

**SOME STRATEGIES USED BY ISIZULU-SPEAKING LEARNERS
WHEN ANSWERING TIMSS 2003 SCIENCE QUESTIONS**

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2006

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Submitted in partial fulfilment of the requirements for the degree of Master of Education
in the School of Education, University of KwaZulu-Natal, Pietermaritzburg.

December 2006

DECLARATION

I, Sandile Cleopas Zuma, declare that “Some strategies used by isiZulu-speaking learners when answering TIMSS 2003 science questions” is my own work and has not been submitted previously for any degree at any university. All sources that I have used have been indicated in the list of references.

Signature.....

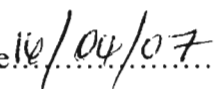
Pietermaritzburg, 2006

I hereby declare that this thesis has been submitted for examination with my approval.

Signature.....

E. R. Dempster

(Supervisor)

Date.....

dedicated to my late brother, Wiseman Xolani

ACKNOWLEDGEMENTS

I would like to record my sincere thanks to:

- My supervisor, Dr. Edith R. Dempster, for the supervision, support and encouragement throughout the research.
- Dr. Vijay Reddy and the Durban HSRC office for the support and data.
- Staff members at the School of Education, Pietermaritzburg, for all the support and patience throughout the research.
- Principals and teachers of the participated schools for allowing me to research with the learners during school times.
- Parents and learners for their consent to participate in the research.
- Back-translators and assistants for so much work done with all the translations.
- Nombulelo N. I. Zondi for encouragement, help with statistical analysis and support since the beginning of the research.
- My colleagues, Janine Kietzka ('Mrs. K'.) and Doras Sibanda for encouragement and sharing of research materials.
- Most of all, my family [Mom, sister (Zama) and my daughter (Sisanda)] for being so supportive of me in many ways.

ABSTRACT

The purpose of this study was to describe the performance of the South African Grade 8 learners in Trends in International Mathematics and Science Study (TIMSS) 2003 science test, to explore the translatability of TIMSS 2003 science items into isiZulu without significant loss of meaning, and to explore the strategies used by isiZulu-speaking learners when answering questions in the TIMSS 2003 test. Thirty six isiZulu-speaking learners were tested using written test questions taken from the science test in the TIMSS 2003. The degree to which a sample of 36 learners represented their understanding of the questions in a written test compared to the level of understanding that could be elicited by an interview is presented in this study.

The findings of this study are presented, interpreted and discussed using Pollitt & Ahmed's (2001) model of question answering process as well as other relevant literature.

The key findings of this study are as follows:

- the South African Grade 8 learners performed very poorly on TIMSS 2003 science test,
- close translation of TIMSS 2003 science items into isiZulu is possible if conducted with care by expert teachers,
- the language of the test had some effect on isiZulu-speaking learners' performance on TIMSS 2003 science test,
- the strategies used by isiZulu-speaking learners when answering science questions included:
 - translating the question into isiZulu before trying to answer it,

- choosing an answer containing a word/term common in the question stem and in the options,
- choosing the answer containing a familiar/unfamiliar word in the options,
- guessing,
- looking at patterns of previous choices,
- ‘picture memory’, and
- ‘general knowledge’.

When Pollitt & Ahmed’s (2001) model of question answering is applied to isiZulu-speaking learners, two ‘new’ phases are introduced.

The findings of this study suggest that language factors are embedded within other factors, importantly, the appropriate level of cognitive proficiency to enable correct answering of science questions. The findings of this study further suggest the need for development of cognitive/academic language proficiency (CALP) in both English and isiZulu languages, or in one of them.

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LIST OF ACRONYMS

CALP	Cognitive Academic Learning Proficiency
C2005	Curriculum 2005
DoE	Department of Education
EFgnL	English Foreign Language
ESL	English Second Language
FET	Further Education and Training
GET	General Education and Training
GETC	General Education Training Certificate
HE	Higher Education
HSRC	Human Sciences Research Council
IEA	International Association for the Evaluation of Educational Achievement
JET	Joint Education Trust
NEPA	National Education Policy Act
NQF	National Qualifications Framework
RSA	Republic of South Africa
RNCS	Revised National Curriculum Statement
SASA	South African Schools Act
SAQA	South African Qualifications Authority
SE	Standard Error
TIMSS	Third International Mathematics and Science Study
TIMSS-R	Third International Mathematics and Science Study-Repeat
TIMSS 2003	Trends in International Mathematics and Science Study 2003

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CHAPTER 1

INTRODUCTION

“An inability of the African nations to develop sufficient levels of mathematics, science and technological literacy will condemn them to a continued existence of dependency and poverty” (Forje, 1998).

