
- Verification – it allows a researcher to test the validity of certain assumptions, claims, theories, or generalizations within real world contexts.
- Evaluation – it provides a means through which a researcher can judge the effectiveness of particular policies, practices, or innovations.

3.1.2 Quantitative Research

Leedy and Ormrod (2005:94) explain that quantitative research is used to answer questions about relationships amongst measured variables and testing hypotheses with the purpose of explaining, predicting and controlling phenomena. They stress further that quantitative research is primarily concerned with identifying cause-and-effect relationships. Neuman (2006:349) also contends that in quantitative research, data are transformed into numbers, tables, charts and frequencies, which are mathematically examined according to some given standards such as norms, averages, percentiles and tendencies. One of the main purposes of quantitative research is that it has the capacity for generating quantifiable data on large numbers of people who are known to be representative of a wider/target population in order to test theories or hypotheses (Bryman, 2000:11). Survey and experiment are probably the main vehicles of quantitative research.

3.2 RESEARCH DESIGN

This study used an experimental design. More specifically, the study employed a slight modification of the pre-test, post-test non-equivalent comparison (Campbell and Stanley 1966, cited in Imenda & Muyangwa, 2006:42). This design involved the following major steps:

- The administration of a pre-test to two groups – one Experimental and another Comparison/Control.
- The students in the Experimental group were exposed to treatment in selected biological topics presented in IsiZulu/English Code Switching – IZECS. The students in the Comparison/Control group were exposed to the same biological topics in the English Language – EL only.

- The administration of a post-test to the two groups. The scores on the dependent variable (i.e. post-test) were compared between the two groups and the differences in the scores were taken to be mainly due to the differences in treatment/intervention that occurred.

The design is represented diagrammatically in Table 3.1. below

Table 3.1: Design Representation

Group 1	O_1	X_1	O_2
Group 2	O_1	X_2	O_2

Here,

O_1 – Observation (pre-test)

X_1 – Experimental group intervention (IZECS)

X_2 – Comparison group intervention (EL)

O_2 – Observation (post-test)

According to Imenda and Muyangwa (2006:42) and Ary, Jacobs, Razavieh and Sorensen (2006:342) this design has some deficiencies that can seriously threaten the internal validity of this design as a result of non-randomization of subjects (students) to the experimental and control groups. To deal with this threat, initial observation (pre-test) scores for the Experimental and Comparison/Control groups needed to be statistically equivalent. These findings are reported in the next chapter.

3.3 POPULATION AND RESEARCH SAMPLE

High schools in KwaDlangezwa and ESikhawini Townships in Uthungulu district of KwaZulu-Natal province constituted the accessible population for this study. The Townships were specifically identified as suitable for the following important reasons. Firstly, the two Townships were easily accessible; and secondly, the selection of the Townships ensured that cost was minimised. Lastly, the schools in these Townships are predominantly Black schools and IsiZulu is the major language for the majority, if not all, the students.

3.4 SAMPLING TECHNIQUE

Simple random sampling was used to select the four participating high schools out of the fifteen high schools in ESikhawini and KwaDlangezwa Townships from the sample frame collected from the Department of Education, Mtunzini Circuit, South Africa. The researcher randomly assigned the four selected schools to the two treatment conditions i.e. IZECS and EL. Two schools formed the Experimental group (IZECS) and the other two schools formed the Comparison/Control group (EL). Table 3.2 shows the schools sampled, grade, number of students and teachers that were involved in the conduct of the experiment.

Table 3.2: Schools Sampled

SCHOOL	GRADE	NUMBER OF STUDENTS	NUMBER OF TEACHERS
Comparison	10	60	1
Experimental	”	74	1
Experimental	”	44	1
Comparison	”	60	1
TOTAL		238	4

3.5 RESEARCH INSTRUMENTS

Three kinds of instruments were used in collecting data for this study. These were Biology Achievement Test (BAT), Questionnaire and Direct Observation.

3.5.1 Biology Achievement Test (BAT)

The development of the BAT instrument began with a study of the grade 10 Biology syllabus in South Africa. A biology topic on Gaseous Exchange (human breathing system) and diseases that are related to the human breathing system were chosen for the study. The gaseous exchange system is an important topic because it helps students to understand how their bodies exchange gases and know the risks of death caused by diseases related to smoking cigarettes and inhaling polluted air (Ayerst, Langley, Majozi, Metherell, & Smith, 2005).

The sub topics included the structure of the human breathing system, description of the process of breathing, equipment to show the process of breathing, description of

the process of breathing, equipment to show the process of breathing, identification and description of allergies and diseases that are related to the breathing system. The first design of the BAT consisted of 30-multiple choice questions constructed by three expert grade10 biology teachers in the schools selected. The teachers were degree holder in biology education who had been teaching these classes for at least two years. The BAT was constructed in the English language because biology in the matriculation examination is written in English language. The researcher randomly selected 15-multiple choice questions with four optional answers (one intended response and three distracters) out of the questions constructed by the school teachers to avoid leakages and to make sure that all the students were exposed to the same questions.

3.5.1.1 BAT Administration

The BAT was administered as both the pre-test and post-test to the two groups. The test was completed during the normal school period in each school. Instructions were read out to the students, and they were required to circle letters corresponding to the answers of their choice. The time limit of 20 minutes was given to enable all the students to finish as this test was not a speed test which tends to contain a large number of very simple items and too long to allow most students to finish with the established time limits (Sax, 1979:214). The test contained short items and the questions were phrased in simple and clear English language, to measure the students' understanding with which each student was able to respond.

3.5.1.2 Scoring Procedure for BAT

In the BAT, the students were required to choose only one correct option from the four options provided. The total score on the 15-items test formed the individual's achievement score. Each correct item was scored as one point.

3.5.2 Questionnaire

A twenty four (24) item researcher-designed questionnaire to measure students' attitudes towards biology (SATBIO) was developed for this study. The questionnaire comprised three different sections: A, B, C (see Appendix B), described as follows.

A- Biographical information of the students which was made up of seven items.

B- Students' views about biology, consisting of fifteen items.

C- Students' preferences for the language of instruction used in teaching biology in their schools, consisting of two items.

The questionnaire comprised both structured (closed) and unstructured (open ended) questions. A 4-Likert scale was used where students were requested to give their honest views. The scale comprised Strongly Agree, Agree, Disagree, and Strongly Disagree. The questionnaire was administered as a pre-test and post-test to the two respective groups. The questionnaire was completed during the normal school time in each school after a brief introductory talk in which the completion procedure was explained to the students. The SATBIO was administered for a period of thirty minutes, under the supervision of the respective biology teachers and the researcher.

3.5.2.1 Characteristics of a Good Questionnaire

According to Imenda and Muyangwa (2006:120) in constructing a questionnaire, we must take into cognisance a number of considerations for the study to succeed.

These include:

- The questions should be easy for the respondent to understand and to answer.
- The questionnaire should be easy to administer.
- The flow or length of the questionnaire should encourage interest.
- The intended responses should be easily editable.
- The instruction for completing the questionnaire should be clear.
- The subject matter of the question is readily identifiable.
- Great care must be taken to ensure that the questions are unambiguous.

To appeal to the interest of the students in this study, considerable attention was paid to the construction of questionnaire instrument. The instruction for completing the questionnaire was clear because the researcher read the instructions verbally to the students and communicates to them exactly how they should respond to the questions. The questionnaire was short and the questions were phrased in simple and clear English language. This was due to the fact that the ambiguous questions were detected during the editing of the questionnaire and such questions were rephrased. The questions also contained information that is essential to the study, that is, students' views about biology and their feeling about the language used in teaching biology in their schools.

3.5.2.2 Advantages of Using Questionnaire

Six main advantages of questionnaires have been noted:

- Each respondent receives the same set of question phrased in exactly the same way, as they are on standardized test.
- The researcher can get at a large sample relatively easily and cheaply.
- Respondents can provide frank responses especially if confidentiality and anonymity are guaranteed.
- Respondents have enough time to read and understand questions, and enough time to respond to them.
- There are economies of scale in devising and analysing questionnaire.
- Questionnaire is not as time-consuming as other research techniques.

In this study, the questionnaire permitted the researcher a wide coverage of a large sample at minimum cost in terms of both capital and effort. This was made possible by the fact that the students were conveniently found together in one place, that is, in a classroom. All students received similar questions and twenty minutes was given to enable them to respond to all the questions. The students answered the questions freely because the researcher assured them that their responses would be kept strictly confidential, and would be used for research purposes only and not for any other reasons. There is no place where the student gave his/her particulars.