1.1 TRENDS IN INTERNATIONAL MATHEMATICS AND SCIENCE STUDY

The International Mathematics and Science Studies, conducted by the International Association for the Evaluation of Educational Achievement (IEA), assess the mathematics and science knowledge of fourth and eighth-grade learners in a range of countries. Trends in International Mathematics and Science Study (TIMSS) provides important information for policy development, to foster public accountability, to allow areas of progress or decline in achievement to be identified and monitored, and to address concerns for equity (Mullis, Martin, Smith, Garden, Gregory, Gonzalez, Chrostowski & O’Connor, 2001).

The aim of TIMSS is to help countries all over the world improve learner learning in mathematics and science by providing educational achievement data collected at the fourth and eighth grades in relation to different types of curricular, instructional practices, and school environments (Mullis, *et. al.*, 2001). TIMSS uses the curriculum, broadly defined, as the major organizing concept in considering how educational opportunities are provided to learners, and the factors that influence how learners use these opportunities. 47 countries

participated in TIMSS 2003 at the Grade 8 level, including six African countries (Egypt, Tunisia, Morocco, Botswana, Ghana and South Africa).

1.2 TIMSS IN SOUTH AFRICA

South Africa has participated in the three most recent cycles of TIMSS at Grade 8 level: the original TIMSS (Third International Mathematics and Science Study) conducted in 1995, TIMSS-R (Third International Mathematics and Science Study – Repeat) in 1999, and the most recent TIMSS 2003 (renamed the Trends in International Mathematics and Science Study).

The Human Sciences Research Council (HSRC) has conducted the TIMSS studies in South Africa. The 1995 TIMSS and 1999 TIMSS-R were conducted by the Group: Education and Training, while the TIMSS 2003 study was conducted by the Research Programme: Assessment Technology and Education Evaluation. For TIMSS 2003, the HSRC tested about 9000 Grade 8 learners in 254 schools from all 9 provinces in November 2002. Within each province the schools were sorted by language of instruction (English or Afrikaans) and school funding (state, state aided or private).

As in all the participating countries, the TIMSS 2003 assessment tests were written in the learners' language of instruction, which was English or Afrikaans for South African learners. The tests were modified for the South African context, including the adaptation of American English to South African English, selecting more appropriate names for the learners, and sometimes modifying the context (e.g. changing dollars into rands). The

assessment tests were also translated into Afrikaans and verified by the IEA verification centre.

1.3 SOUTH AFRICAN TIMSS 2003 SCIENCE RESULTS

South African learners performed poorly in science when compared to all participating countries. The mean scaled score of 244 ± 6.7 is well below the international mean of 474 ± 0.6 . The South African results for science are significantly below the mean scaled scores of all other participating countries, including the five other African countries of Ghana (255 ± 5.9), Botswana (365 ± 2.8), Morocco (396 ± 2.5), Tunisia (404 ± 2.1) and Egypt (421 ± 3.9). Four Asian countries – Singapore (578 ± 4.3), Chinese Taipei (571 ± 3.5), Korea (558 ± 1.6) and Hong Kong (556 ± 3.0) – joined Estonia (552 ± 2.5) and Japan (552 ± 1.7) in demonstrating the best performance in science (see Appendix 1).

The South African TIMSS 2003 study in science showed that there is a difference in performance among provinces. The province with the highest mean scaled score for science was Western Cape with 386 ± 28.1 (see Table 1.1). Northern Cape achieved the second highest mean scaled score with 334 ± 13.9 , followed by Gauteng with 309 ± 22.9 . The performance of these three provinces was significantly above the national mean scaled score and above the mean scaled scores of the other provinces. However, the performance of these provinces was still significantly below the international mean scaled score of 474 ± 0.6 . The three lowest performers were KwaZulu-Natal (227 ± 16.5), Limpopo (191 ± 6.6) and Eastern Cape (190 ± 10.0). The top performing provinces had almost twice the mean scaled scores of the lowest performing provinces.

Table 1.1 Inter-provincial results for science

Province	Science score (SE)
International average	474 (0.6)
Western Cape	386 (28.1)
Northern Cape	334 (13.9)
Gauteng	309 (22.9)
Free State	245 (9.3)
National average	244 (6.7)
Mpumalanga	239 (28.5)
North West Province	231 (21.5)
KwaZulu-Natal	227 (16.5)
Limpopo	191 (6.6)
Eastern Cape	190 (10.0)

Source: HSRC, 2004.

Analysis of performance of learners according to categories reflecting the former racially based departments of education, indicates that learners in the African schools have the lowest mean scaled scores, and learners in the former White schools have the highest mean scaled scores (see Table 1.2). Learners in the former White schools have a mean scaled score just below the international mean. The number of learners from other racial groups attending the former White schools has increased since the TIMSS-R study (Reddy, 2006).

Table 1.2 Analysis of scaled scores by former racially based Departments of Education.

School	Science score (SE)
Former African schools (n = 6 697)	199 (3.9)
Former White schools (n = 741)	483 (17.3)
National average	244 (6.7)
International average	474 (0.6)

Source: Reddy, 2006.

Those learners who took the test in Afrikaans scored higher than learners who took the test in English (see Table 1.3). The learners who took the test in Afrikaans came mainly from the Western Cape and Northern Cape – the provinces that had the highest scores.

Table 1.3 Performance by language of test

Language of test	Science score (SE)
English (n = 7 912)	231 (6.9)
Afrikaans (n = 1 040)	376 (26.4)
National average	244 (6.7)
International average	474 (0.6)

Source: Reddy, 2006.

South Africa's scores reflected the widest distribution of scores in science of all the countries that participated in the study, indicated by very low as well as a few very high scaled scores. The wide distribution is a reflection of the continuing inequalities in education in the South African society (HSRC, 2004).

In 1995, about 80%, in 1999, 73% and in 2003, more than 70% of the South African learners wrote the test in a language that was not their main language and there were indications that this affected their performance negatively. The present study is one of a number probing this topic (Howie, 2001; Reddy, 2006; Dempster & Reddy, in press).

Research evidence suggests that language plays an important role in learners' learning (JET, 1998; Rollnick, 2000) and that learners learning and completing tests in an alternative language may be disadvantaged (Clarkson, 1991), and performance on a test may be affected by lack of proficiency in the language of the test, and also by lack of knowledge of the subject matter being tested (Ellerton & Clements, 1991). Science has a language of its own, and Halliday & Martin (1993) suggest that even first language English speakers recognize scientific discourse as a type of English, but not like the one they commonly use, and are alienated by it. Many African languages do not, at present, have the linguistic capacity for western scientific explanation (Dlodlo, 1999).

The issue around the language policy for teaching and learning has become a sensitive and controversial topic in South Africa. Therefore as part of the ongoing debate of language in the country, it is important to ascertain the relationship between the learners' proficiency in the language of learning and their performance in science and to try and identify any other significant factors influencing learners' achievement in science. The present study focuses on the effect of language on South African learners' performance in TIMSS 2003. It does so by translating a number of TIMSS items into isiZulu, and testing a sample of isiZulu-speaking learners in English and isiZulu. The learners were then interviewed.

CHAPTER 2

SOUTH AFRICAN CONTEXT

2.1 REFORM OF THE SOUTH AFRICAN EDUCATION SYSTEM: POST-1994

South Africa's education system has been in the process of transformation since 1994. However, it is marked by crises at each level of the system (Howie, 2001). Poor communities, in particular, those of rural Africans bear the brunt of the past inequalities. The new government in 1994 faced a tremendous challenge in merging the 19 separate education administration and management systems of the former apartheid government. Initially, the Ministry of Education focused on dismantling apartheid structures and establishing a more equitable basis for the financing of education.

A number of policy papers emerged from government, including the White Paper, Education and Training in a Democratic South Africa: First Steps to Develop a New System (RSA, 1995), the National Education Policy Act (NEPA) (RSA, 1996), The South African Schools Act (SASA) (RSA, 1996), Further Education and Training Act (RSA, 1998), Education White Paper 4 on Further Education and Training (RSA, 1998) and the Employment of Educators Act (RSA, 1998), South African Qualifications Authority (SAQA) Act (RSA, 1995), Curriculum 2005 (C2005) (DoE, 1997).

South Africa's present education system is an amalgamation of 19 separate education departments that merged in 1995 as a result of the change in government. Nine provincial Departments of Education, and one national Department of Education have been

established. Major school reforms have resulted in significant distribution of power to the new provinces and also to schools. Under-resourced and often mismanaged in the past, many of the old departments of education provided insufficient and ineffective education to millions of young people, especially those from the African community (Soudien, 2004). Presently, the nine provincial departments of education are directly responsible for the management and administration of education in schools within their provinces.