3.5.2.3 Disadvantages of Using Questionnaire

There are three main disadvantages of using questionnaires:

- The motivation of the respondent is difficult to check, as this could lead to low response rates, resulting in a non-representative research sample.

- The researcher may not be sure of the expected number of respondents, since other people do not bother to return the questionnaire.
- There could be problems regarding effectiveness of communication because of the language used, and the comprehension level of the respondents.

To counteract the above mentioned disadvantages in this study, the researcher read the introductory part of the questionnaire to the students, and explained the purpose of the study in order to motivate the students to respond. The personal interactions in the administration of the questionnaire reduced the possibility of misinterpretation of questions because the researcher explained each question thoroughly and encouraged students to ask questions where necessary. The questionnaires were administered by the participating teachers and completed in the presence of the researcher. This resulted in all the questionnaires being returned.

3.5.2.4 The Structure of the Questions

Questions were structured in such a way that they probed answers to the research questions introduced in chapter one. The questionnaire consisted of both open-ended and closed ended questions. Using both types of questions helped to compensate for the deficiencies of the other. Moreover, mutual confirmation of data obtained through both types of questions was in fact a good indicator of validity.

The closed ended questions were used to limit the responses of the subjects to stated alternatives. It facilitated answering and made it easier for the researcher to code and classifies the responses, and statistically analyzes them. A closed-ended question has the advantages of being standardizable, quicker for the respondents to answer, simple to administer and relatively inexpensive to analyze. Also, the answers of different respondents are easier to compare for the purpose of the investigation.

Closed ended questions are however not without disadvantage. The fixed form of alternative answers may have the effect of forcing the respondent to think along certain pre-determined lines which s/he might not have done, had s/he been left to make up his/ her response on her/his own terms.

The open ended questions were designed to permit the respondents to feel completely free to express their answers as they wished, as detailed and complex, as long or as short as they felt were appropriate. These questions were intended to evoke fuller and richer responses and probe deeper. This way, unanticipated findings could be discovered. Open ended questions are advantageous in that they put few words in the mouth of the respondent to state his/ her case freely, and possibly give reasons as well. Secondly, if the respondent does not have enough understanding of the question, it will reflect in his/ her answer to the question.

The open ended questions are however not without weaknesses. One main weakness is that different respondents give varying degrees of detail in answers, which are not too useful in testing specific hypotheses. Moreover, the work of tabulating and summarising the responses is time-consuming and often very tricky. Another problem is that coding responses, comparisons and statistical analyses become very difficult.

In this study, closed ended questions were used for soliciting information and honest views regarding the students' attitudes to biology. Furthermore, open ended questions were used to elicit information about the general feeling of the students about the language used in teaching biology in their schools.

3.5.3 Observation

Imenda and Muyangwa (2006:125) define observation as a systematic and attentive recording of events as they occur (without attempting to modify them) with the use of appropriate means of study and investigation. Systematic direct classroom observation was used in both the Experimental and Comparison (Control) groups to observe the teachers' method of teaching (i.e. IsiZulu/English code switching and English language) and the students' participative or disruptive behaviour in the classroom. Imenda (ibid) listed four main ways in which an observational researcher may wish to make observation:

- Diaries
- Anecdotal records
- Time sample observation
- Event samples

In this study, the traditional paper-and-pencil note-taking techniques were used to record all the events that happened in all the classrooms by the researcher and the research assistant. The research assistant, an IsiZulu speaking student also recorded both the English and the IsiZulu version of the classroom lessons.

3.5.3.1 Advantages of Systematic Observation

Systematic observation has several advantages, namely:

- It is the most direct method of studying events.
- It demands the least on the observed compared to other research instruments.
- It allows simultaneous recording of both behaviour and circumstances, and permits the recording of events which would have been left out in the questionnaire.

In this study, the aim of using observation was to record the events which were left out in the questionnaire. However, direct classroom observation was used to focus on the structure, methodology, the utterances of both teacher and the students, examples and timing of the lessons. The researcher and the research assistant recorded as much as possible of what happened on the spot during the lessons. In order to get the best visibility of the students and the teachers the researcher and the research assistant was seating behind all of them. They were able to capture the interaction between students and teachers during the lessons, and also had the opportunity to get an idea about the feelings of both students and teachers concerning the research.

3.5.3.2 Disadvantages of Systematic Observation

However, systematic observation also has some limitations. These include the following:

- The people being observed may be affected by the presence of the observer, and change their behaviour
- Classifying observation for the purpose of comparisons could be difficult, owing to the lack of standard sequence of behaviour as each event may be unique.
- The observer's own perceptions, beliefs and biases could influence the way he or she observes and interpret the event.
- Inattention, fatigue, limitations of the sense organs may oblige the observer to miss some of the events that he or she could have regarded as being unimportant, had s/he noticed them.

In this study, some of these disadvantages were circumvented by taking the following measures:

- The researcher and the research assistant sat at the back of the classrooms during each lesson in order not to disturb the class.
- The researcher and the research assistant had decided beforehand which behaviour to observe and to record.
- To solve the problems that memory may pose, the researcher and the research assistant recorded all the observations as the lesson progressed in each classroom, and compared observations afterwards.

3.6 DATA ANALYSIS PROCEDURES

Data from the questionnaire responses and marks scored in the BAT were analyzed both qualitatively and quantitatively. Quantitative data were analyzed statistically with regards to tables, central tendency and t-test. Qualitative data collected from the responses from open-ended questions were analyzed using tables and content analysis. The detailed procedures for data analysis are fully described in chapter 4.

3.7 DIFFICULTIES ENCOUNTERED IN COLLECTING THE DATA

The researcher was unable to get the accurate sample size proposed for this study because the number of grade 10 students in each school was not up to one hundred (100) as proposed. In addition, some of the students in each school were conspicuously absent during the process of data collection.

3.8 ETHICAL CONSIDERATIONS

Permission to conduct research during the first two weeks of October, 2007 in the schools selected for this study was requested and obtained from the Education Department through the office of the Mtunzini Circuit Inspector based in ESikhawini Township. Notes were given from the Circuit Inspector to all the principals of the schools who, in turn, informed all the Grade 10 biology teachers in their respective schools about the study. The study was overwhelmingly accepted in all the schools visited, and there were no objections received from the students who participated in the study.

3.9 CONCLUSION

This chapter provided the research design and methodology used in this research. Basically, both qualitative and quantitative approaches to the data collection were used. The two approaches were chosen because of the nature of the data that needed to be collected and to validate the findings. Data were collected through an achievement test, a questionnaire and direct classroom observations through note taking. Each of these methods has been described in detail. In the following chapter, data analysis, presentation, interpretation and discussion of the findings are presented.

CHAPTER 4

DATA ANALYSIS AND INTERPRETATION

4.0 INTRODUCTION

This chapter is concerned with the analysis, interpretation and discussion of research findings from the data collected in relation to the research questions to be answered in this study. The main purpose of this study, as previously stated, was to investigate the effect of IsiZulu/English code switching, as a medium of instruction on high school students' performance and attitudes towards biology. The data collected on the performance of students in the Biology Achievement Test (BAT) are presented, followed by the results of the questionnaire on students' attitudes towards biology (SATBIO). Finally, the data collected from direct classroom observations are then also presented. The data presented on BAT and SATBIO were gathered on the pre-test and post-test basis between the Experimental and the Control/Comparison groups.

4.1 DATA ANALYSIS

Both quantitative and qualitative methods were employed for analysis. The quantitative data were initially entered into Microsoft Excel spreadsheet Version 5 and then converted to SPSS (Statistical Package for Social Sciences) files for further statistical analysis. This conversion becomes essential since Excel provides easier data entry facility than SPSS, but contains fewer statistical analysis tools compared to SPSS. Hence, this combination of statistical tools enabled robust data entry and analysis. The t-test statistic was used to determine any statistical differences that may

have existed between the IZECS and EL groups. Furthermore, the Pearson Product Moment Correlation Coefficient (r) was used to verify whether there was any relationship between the students' performance in biology and their attitudes towards the subject. The significance or probability value was set at $\alpha = 0.05$, i.e. 95% confidence interval. For the qualitative data, individual responses were coded and rearranged into different categories. Devlin (2006:199) lists the steps to take in qualitative analysis as follows:

- Read through all the written responses
- Create a condensed list of the respondents
- Create a list of categories (not more than six to seven)
- Develop an operational definition for each category.

These steps were followed for easy interpretation of the data and for comparison purposes. Furthermore, for the purpose of substantiating the categories, respondents' views are quoted, verbatim.

4.2 DATA PRESENTATION

The data collected were presented mainly by tabulation. Saravanavel (1991:201) defines tabulation as the process of summarizing raw data and displaying data in a compact form for further analysis. On the other hand, Ary, Jacobs, Razavieh and Sorensen (2006:499) state that the different categories/themes made from responses may be displayed using graphs, charts, concept maps, or other visual representation of the patterns observed. In this study, tables were used for presenting results of both qualitative and quantitative data. Table structure easily supports readability, it is compact, it does not require data coding, and it is a good data normalization scheme most suitable for data processing on the computer.

4.3 BIOLOGY ACHIEVEMENT TEST

The data presented on the BAT emanated from the pre and post-tests between the Experimental and the Comparison groups. In this regard, biology achievement scores were obtained before the two groups were exposed to their respective interventions. Post-test data on biology achievement were gathered after the two groups were exposed to the respective interventions. To ascertain whether there was any significant effect of IsiZulu/English code switching instructional approach on the performance of students in biology, the t-test statistic was used to compare the mean gain scores of the Experimental group with the mean gain scores of the Comparison group.

The first research question was: Does IsiZulu/English code switching have any significant effect on the performance of high school students in Grade 10 biology?

To answer this question, the following hypothesis was formulated and tested:

Hypothesis 1

Ho: There is no statistically significant difference in performance of students taught biology using IsiZulu/English code switching versus those taught using only the English language

4.3.1 Pre-test Comparisons

The BAT pre-test scores used to test the students' existing prior knowledge of the human breathing system between the two groups is presented in Table 4.1.

Table 4.1: t-test comparison of initial performance scores before intervention

Groups	N	Mean	Std Dev.	DF	t-value	p-value Sig.(2-tailed)	Remarks
Experimental (IZECS)	118	6.81	2.27	236	- 0.399	0.690	P > 0.05 Not sig.
Comparison (EL)	120	6.69	2.11				

$t(df\ 236) = - 0.399; P > 0.05$. Not Significant

Table 4.1 shows that the IZECS group has a slightly higher mean score of 6.81 than the EL group (6.69), the difference was not statistically significant. There was, therefore, no significant difference in the initial achievement levels in biology with respect to the two groups of students. This indicates that students' existing/prior knowledge of human breathing system between the two groups was equivalent before the intervention. This was a very important step in testing for the initial equivalence of the two groups, and allowed for post treatment comparisons to be made with confidence.

4.3.2 Post-test Comparisons

Table 4.2 presents the results of the post-test comparisons based on the above hypothesis.

Table 4.2: t-test comparison of post-test performance scores

Groups	N	Mean	Std Dev.	DF	t-value	p-value Sig. (2-tailed)	Remarks
Experimental (IZECS)	118	10.78	2.059	236	-8.545	0.000	P < 0.05 *Sig.
Comparison (EL)	120	8.55	1.965				

$$t(df236) = -8.545; P < 0.05 * \text{Significant}$$

Table 4.2 shows a statistically significant difference between the mean performance scores of the IsiZulu/English code switching group versus the English Language group, in favour of the IsiZulu/English code switching group. Therefore, the null hypothesis was rejected in favour of the alternative, i.e. there is a statistically significant difference between the mean performance scores of the two groups. In this regard, the students in the IsiZulu/English code switching group performed better than those in the English Language only group.

4.3.3 Mean Gain Score

The performance gain scores in Pre-test and Post-test (BAT) between the two groups are shown in Table 4.3.

Table 4.3: Mean Gain scores in pre-test and post-test (BAT) performance scores

Groups	N	Mean	Std Dev.	DF	t-value	p-value Sig. (2- tailed)	Remarks
Experimental (IZECS)	118	3.97	2.21	236	-8.58	0.000	P< 0 .05 *Sig.
Comparison (EL)	120	1.86	1.54				

$$t (df236) = -8.58; P < 0.05 * \text{Significant}$$

Table 4.3 shows that the IZECS group had a higher mean gain score than the EL group. Therefore the null hypothesis was rejected; leading to the inference that teaching in IsiZulu/English code switching has a significant effect on the students' performance in biology. This test re-validates the result reported in Table 4.2 above.

4.4 QUESTIONNAIRES

The questionnaires were made up of three sections as discussed in chapter 3 of this study. **Section A** dealt with the biographical information of the students.

4.4.1 Biographical information

The students who participated in this study came from two schools in Esikwawini Township and two schools in KwaDlangezwa Township all of which were rural schools in the KwaZulu-Natal province of South Africa. A total number of 238 students participated in the study, comprising 114 females and 124 males. The data concerning home language of the students showed that 234 students indicated IsiZulu, 3 indicated both IsiZulu and IsiXhosa as home languages, and 1 indicated IsiZulu and Sesotho as their home languages. The number of students that indicated IsiZulu as their home language was satisfactory to advance the study. The data collected therefore, were reliable for the Experimental study and results could be drawn without much bias. However, on the question of what language(s) were spoken at school, 41 students indicated that they spoke English at school, 40 indicated IsiZulu and 157 reported that they spoke both English and IsiZulu. Moreover, on the question of what language(s) the biology teacher taught in, 159 students indicated that their teacher taught them in English, 2 indicated IsiZulu and 77 indicated English and IsiZulu. Furthermore, on the question of what language(s) the students learnt biology in, 196 students indicated that they learnt biology in English and 42 indicated English and IsiZulu. It is clear from this analysis that this study is relevant to the rural communities selected. Investigating IsiZulu/English code switching in these communities could, therefore, reveal very useful information that could assist in planning and policy.

Section B sought to elicit the students' honest views about biology.

4.4.2 Students Views about Biology

The students' views about biology were assessed using the Students Attitudes Towards Biology Test (SATBIO) before the two groups were exposed to the interventions and after the interventions. The SATBIO test comprised a Likert type scale consisting of 15 questions. On each question, students indicated their levels of agreement or disagreement with the given statements related to biology attitudes. Scores on each question ranges from 1 to 4, with lower values indicating more negative attitudes towards biology. The SATBIO test scores could range from 15 to 60, a range of 45 points. A score higher than the midpoint of 37.5 indicated a relatively positive attitude towards biology and score lower than 37.5 indicated a relatively negative attitude. To verify whether there was any significant effect of IsiZulu/English code switching on students' attitudes towards biology, the t-test statistic was used to compare the mean gain scores of the Experimental group with the mean gain scores of the Comparison group on the attitude instrument.

The second research question was: Does IsiZulu/English code switching have any significant effect on Grade 10 biology students' attitudes towards the subject?

To answer this question the following hypothesis was formulated and tested.

Hypothesis 2

H₀: There is no statistically significant difference in student attitudes towards biology between students taught using IsiZulu/English code switching versus those taught using only the English language.

4.4.2.1 Pre-test Comparisons

The SATBIO pre-test scores used to test the students' initial attitudes towards biology between the two groups is presented in Table 4.4.

Table 4.4: t-test comparison of initial attitude scores before intervention

Groups	N	Mean	Std Dev	DF	t-value	p-value Sig. (2-tailed)	Remarks
Experimental (IZECS)	118	45.67	6.020	236	1.823	0.070	P > 0.05
Comparison (EL)	120	46.67	4.669				Not sig.

$$t(236) = 1.823; P > 0.05 \text{ Not Significant}$$

Table 4.4 shows that the mean scores of the students in the EL group (46.67) was slightly higher than that of the students in the IZECS group (45.67). However, the difference was not statistically significant. Consequently, it was inferred that there was no significant difference in initial attitudes of students towards biology between the two groups, $t(df\ 236) = 0.070, P > 0.05$. This was an important step in establishing the initial equivalence of the two groups – thereby paving way for the meaningful testing of post – intervention equivalence. The mean of the SATBIO pre-test scores for all students was 46.17, which was eight points higher than the midpoint of the test. The maximum pre-test score was 58; and the minimum was 30. The range of pre-test scores varied over 28 points. This result shows that most of the students

started the study with positive attitudes towards biology, as defined by a score of 37.5 or higher on the SATBIO pre test

4.4.2.2 Post-test Comparisons

Table 4.5 presents post-intervention comparative scores between the two groups on the SATBIO post test.