Formal education in South Africa has been re-categorized into three levels: the General Education and Training (GET) band incorporates a reception year (Grade R) and learners up to Grade 9, as well as an equivalent adult basic education qualification. The Further Education and Training (FET) band comprises Grades 10 to 12 in school education, out-of-school youth and adult learners. Technical, youth and community colleges, as well as a range of other industry-based and non-formal providers, also fall into the FET band (Soudien, 2004).

The Higher Education (HE) band incorporates a range of national diplomas, certificates and degrees up to and including postdoctoral degrees. The levels are integrated within a National Qualifications Framework (NQF) provided for by the South African Qualifications Authority Act (RSA, 1995) and offered in universities and technikons.

The introduction of the South African Schools Act (RSA, 1996) resulted in the multiple schools model of the apartheid era being reduced to only private (independent) and government (public) schools and encouraged the migration of African learners into the

former Indian, Coloured and White schools (Soudien, 2004). Nonetheless, the gap between affluent and poor schools is still large. The public schools are divided into Section 20 and Section 21 schools, distinguished by, school fees not being compulsory in Section 20 schools whereas Section 21 schools are allowed to determine school fees. Most of the ex-White schools are Section 21 schools, thereby “sifting out” poorer children who cannot afford the fees. What is emerging is that the inequalities in provision of education are increasing and run along class lines rather than racial lines (Howie, 2001).

Funding for public schools originates from the provincial administration derived from a budget that is determined by the national department of education. Only a small proportion of all learners (3%) in South Africa are enrolled at private (independent) schools. The average teacher: learner ratio at 25: 1 in these schools is more favourable than that in government funded schools (which is on average 40: 1); and the ratio can be as low as 14: 1.

A considerable number of schools in South Africa suffer serious shortcomings ranging from poor access to water, telephones and electricity, to the poor condition of many school buildings (HSRC, 1997). In general, the supply of ordinary textbooks is greatly restricted by financial constraints. Reading in African languages also appears to be on the decline (Howie, 2001).

Most teachers in general have a 3- or 4-year teaching diploma from a teacher training college, although teacher training is also offered at post-graduate level at universities and

technikons (Howie, 1999). Due to financial reasons, all teacher training colleges were closed or amalgamated with universities and technikons in 2001.

In addition to the financial reasons for the closure of teacher training colleges, there were also reasons linked to quality, especially regarding mathematics and science. Many South African mathematics and science teachers are not qualified to teach these subjects. Very few teachers of Grade 8 mathematics and science have degrees with a major in the subjects they teach at school. Although 85% of mathematics teachers are professionally qualified, only 50% had specialized in mathematics; and of the 84% of professionally qualified science teachers, only 42% had qualified in science (Howie, 1999).

2.2 OUTCOMES-BASED EDUCATION AND CURRICULUM 2005

During the apartheid era, the curriculum was very prescriptive, content heavy, detailed and authoritarian with little space for teacher initiative. Teaching was primarily chalk and talk, with a strong dependency on textbooks, whilst learners depended heavily on rote learning (Jansen, 1999). In an attempt to depart from this status quo, the government introduced Curriculum 2005 (C2005) which was a huge and ambitious enterprise to radically reform education. C2005 provides the vision of what learning and teaching should be according to society's goals. The underlying principle of this curriculum reform was that of outcomes-based education.

This new focus of learner-involvement required schools and teachers to play major roles in curriculum design: according to learners' experiences and needs. They were also expected

to take major responsibility for the assessment of learners' achievements as both a guide to teaching and learning and also for the purpose of reporting and accountability for the system. School managers are expected to provide professional leadership in curriculum. Provincial departments, especially at the district level are expected to provide professional support and leadership in curriculum, management and quality assurance. All these stakeholders as a result required professional development and training. Finally, systems of quality assurance and accountability had to be established, for answerability purposes to communities and the nation (Chisholm, 2000).

Curriculum 2005 was developed through an extensive process of participation and consultation and was released in 1997 (DoE, 1997). It was driven by principles of outcomes-based education, learner-centred education and the critical outcomes of the NQF. However, C2005 was attacked from many quarters (e.g. Jansen, 1997; Tema, 1997; amongst others). The new curriculum came under fire for several reasons, primarily due to anticipated difficulty of implementing it in a system with so many under-prepared and under-qualified teachers.