Table 4.5: t-test comparison of post-test attitude scores

Groups	N	Mean	Std Dev	DF	t-value	p-value Sig. (2-tailed)	Remarks
Experimental (IZECS)	118	45.97	5.854	236	0.093	0.926	P > 0.05 Not Sig.
Comparison (EL)	120	46.04	5.281				

$t(df\ 236) = 0.093; P > 0.05$ Not significant

Table 4.5 shows that the EL has a slightly higher mean score of 46.04 than the IZECS group (45.97), the difference was not statistically significant. Statistically, there was no significant difference in students' attitude in the post test between the IsiZulu/English code switching and English language groups, following the interventions. The null hypothesis was therefore found to be tenable.

4.4.2.3 Mean Gain Score

The attitude gain scores in pre-test and post-test (SATBIO) between the two groups are shown in Table 4.6.

Table 4.6: Mean Gain scores in pre-test and post-test (SATBIO) attitudes scores

Groups	N	Mean	Std Dev	DF	t-value	p-value Sig. (2-tailed)	Remarks
Experimental (IZECS)	118	0.31	3.662	236	-2.681	0.0008	P < 0.05 * Sig.
Comparison (EL)	120	-0.99	3.796				

$$t (df 236) = -2.681; P < 0.05 * \text{Significant}$$

Table 4.6 shows that the IZECS group has a higher mean gain score of 0.31 which was higher than the EL group (-0.99). On the basis of this finding the researcher infers that code switching improved students' attitudes towards biology. Although most students in both groups began the study with positive attitudes towards biology, the attitudes of students in the IZECS group improved in the post-test to a greater extent than did for those in the EL group whose attitudes declined in the post-test. This indicated that the IsiZulu/English code switching instructional approach had a significant effect on the students' attitude towards biology.

4.4.3 Responses from the Open–Ended Section

Section C of the questionnaire consisted of two open-ended questions. All the responses to these questions were gathered on the pre-test and post-test basis. The responses are interpreted and presented below.

4.4.3.1 Prior and Post Qualitative Explanations Regarding Preferred Language(s) of Instruction

This section presents preferences, explanations of these preferences, and the comments, regarding language(s) of instruction for the two groups prior and after the interventions.

Question 1: In which language(s) would you prefer biology to be taught at your school?

4.4.3.2 Overall Prior and Post Language Preferences

The overall prior and post language preferences for the two groups are presented in Table 4.7 below.

Table 4.7: Overall Prior and Post language preferences

Language(s)	Number of students			
	Experimental (IZECS)		Comparison (EL)	
	Pre	Post	Pre	Post
English	44 (37%)	42 (36%)	58 (48%)	57 (47%)
English/IsiZulu	62 (53%)	66 (56%)	55 (46%)	54 (45%)
IsiZulu	12 (10%)	10 (08%)	7 (06%)	9 (8%)
Total Responses	118	118	120	120

Table 4.7 shows that in the Experimental group the prior data for the English language preference indicated that 44 (37%) on the pre-test and 42 (36%) on the post-test out of 118 students; 62 (53%) on the pre-test and 66 (56%) on the post-test preferred IsiZulu/English, and 12 (10%) pre- and 10 (8%) post-test preferred IsiZulu. In the Comparison group 58 (48%) students on pre- and 57 (47%) post-test out of 120 indicated that they preferred English; 55 (46%) on the pre-test and 54 (45%) on the post-test preferred IsiZulu/English, and 7 (6%) pre-and 9 (8%) post-test preferred IsiZulu.

Clearly, there is a slight disagreement in the opinion expressed by students in both groups. The majority of students (53% on pre-test and 56% on post-test) in the Experimental group preferred IsiZulu/English code switching to the use of English language only, while the majority of students in the Comparison group (48% pre- and 47% post-test) expressed a preference for the English language. This shows an increase in preference for the IsiZulu/English code switching for the Experimental group. On the other hand, there was a slight decrease in preference for English only amongst the Comparison group. A minority of students on the pre- and post-test in the two groups preferred IsiZulu to the use of English language and IsiZulu/English code switching. The high expression for English language preference in the Comparison group could be attributed to their lack of exposure to the IsiZulu/English code switching instructional approach. So, in a sense, they had nothing concrete to compare their English language experiences with.

Question 2: Please, explain why you prefer the language(s)

4.4.3.3 Prior and Post Intervention Explanations for English Language Preference

The prior and post intervention explanations for English language preference for the two groups are presented in table 4.8.

Table 4.8: Prior and Post Intervention explanations for English language preference

Statements	Number of Students			
	Experimental (IZECS)		Comparison (EL)	
	Pre	Post	Pre	Post
Makes biology easy to understand	11	9	23	26
Helps find a good job after leaving school	7	7	17	13
Biology examinations are written in English language	5	5	3	2
Helps to communicate with people from other provinces and countries	20	21	11	14
Increases chances of passing biology	1	-	4	2
Total Responses	44	42	58	57

Table 4.8 shows the distribution of explanations given by the respondents for English language preference by both the IZECS and EL groups. For the IZECS group, 20 out of 44 students on pre-test and 21 out of 42 students on post-test expressed their preference for English language, and believed that it would help them communicate fluently with other people. This is substantiated by the following statements:

- *“I prefer biology to be taught in English because when you get job you have to speak English with other people you are working with”.*
- *“English is a national language which many people from other provinces and countries understand in South Africa than some other language”.*

However, for the EL group, the highest loading went to 23 out of 58 students on pre-test and 26 out of 57 students on post-test who expressed their preference for the English language – and gave the reason that English language would make biology easy to understand. This is substantiated by the following quotes:

- *“I understand biology when teacher teaches in English because biology word in English gives knowledge and information”.*
- *“I understand biology in English and it is easy for me to learn in English”.*
- *“It is easy and clear to understand biology in English”.*

Some students on the pre-test 7 (IZECS), 17 (EL) and post-test 7 (IZECS), 13 (EL) in both groups explained that English language would help them find a good job after leaving school. This is indicated in the following statements:

- *“It will increase my chances of getting a good job after passing matriculation examination”.*
- *“So that I can find a good job after leaving school and be able to read things written in English”.*

Moreover, few students on the pre-test 5 (IZECS), 3 (EL) and post-test 5 (IZECS),

2 (EL) explained that biology examinations are written in English language. This is substantiated by the following statements:

- *“I don’t write biology test and examinations in IsiZulu because some biology words cannot be changed to IsiZulu”.*
- *“I have to learn biology in English and understand because biology examinations are written in English”.*

A minority of students on the pre- and post-tests in the two groups explained that the use of the English language would increase their chances of passing biology.

4.4.3.4 Prior and Post Intervention Explanations for IsiZulu/English Code Switching Preference

The prior and post intervention explanations for IsiZulu/English code switching preference for the two groups are presented in table 4.9.

Table 4.9: Prior and Post intervention explanations for IsiZulu/English code switching preference

Statements	Number of Students			
	Experimental (IZECS)		Comparison (EL)	
	Pre	Post	Pre	Post
Makes biology easy to understand	34	40	35	33
Some words in English language will be explained in IsiZulu	18	12	9	11
Increases chances of passing biology	10	14	4	8
No explanation	-	-	7	2
Total Responses	62	66	55	54

Table 4.9 shows a breakdown of the explanations given by the respondents who expressed their preferences for the IsiZulu/English code switching instructional approach. The majority of students on the pre-test 34 (IZECS), 35 (EL) and post-test 40 (IZECS), 33 (EL) in both groups expressed their preferences for this approach in the belief that it would make biology easy to understand. There was a general agreement between the two groups that the IsiZulu/English code switching approach would made biology easy to understand. This is indicated in the following statements:

- *“I don’t understand biology every time with English but the two language will quicken my understanding of biology”.*

- *“I paid attention more when they taught me with English and IsiZulu and this make it easy to understand”.*
- *“I cannot understand biology in English but when teacher mix it with IsiZulu I understand everything he teaches”.*

However, some students on the pre-test 18 (IZECS), 9 (EL) and the post-test 12 (IZECS), 11 (EL) in both groups explained that some words in the English language would be explained in IsiZulu. This is substantiated by the following quotes:

- *“...because there are some hard words in our biology textbooks that should be explain in IsiZulu”.*
- *“There are some words in biology which are difficult in English that IsiZulu will explain better”.*

Some students on the pre-test 10 (IZECS), 4 (EL) and the post-test 14 (IZECS), 8 (EL) in both groups believed that IsiZulu/English code switching would increase their chances of passing biology as indicated in the following quotes:

- *“It will make us pass examination so that we can be a better person after matriculation”.*
- *“It will help me to pass biology in higher grade”.*

A minority of students in the EL group failed to express their opinions on this matter. Conclusively, based on the general opinion of students in the two groups who expressed their preference for IsiZulu/English code switching, it can be inferred that IsiZulu/English code switching was regarded as a good medium for making biology easy to understand.

4.4.3.5 Prior and Post Intervention Explanations for IsiZulu Language Preference

The prior and post intervention explanations for IsiZulu language preference for the two groups are presented in Table 4.10

Table 4.10: Prior and Post Intervention explanations for IsiZulu language preference

Statements	Number of Students			
	Experimental (IZECS)		Comparison (EL)	
	Pre	Post	Pre	Post
Makes biology easy to understand	6	8	7	9
We fail biology because the teacher is using English language	3	2	-	-
No explanation	3	-	-	-
Total Responses	12	10	7	9

Table 4.10 presents the opinions of the respondents regarding IsiZulu language preference as the exclusive medium of instruction for biology at Grade 10 level. It is clear that fewer students expressed their preferences on pre- and post-test for the sole use of the IsiZulu language as a medium of instruction, in both groups. These students explained that the use of IsiZulu language as a medium of instruction for

teaching biology would make biology easy for them to understand – on account of IsiZulu being their home language. This is indicated in the following quotes:

- *“...because IsiZulu is my mother tongue which I understand and speak so I will understand biology better with Isizulu.”*
- *“IsiZulu make me to understand biology because if my teacher is teaching in English he have to explain in IsiZulu for me to understand”*.

Overall, therefore, it may be said that the sole/exclusive use of IsiZulu as a medium of instruction at the Grade 10 level was not supported by the majority of the respondents. Table 4.10 shows that the preference for IsiZulu as an exclusive medium of instruction was made by relatively fewer respondents, in comparison to those who preferred either English only or the IsiZulu/English code switching.

4.5 CLASSROOM OBSERVATIONS

The traditional paper-and-pencil note-taking techniques were used to record all the events that happened during the classroom lessons in both the Experimental and Comparison groups. The Experimental group was made up of 118 students, of whom 65 were female and 53 were male. Two teachers, a male and a female who were degree holders in biology education were involved in the study. The teachers taught the topic gaseous exchange (i.e. breathing system) and diseases that are related to the breathing system using IsiZulu/English code switching. A total of two lessons, each lasting for one hour daily for two weeks were conducted for this group. The teaching methods used were pupil-centred, involving mainly question-answer, and group discussions. The teachers asked questions in the code switching (i.e. IsiZulu/English) mode and the students responded accordingly. The teachers code-switched intrasententially, which served as explanatory, informatory and regulatory functions.

1. Explanatory: The teachers code-switched in presenting the new concepts to the students. They illustrated the breathing system using a biological model constructed from improvised materials, i.e. a balloon as the lung, a straw as trachea, a plastic bag as diaphragm and a two litre plastic bottles as the rib.

They related the facts in the topic to student's experiences (some students demonstrated the symptoms/signs of some of the diseases affecting the breathing system e.g. constant coughing and sneezing). The teachers involved some students as peer-tutors by asking them to demonstrate the mechanism of exhalation and inhalation to their fellow students, using the improvised teaching aids. Examples are given below.

A. Tr: Inhalation *yindlela yokudonsa i* – oxygen *kanti* exhalation *yindlela*

yokukhipha i - carbondioxide (IsiZulu/English code switching).

(Inhalation is the process of breathing in oxygen and exhalation is breathing out carbondioxide) (English).

B. Tr: What *izinkomba* of *sifo-sofuba*? (IsiZulu/English code switching).

(What is the symptom of Tuberculosis?) (English).

Stus: *Njalo-njalo* coughing (IsiZulu/English code switching).

(Constant coughing) (English).

C. Tr: *uSabatha*, go round *igumbi lokufundela* by demonstrating *indlela* of

breathing system *kubafundi bakhe* (IsiZulu/English code switching).

(Sabatha, go round the class demonstrating the process of the breathing system to your fellow students.) (English).

It was clear from the above examples that the teacher used code switching to facilitates the students understanding of the new concepts, enable them to participate

and be active in class activities, improve their way of working together as a group and give them an opportunity to fluently explain themselves.

2. Informatory: The teachers used this type of code switching during the lesson to give information to the students. For example:

A. **Tr:** *Akesibuke* at the breathing *ngezinkomba azibambile uSabatha*. When you *donsa* plastic, *i - ballon liyafutheka* and this is the way *esifaka ngayo umoya*. *Akunjalo yini?* (IsiZulu/English code switching).

(Let us look at the breathing apparatus that Sabatha is holding. When you pull the plastic bag downwards, the balloon relaxes, and this is the way to breathe in. Isn't it?) (English).

This type of code switching is also used to give clarity to the whole class about the breathing system. The teachers also code switched to communicate their opinions/views about the lesson to the students. For example;

B. **Tr:** I believe *wonke umuntu* can demonstrate *lendlela yokuphefumula manje*. *Angikholwa ukuthi* nobody can do it *ngaphandle kokuthi* you can prove it. When *ufika ekhaya*, practise *lokhu esiwenzile* and tell me *okubonile kusasa* (IsiZulu/English code switching).

(I believe that everybody can demonstrate the model of the breathing system now. I do not believe that nobody can do it unless you prove it. When you reach home, practise it and come and tell me what you observe tomorrow.) (English).

3. Regulatory: The teachers used this type of code switching for control, especially when the teachers called for the attention of the students, or used it to regulate the behaviour of the students. For example:

A.**Tr:** Siph, *beka izandla zakho* at the side chest, *bese undonsa umoya* in and

out. What happens *esifubeni sakho?* (IsiZulu/English code switching).

(Sipho, put the palms of your hands at the side of your chest, breathe in deeply and breathe out. What happens to your chest?) (English).

B. **Tr:** Please *thulani umsindo* (IsiZulu/English code switching).

(May you please keep silent?) (English).

At the end of the lesson, one of the teachers expressed his opinion about the study as follows:

“This teaching strategy would have been the best for the teachers and the students if government allowed it. The students failed biology at matriculation examination, not because of the nature of the subject, but because of the language used in teaching them. The students had problems in communicating and writing what they knew in English and this contributed to high failure rates in the examinations. Many of the students were confused and became passive in the class when you used English, but immediately you switched to IsiZulu they became active and participated in class activities.” (Tr contribution, 2007-10-10).

The Comparison group was made up of 120 students, of whom 49 were females, 71 males. Two teachers, a male and a female who were degree holders in biology education taught the same topic using the English language. Two lessons, each lasting for one hour daily for two weeks were prepared for this group. Like for the other group, the teaching approaches used were pupils-centred, questions and answers. The teachers illustrated the breathing system using a biological model constructed from improvised materials, i.e. a balloon as the lung, a straw as trachea, a plastic bag as diaphragm and a two litre plastic bottles as the rib. Some students demonstrated the process of inhalation, exhalation and the symptom of tuberculosis

using body language. The teachers tailored their English to accommodate the students' understanding of the concept. They intentionally used simpler words, often repeating themselves, and gave the students a space of time for answering questions. However, the teachers sometimes unconsciously switched to IsiZulu to maintain contact with some of the students who were not following the lesson. Examples are given below.

Tr: *Amaphaphu ami adinga umoya oswakeme* (IsiZulu).

(You need air and moisture in the lung) (English).

Tr: *Umdlavuza uyawalimaza amaphaphu* (IsiZulu).

(Lung cancer damages the lung) (English).

However, they immediately went back to English for all the teaching, as they were required to do. The teachers asked questions in English and the students responded to the questions in the same language. Examples are given below.

Tr: smoking cigarette causes

Stus: cancer

Tr: which damages the

Stus: lungs

4.6 DISCUSSION OF FINDINGS

This section aims at discussing the findings of this study, which have been presented and analysed above. The hypotheses and indicators that were used to collect data are used as headings for discussions.

The aim of this investigation was to answer the following questions:

- (1) Does IsiZulu/English code switching have any significant effect on the performance of high school students in Grade 10 biology?

- (2) Does IsiZulu/English code switching have any significant effect on Grade 10 biology students' attitudes towards the subject?

In respect of the foregoing questions, two hypotheses were formulated in chapter 1(see 1.6). These hypotheses were tested and revealed the following findings.