Implementation began in 1998 in Grade 1. This was followed by Grade 2 in 1999, Grades 3 and 7 in 2000, Grades 4 and 8 in 2001, and was supposed to be followed by Grades 5 and 9 in 2002. As the critics had warned, the implementation became extremely problematic resulting in the establishment of the Curriculum Review Committee appointed by the then Minister of Education, Professor Kader Asmal, (Chisholm, 2000), the task of which was to refine the C2005 policy documents (DoE, 2001).

A revised set of National Curriculum Statements for Grades R – 9 was published in the second half of the year 2001 for public discussion. The revisions were to simplify the structure, redefine the outcomes, and provide more guidance on progression and content in each learning area. C2005 had moved away from the discipline-based subjects, as they existed in the old curriculum, toward learning areas. The eight learning areas are: Languages, Mathematics, Natural Sciences, Technology, Social Sciences, Arts and Culture, Life Orientation, Economic and Management Sciences (DoE, 2001).

Feedback from the public was received by the first quarter of 2002 and the provinces indicated that the revised statements could be implemented more easily and were clearer to understand. The main differences between the original C2005 documents and the revised versions are that:

- there are fewer curriculum design features, and fewer learning outcomes.
- environmental education has been integrated into the curriculum as has human rights and inclusivity issues
- there are assessment exemplars,
- there is clear guidance to teachers on what to teach at every Grade and phase,
- there are implementation guidelines, and that
- there is a qualification document for GET Certificate (GETC) (DoE, 2001).

Finally, it was proposed that the Revised National Curriculum Statement (RNCS) would become policy at the end of 2001 with the implementation timelines. These timelines

implied that the first learner to come out of the streamlined curriculum would be in 2009. However, there were also suggestions that if schools were able to implement the new curriculum earlier than the timelines, they may be allowed to do so.

The RNCS introduced changes in the science curriculum. Prior to 1994, the core syllabus for science was General Science which consisted of half the syllabus in Biology and the other half in Physical Science (Physics and Chemistry), with a list of content to be taught and learnt in each year. In C2005 and its successor, the RNCS, the science curriculum was redefined as the Natural Sciences, and comprises four content areas: Life and Living, Energy and Change, Matter and Materials and Planet Earth and Beyond. Each one of these curriculum components make up a quarter of the Natural Sciences curriculum. Unlike in the General Science core syllabus where content was listed, the Natural Sciences curriculum for C2005 has 9 learning outcomes and the subject matter is the vehicle for achieving these learning outcomes. In the RNCS, the 9 learning outcomes have been reduced to 3, and content is specified in very general terms for 70% of the teaching time. The remaining 30% is available for extension activities, locally relevant science or local issues (DoE, 2001).

Although C2005 had been implemented in Grade 8 at the time of the TIMSS 2003 tests, some of the terminology linked to this new intended curriculum was widely known amongst the teaching fraternity but not well understood. In practice, many teachers kept the content of General Science and arranged it around the 9 learning outcomes. However, at the time of TIMSS 2003 (November 2002), many schools were struggling to implement

C2005, with differing levels of success. Teachers were having difficulties in adapting to an open-ended curriculum, whereas previously they had a comprehensive syllabus to work from, they also had to cope with a new content area: Earth and Beyond, which had been added to the Natural Sciences (Dempster, 2005, personal communication).

2.3 LANGUAGE-IN-EDUCATION POLICY AND PRACTICE IN SOUTH AFRICAN SCHOOLS

South Africa is a multicultural and multilingual country. Eleven official languages are recognized: Afrikaans, English, isiNdebele, Northern SeSotho, Southern SeSotho, SiSwati, XiTsonga, SeTswana, TshiVenda, isiXhosa and isiZulu. The South African Constitution makes provision for schools to choose any of the official language as the language of instruction. The multi-lingual context provides great challenges to policymakers and practitioners and is a highly politicized issue. The importance of all the South African languages is stressed in policy papers and documents, which promote bilingualism at school level at the very least, but preferring that learners should learn at least three languages. However, most schools have selected English or, to a lesser extent, Afrikaans, as the language of instruction. The language of instruction is a problem in the majority of schools where it is not the mother tongue of the teachers and/or the learners.

Like so much of South Africa's history prior to 1990, different policies were applied to different ethnic groups. The policy in previous Coloured, Indian and White schools has stayed much the same since 1910 with English and Afrikaans (previously Dutch) being the official languages of the Union of South Africa. This meant that either English or

Afrikaans was used as the medium of instruction with the second language being taught as a compulsory subject for all learners.