4.6.1 The Effect of Code-Switching on Students' Performance in Biology

The first hypothesis of this study is re-stated as follows:

- **H₀**: There is no statistically significant difference in performance of students taught biology using IsiZulu/English code switching versus those taught using only the English language.

It was important to test whether or not the Experimental and Comparison groups were equivalent at the beginning of the study with regard to their understanding of the biology topic involved in the study. In this regard, the Experimental group had a slightly higher mean score of 6.81 than the Comparison group (6.69), the difference was not statistically significant. The finding revealed that there was no significant difference in initial performance between the two groups of students. This indicated that students' existing/prior knowledge of the human breathing system between the two groups was equivalent before the interventions.

However, after the interventions, there was a highly significant difference between the mean performance scores of the IsiZulu/English code switching (Experimental) group (10.78) and the English language (Comparison) group (8.55) in favour of the IsiZulu/English code switching group. This meant that the students taught using the IsiZulu/English code switching performed better than those taught only in the English language. To validate the difference in the performance between the two groups the gain score in Table 4.3 revealed that the Experimental group had a

higher mean gain score of 3.97 than the Comparison group (1.86). This led to the inference that teaching in IsiZulu/English code switching had a significant effect on the students' performance in biology.

Students' achievement is of great importance to every school; it establishes the public opinion of the school, whether good or bad, achieving or under achieving. The literature study has revealed that language and achievement are closely linked and that the use of the English language as a medium of instruction for Black South Africa students contributes a great deal to their poor performance and dropout rates in science subjects (Maree, *et al.*, 2006; Department of National Education, 1995; Maphalala, 1999; Muwanga-Zake 2001; Heugh, 2005). In this regard, Martin (1997:4) suggested a move towards bilingual education involving English language and IsiZulu in Kwazulu-Natal. This is in support of a new Language in Education Policy (1997), which espouses the promotion of multilingual education and bilingual language practices like code switching (Setati, *et al.*, 2002). Moreover, one such strategy identified by Blake and Van Sickle (2001 cited in Vizconde 2006) to solve the predicament of language of instruction is code-switching from the local dialect to standard teaching, which seemed to work well as it improved the academic achievement of students in science and mathematics. Sert (2005) also stressed further that the functions of teacher code switching would influence the academic success of the students. Lemmer and Squelch (1993:41) point out that the language of instruction is a crucial means for the students to gain access to important knowledge and skills, and it can promote or hinder academic success. The researcher, taking the above into account, believes that the instructional approach used for the students in the IZECS group enabled them to perform better than the students in the EL group.

4.6.2 The Effect of Code-Switching on Students' Attitudes towards Biology

The second hypothesis of this study is re-stated as follows:

- **H₀**: There is no statistically significant difference in attitudes towards biology of students taught using IsiZulu/English code switching versus those taught using only the English language.

The initial test to ascertain whether or not the Experimental and Comparison groups had positive or negative attitudes towards biology revealed that most students started the study with positive attitudes towards biology, as defined by a score of 37.5 or higher on the SATBIO pre-test. However, the mean attitudes score of students in the Comparison group 46.67 was slightly higher than that of the students in the Experimental group (45.67), the difference was not statistically significant.

The post-intervention results also showed that the Comparison group had a slightly higher mean score of 46.04 than the Experimental group (45.97), the difference was not statistically significant. This means that the majority of the students maintained their positive attitudes after the treatment. To detect the differences in the attitudes of each of the group after the intervention, the attitude gain score in Table 4. 6 revealed that the Experimental group had a higher mean gain score of 0.31 than the Comparison group (-0.99). This led to the conclusion that the attitudes of students in the Experimental group improved more favourably towards biology after the intervention than those in the Comparison group.

The medium of instruction used in teaching science subjects is an important factor affecting students' attitudes towards science. Language is used to create a good atmosphere between students and teachers and a good climate in the classroom is of great benefit to the students as this could also increase their interest and attitudes towards science. This notion is supported by Mwinsheihke (2002, cited in Brock-

Utne, 2003) who points out that the low level of science teachers' participation and the dull atmosphere in her workshop became evident due to teachers' problem with the English language, and immediately she started switching between Kiswahili and English the working atmosphere was good, lively and conducive for learning.

Setati (1997), on the other hand, observed that the teacher in her study used code switching in the class by switching from English to Setswana in engaging the passive students, to improve pupils' ways of working together in a group, to give clarity and direction to the whole class, to exercise control on how to carry out the task, and to probe further when pupils gave incorrect responses to questions. Moreover, a study carried out by Smit (1996) on language attitudes found positive attitudes among Black students towards the use of other languages (IsiXhosa and Afrikaans) alongside English as media of instruction.

This study found that the students in the IsiZulu/English code switching group interacted freely and spoke among themselves; they became active and participated fully in classroom discussions, and those who had difficulty with biology also got involved. The teachers in this group were more flexible, accommodative of students' understanding of their own language and the use of code switching by the teachers and the students played a role in promoting more positive attitudes towards biology to the students.

4.6.3 Explanations Regarding Preferred Language(s) of Instruction

The findings of this study showed that out of the total sample of 238 in the two groups, 102 students on the pre- and 99 on the post-test expressed their preference for the English language, 117 on the pre- and 120 on the post-test preferred IsiZulu/English code switching, and 19 on the pre and post-tests expressed

preference for IsiZulu. A point that is worth mentioning is that a great number of students in the Comparison group (55 on the pre- and 54 on the post-test) preferred IsiZulu/English code switching to the English language. This suggests that the teachers may have been practising with the use of code-switching in lessons, and this was substantiated by the remark of one teacher in the IZECs group that students had problem in understanding the concepts they were teaching them in English, but the students followed and became active in class when they occasionally switched to IsiZulu. The use of IsiZulu to aid English during teaching and learning suggests that students do not have satisfactory mastery of the English language which is their second or weaker language. Students can thus be described as co-ordinate bilinguals, meaning that they learnt English having acquired IsiZulu.

However, in the Experimental group 21 out of the students that preferred English explained that it would help in communication, while 26 out of the students that preferred English in the Comparison group explained that it would make biology easy to understand. These students thought of English as a universal language that is used in communicating during interviews when they are looking for jobs, in offices and with foreigners or non – IsiZulu South Africans.

In addition, 40 out of the students that preferred IsiZulu/English in the Experimental group and 33 out of the students that preferred IsiZulu/English in the Comparison group explained that the two methods would make biology easy for them to understand. These results show that in the Comparison group, the number of students who explained that IsiZulu/English code switching would make biology easy for them to understand was higher than those who explained that English would make biology easy for them to understand. Meyer (1997) affirms that most African students have not been taught in their mother tongue, instead teachers use different models in

class, such as code-switching, to make them understand the content which is written in English. Rakgokong (1994, in Setati, 2002) argues that using the English language for learning and teaching in a multilingual classroom in South Africa where English is not the first language of the students has a negative effect on the students' "meaning making" and problem solving. Probyn (2001) points out that science and mathematics teachers in her study said they code-switched because the focus was on communicating the concepts in the most comfortable language. As such, the teachers contended that code switching helped students understand everything because it was not a language lesson. Furthermore, they also felt that code switching helped clear up some misunderstanding.

Finally, this study found that the use of code-switching in the science classroom enabled the students to understand the subject matter better. This is in line with the spirit of the Language in Education Policy which supports additive bilingual practices like code switching.

4.6.4 Classroom Observations

Classroom observations showed that the teachers in the Experimental group used code switching to enable the students to participate in the lesson, discuss meaning and improve students' propensity to work together as a group, and allowing other students to assist in the lesson. The teachers also gave clarity of the subject matter to the whole class. Code switching was also used for control purposes, especially when the teachers needed to call for the attention of the students. The teachers appeared to be totally at ease and students were motivated to concentrate on conceptual understanding. This is supported by Setati (1997) who observed that the teacher in her study used code switching to serve three different functions (i.e.

explanatory, informatory and regulatory). Rose and Dulm (2006) focused on specific functions of code switching between English and Afrikaans in a multicultural and multilingual secondary school, where code switching was observed to be used for clarification, confirmation and expansion (to aid teachers and learners in attaining academic goals). A second very important issue in this group was that the teachers used improvised teaching materials to explain the concept of the human breathing system to the students. This is in line with the views of Ajitha and Pushpam (2000) that a low willingness of secondary school biology teachers to use teaching aid- and other activities, such as field-trips, exhibitions, fairs and conducting demonstrations in the classroom to supplement classroom learning - might reduce the learners' attainment of learning outcomes and attitude.

However, in the Comparison group the teachers had problems in conducting the lessons in English only. They had to switch occasionally from IsiZulu to English because students' participation at times became negligible and the teachers switched to IsiZulu to make them to follow and understand. The teachers also used improvised teaching materials to explain the concept of the human breathing system to the students.

4.7 CONCLUSION

This chapter analysed, interpreted and discussed the findings of this study. SPSS, Microsoft Excel and the t-test statistic were used to analyze data and then copied back into Microsoft Word, which was used in typing this dissertation. Tables were used for presentation of both qualitative and quantitative data.

The findings indicated that IsiZulu/English code switching had a significant effect on students' performance in biology and their attitudes towards biology. The

majority of the students pointed out that using IsiZulu/English code switching in teaching biology was the only way that would make them comprehend the lessons better. It seems clear from the findings that the use of code switching in biology classrooms facilitates learning, enables the students to participate in the lesson with confidence, improves their way of working together as a group and helps the students to properly understand the subject. Conclusively, the results of the study showed that IsiZulu/English code switching was better than the use of the English language alone for teaching biology at the Grade 10 level, where the official language of instruction is different from the home language of the students. The next chapter provides a summary of the whole study together with conclusions and recommendations.

CHAPTER 5

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.0 INTRODUCTION

The purpose of this chapter is to provide a summary of the study as a whole, and present a synopsis of how the research problem, research questions, the aim and objectives of the study were addressed. This being the last chapter, it's also important to provide a conclusion, and finally suggest recommendations in areas that still need more attention.

5.1 SUMMARY

The problem, which gave rise to this research, started as a result of the researcher's concern for poor performance of Black South African high school students in mathematics, physical science and biology, compared to other subjects at matriculation examinations. It has been observed that a relatively low number of Black South African students choose physical science and mathematics in high school because of the general unfavourable attitude towards science subjects. Science programmes in universities and colleges have a shortage of high quality Black students and teachers. An important factor for the apparent negative attitudes of students towards science subjects and their poor performance in examinations has been attributed mainly to the medium of instruction used in teaching. The choice of a language that is used by any school is of paramount importance and can affect the academic performance of students.

This study was designed to investigate the effect of IsiZulu/English code switching as a medium of instruction on students' performance and their attitudes towards biology. The aim of the study was to investigate whether high school students in rural communities of Kwazulu-Natal province of South Africa, would perform better in biology when IsiZulu/English code switching was used as a medium of instruction. Specifically, the objectives followed to accomplish the aims of the research were to find out whether IsiZulu/English code switching, as a medium of instruction, had any significant effect on:

- Student performance in biology at the high school level
- The attitudes of high school students towards biology.

More specifically, two research questions were drawn in line with the aims and objectives of the study. These questions are enumerated as follows:

- Does IsiZulu/English code switching have any significant effect on the performance of high school students in Grade 10 biology?
- Does IsiZulu/English code switching have any significant effect on Grade 10 biology students' attitudes towards the subject?

In view of the above research questions, the following null hypotheses were formulated:

H₀: There is no statistically significant difference in performance of students taught biology using IsiZulu/English code switching versus those taught using only the English language.

H₀: There is no statistically significant difference in attitudes towards biology of students taught using IsiZulu/English code switching versus those taught using only the English language.

The research questions posed led to the review of literatures relevant to this study. The study discussed the Language in Education Policy of South Africa, bilingualism or multilingualism in the South Africa context, theories of second language acquisition, code switching, views on code switching, types of code switching, reasons for code switching, functions of code switching and code switching in science classroom. Attitudes of students towards biology, aims of teaching biology and a multi-loop code switching model for teaching and learning were lucidly discussed.

The literature review led to the conclusion that the study should be conducted using both qualitative and quantitative approaches. The two approaches were chosen because of the nature of the data that needed to be collected to adequately address the research questions. Moreover, it was also held that mutual confirmation of data obtained through both approaches would in fact be a good indicator of validity through triangulation. The research design was based on Campbell and Stanley's pre-test, post-test non-equivalent comparison - group design. Altogether, three research instruments were used for data collection. These were: a biology achievement test, a questionnaire and direct classroom observation schedule. The data collected were analysed using Microsoft Excel spreadsheet Version 5, SPSS (Statistical Package for Social Sciences), the t-test statistic and content analysis.

The hypotheses, as listed above, were tested and the findings showed that:

- There was no statistically significant difference in initial performance of the students in both the IsiZulu/English code switching and English language groups in the pre-test biology achievement test, with regards to understanding of the human breathing system. This indicated that students' existing prior knowledge of human breathing system between the two groups was equivalent before the interventions. However, there was a statistically

significant difference in performance of the students between the IsiZulu/English code switching and English language groups in the post-test biology achievement test in favour of the IsiZulu/English code switching group. This indicated that the students in IsiZulu/English code switching class performed better than those in the English language class after the interventions.

- There was no statistically significant difference in initial attitudes of students towards biology between the IsiZulu/English code switching and English language groups. The majority of the students started the study with positive attitudes towards biology. However, although there was no statistically difference between the two groups, the attitudes of students in IsiZulu/English code switching group improved more favourably towards biology than did those of the English language only group after the interventions.

Further to the above, the findings also showed that the majority of the students in both groups preferred using IsiZulu/English code switching to the English language only, as well as the IsiZulu language to teach biology in their classrooms. These findings are in support of the government's Language Policy for Education which provides that the school governing bodies must stipulate how the school will promote bilingualism through using more than one language of learning and teaching. Moreover, the majority of the students that showed preference for IsiZulu/English code switching in the two groups explained that the strategy would make biology easier for them to understand. They strongly recommended that teachers should be using IsiZulu/English code switching to teach biology to further their understanding.

5.2 CONCLUSION

The first step towards solving the problem of poor academic performance in science subjects among Black students is for institutions of learning and government to acknowledge that Black students have problems with the sole language of instruction that is being used to teach them. The language of instructions used for teaching science subjects is an important factor in a student's performance and attitudes towards the subject. Making students to improve their academic performance and attitudes towards science is a process that requires total commitment on the part of the student, the teacher and government. However, it can be done, as it has been demonstrated in this study using code switching as instructional method (see chapter 2.4.2).

To address the problem of the falling standards in the academic performance in science subjects amongst Black students in South Africa, the curriculum should be reviewed. The focus of the new curriculum should be towards additive bilingualism and introduction of an effective strategy, like code switching, which will have the potential to enhance the academic success of the students, based on a model – such as the CODESET model introduced in this study (see chapter 2.4.2). Moreover, since it would be practically impossible to prevent students from the use of code switching at school in interaction with each others, its importance for teaching and learning needs to be looked at with the seriousness it deserves. Code switching is a linguistic tool, which the bilingual people have available to them without being taught. The ability to code switch is very important for both the teacher and student in the learning process within the context of a multilingual and multicultural society like South Africa.

Thus, this research has explored the value of code switching for effective teaching and learning in biology classrooms. The study has shown that code

switching as a teaching strategy facilitates learning. It is effective for understanding the concept of biology lessons; it enhances the students' performance in the subject; improves the students' attitudes towards the subject and their readiness to work together as a group. Code switching was also used effectively for clarification and classroom control.

5.3 RECOMMENDATIONS

The following are recommendations, which can enhance the effectiveness of code switching in biology classrooms.

- *Bilingualism is a meaningful factor in the educational development and transformation of South Africa. School Governing Bodies should implement the Language in Education Policy (1997), which supports additive bilingualism to the benefit of every student. Hence, code switching should be recognised as a resource that facilitates effective learning in high schools.*
- *High school teachers should be encouraged to make adequate use of an additive model of bilingual education like code switching in classrooms in explaining concepts to students so that the students will be able to actively participate in classroom lessons. Enhanced student participation in classroom activities will closely relate to the new national curriculum framework for South Africa, which seeks to move teachers and students away from a teacher-centred, transmission style of teaching and rote learning to an emphasise on student-centred learning approaches and interactive teaching and learning styles.*
- *Students should be allowed to code switch in classrooms between the English language and their home language as they interact with one another, especially when one student code switched to explain certain terms to his/her colleagues for*

clarification. Students may also code switch to assist in conveying the teacher's instructions, or to summarise the lesson in a structured manner to fellow students. This will help the students to develop their communicative and linguistic abilities in a biology class.

- Code switching should be included in the planning of high school syllabi, textbooks and other teaching/learning materials in multilingual settings of South African schools, which cater for bilingual and multilingual students.

5.4 SUGGESTIONS FOR FUTURE RESEARCH

This study has opened up the following important avenues for future research and discussions.

- The scope of this study was on one province of South Africa. Hence, there is a need to extend the area of scope within the province and to cover all the nine provinces of South Africa.
- A larger data sample to generate generalisable results should be explored. The researcher believes that such data can be stored on the internet so as to enable their reuse.
- Research is further needed in high schools on the effect of code switching in other science subjects such as mathematics, physics and chemistry, and also involving other South Africa indigenous languages. This will allow for comparison of results and assist researchers' access to more code switching reports.
- This study could extend to grade eleven and twelve in high schools in all the nine provinces of South Africa, as well as to lower grade levels.

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APPENDICES

APPENDIX A

INTRODUCTION

This test seeks to find out **your knowledge** about gaseous exchange (i.e. breathing system) and diseases that are related to breathing. The findings will not prejudice you in any way. The results will be kept confidential and will only be used for the purpose of this study. Participation is voluntary and you are therefore free to withdraw at any time should you feel inconvenience in any way. However, it will be in the interest of the researcher if you could participate in the study up to the end.

SECTION A: BIOGRAPHICAL INFORMATION

Please, answer the following questions by writing your answer in the spaces provided.

1. Name of school:
2. Research student No
3. Sex: Female..... Male.....
4. Home language:

SECTION B: BIOLOGY ACHIEVEMENT TEST

INSTRUCTIONS: Answer all questions. Four options lettered A to D are provided for each question. Circle the correct option for each question.

1. In people, during inhalation (i.e. breathing in) the.....
 - A. Rib cage is lowered.
 - B. Diaphragm becomes more curved.
 - C. Volume of the thoracic cavity decreases.
 - D. External intercostal muscles contract.
2. Which of the following does NOT occur during Exhalation (i.e. breathing out)?
 - A. Diaphragm relaxes.
 - B. Rib cage is lowered.
 - C. Diaphragm moves back to its original position.
 - D. External intercostal muscles contract.
3. During inhalation (i.e. breathing in) the diaphragm
 - A. Relaxes and becomes flattened.
 - B. Contracts and becomes flattened.
 - C. Relaxes and becomes arched.
 - D. Contracts and becomes hollow.

4. When exhalation occurs during forced breathing, the.....
- A. Pressure in the chest cavity increases.
 - B. Diaphragm contracts.
 - C. Rib cage is lifted.
 - D. Abdominal muscles relax.
5. All the following diseases affect the breathing system except for:
- A. Asthma.
 - B. Tuberculosis.
 - C. Lung cancer.
 - D. Kwashiorkor.
6. When extra mucus is produced inside your nose and this extra mucus blocks your nose and makes it difficult to breathe through, you are said to have
- A. Common cold.
 - B. Hay fever.
 - C. Pneumonia.
 - D. Lungitis.
7. Tuberculosis is a life-threatening disease that damages the
- A. Chest.
 - B. Mouth.
 - C. Lungs.
 - D. Teeth.
8. One of these is a symptom of Tuberculosis
- A. Headache.
 - B. Vomiting.
 - C. High temperature.
 - D. Constant coughing.
9. Tuberculosis is caused by a bacterium called
- A. Tumour.
 - B. Mycobacterium tuberculosis.
 - C. Mesothelioma.
 - D. Bronchitis.

10. The best way to control Tuberculosis is by
- A. Smoking cigarettes.
 - B. Healthy nutrition.
 - C. Alcoholic drinking.
 - D. Taking strong drugs.
11. An allergy which causes the smooth muscles in the wall of bronchioles to contract and makes the tube very narrow is
- A. Hay fever.
 - B. Asthma.
 - C. Lungitis.
 - D. Bronchitis.
12. When a person's air passages close, making it very difficult for him/her to breathe, this is a symptom of:
- A. Asthma.
 - B. Menopause.
 - C. Weight loss.
 - D. Sweating.
13. Smoking cigarettes can cause
- A. Sleeping sickness.
 - B. Fever.
 - C. Lung cancer.
 - D. Tracheitis.
14. When some cells in the lung tissue develop a tumour you have
- A. Kwashiorkor.
 - B. Lung cancer.
 - C. HIV -Aids.
 - D. Hay fever.
15. When the large parts of the lungs are infected and the person is unable to absorb enough oxygen through the lung capillaries, this results in
- A. Hay fever.
 - B. Pneumonia.
 - C. Obesity.
 - D. Common cold

**APPENDIX B: A QUESTIONNAIRE ON ATTITUDES OF STUDENTS
TOWARDS BIOLOGY**

INTRODUCTION

This questionnaire is designed to find out your honest views about biology as one of your school subjects. Please respond to all the questions below carefully and honestly. This is not a test and there are no right or wrong answers. Your responses will be kept strictly confidential, and will only be used for the purpose of this study. Your answers will not prejudice you in any way.

SECTION A: BIOGRAPHICAL INFORMATION

Please, answer the following questions by writing your answer in the spaces provided.

1. Name of School: 2. Research student No:
3. What is your gender? Female..... Male.....
4. What is your home language?
5. What language(s) do you speak at school?
6. In what language(s) does your teacher teaches biology?
7. In what language(s) do you learn biology?

SECTION B: LEARNERS HONEST VIEWS ABOUT BIOLOGY

Please read each of the following statements very carefully and tick the answer which best describes your degree of agreement or disagreement.

The following abbreviations are used: **SA** - Strongly Agree; **AG** - Agree; **DA** - Disagree; **SD** - Strongly Disagree.

ITEM DESCRIPTION	SA (4)	AG (3)	DA (2)	SD (1)
1. Biology is a subject I enjoy very much				
2. I have a good feelings towards biology				
3. I have a real desire to learn biology				
4. I spend much time studying biology				

ITEM DESCRIPTION	SA (4)	AG (3)	DA (2)	SD (1)
5. My biology teacher teaches biology in a clear and understandable way				
6. My biology teacher makes biology very interesting				
7. Learning biology in English makes it easy for me to understand				
8. Learning biology in English increases my chances of passing biology				
9. Learning biology in English increases my chances of getting a good job after leaving school				
10. Learning biology in IsiZulu only will damage my chances of finding a good job after leaving school				
11. Learning biology in both IsiZulu and English would make it easier for me to understand				
12. Learning biology in both IsiZulu and English would increase my chances of passing biology				
13. Learning biology in IsiZulu only would be the best for me				
14. Biology tests and examinations should be written in both IsiZulu and English				
15. Passing biology at matriculation examination can help me find a good career				

SECTION C:

1. In which language(s) would you prefer biology to be taught at your school.....
.....
2. Please, explain why you prefer the language(s).....
.....
.....

Thank you for your cooperation

APPENDIX C

LETTER OF PERMISSION TO THE CIRCUIT INSPECTOR



UNIVERSITY
of ZULULAND

EXECUTIVE DEAN
FACULTY OF EDUCATION

Private Bag X1001
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September 10, 2007

The Circuit Inspector
Department of Education
Mtunzini Circuit
P/Bag X8512
ESIKHAWINI

Dear Sir/Madam

RE: PERMISSION TO CONDUCT RESEARCH – MRS CECILIA OLUGBARA

Mrs Cecilia Olugbara is a Masters student in the Faculty of Education and has now reached a stage to do her field work. She intends to observe the effects of bilingualism (i.e. code-switching between isiZulu and English) versus monolingualism (i.e. use of English only) on both the attitudes and actual achievement of Grade 10 biology learners. It is proposed that the study will involve four high schools – two around *KwaDlangezwa* and two from *eSikhawini*.

Although it is proposed that the study takes place during the first two weeks of the fourth term, it is understood that this will not unduly distract the academic programmes of the proposed four participating high schools as the schools will continue with their scheduled work. The main role of the researcher will be to observe what takes place in relation to her topic of interest. Waiting until next year to collect data will put her in a rather difficult situation.

Participation will be voluntary and anonymous; the test and questionnaire to be used will be disseminated and retrieved by the researcher and the class teachers; and the KZN Department of Education will be acknowledged in the thesis, and a copy of the completed project will be provided.

I trust that you'll look favourably at this request.

Sincerely yours

A handwritten signature in black ink, appearing to read 'Sitwala Imenda'.

Prof. Sitwala Imenda
EXECUTIVE DEAN: FACULTY OF EDUCATION