However, in 1948 when the Nationalist Party came to power, the policy changed and English- and Afrikaans-speaking learners were separated and sent to different schools where their mother tongue automatically became the language of instruction. To date English-medium and Afrikaans-medium schools still exist with a few dual medium schools scattered around the country (DoE, 2001). A small number of these schools introduced African languages that were offered as an optional subject.

Indian schools generally followed the English-speaking schools' example using English as the medium of instruction and offering Afrikaans as a compulsory second language; and in the 1980's started to offer their vernacular languages as part of the school curriculum (Hartshorne, 1992). Coloured schools varied with some opting for English and others for Afrikaans as the medium of instruction and sometimes within one school both languages were used for instruction with learners streamed for this purpose (Howie, 2001).

During the 1940's in the African schools, the vernacular language was a compulsory subject in all primary schools and teacher training colleges and the medium of instruction in all four provinces (Cape, Natal, Transvaal and Orange Free State) was the learners' mother tongue. However, depending on the province, mother-tongue instruction varied from the first two years to four or six years of primary school (Damonse, 1996). After

these initial years, either English or Afrikaans were used as the medium of instruction, with the majority of schools opting for English.

In the 1950's, the Nationalist Party changed the policy and practice of language in education. Firstly African schools were placed under a centralized bureaucracy (Department of Bantu Education) and secondly, the Bantu Education Act of 1953 changed the language policy to extend the use of the African languages and Afrikaans. Mother tongue was to be used for the first eight years of schooling and English and Afrikaans became compulsory subjects from the first year of secondary schooling. This change in policy was immediately met with opposition and became the focus of the opposition to Bantu Education (Hartshorne, 1992). However, it was not until the Soweto uprising in 1976 that this resistance to language policies manifested itself openly.

During the 1970's, the government decided to change the years of compulsory schooling for African learners from eight years to seven years like the other race groups. The independent homelands and self-governing territories all decided (with one exception) to use mother tongue instruction in only the first four years of schooling and only English as the official language of instruction from year five onwards. The consequences of what appeared to be an obvious policy change was that learners had to write their end of primary schooling examination in English or Afrikaans a year earlier with less exposure to these languages (Rollnick, 2000).

By mid-1970's, the official policy was that half the subjects were to be taught in English and half in Afrikaans. This policy change for junior secondary and senior primary schools culminated in the violence famously known as the Soweto uprising of 1976 and the Minister of Education reverted the dual medium policy to a single medium of instruction to be decided by the learners' parents according to the Education and Training Act of 1979 (Rollnick, 2000).

In 1980, the Cabinet instituted a commission to conduct an in-depth investigation into all facets of education in South Africa. One of the issues included in the investigation was that of the language issue. The commission offered three options:

1. start immediately with the medium of instruction to be used in the long term;
2. a sudden transfer from the mother tongue instruction to a second language medium of instruction or
3. a graduated transfer from the mother tongue instruction to a second language medium of instruction (Howie, 1999; Rollnick, 2000).

Although the report was submitted in 1981, the government chose to delay the implementation of the recommendations until 1990.

The 1990's saw a multitude of policy documents on language-in-education. In general, the policy documents promote the concepts of bilingualism and multilingualism. The country's constitution asserts the importance of creating conditions for both the development and promotion of all official South African languages in terms of equal use. The White Paper on Education and Training (DoE, 1995) states that the language in

education policy allows for the learner to have the right to choose their language of instruction where it is reasonably practical. The South African Schools Act (RSA, 1996) stipulates that the school governing bodies are required to announce what the schools' language policy is and how it will promote multilingualism through various means.

The difficulty of this is that schools find themselves in a quandary as to how to introduce such changes when cuts in the education budgets, frozen posts and redeployment of teachers have left little space for schools to enter into new course directions. The absence of a concrete implementation strategy by the government means that in all likelihood, past practices will continue and the goal of a multilingual society will disappear (Howie, 2001).

One of the most noticeable changes after 1994 was the dramatic change in the demography of learners at previously White, Coloured and Indian schools. There has been a movement of Coloureds and Indians into schools that previously catered for White English-speaking learners. African-language speaking learners from the townships poured into schools previously designated Coloured, Indian and White. Nevertheless, African children studying in schools previously designated Coloured, Indian or White constitute only 7% of the total school-leaving population of South Africa (van der Berg, 2004). There has been hardly any movement of learners in the opposite direction (Soudien & Sayed, 2003).

In areas like the Gauteng province where schools often cater for learners of all official language groups and foreign students, the diversity of languages is vast, and many learners do not have an obvious primary language nor have the desire to identify with any one

linguistic group (Brown, 1998). Instead many learners speak a number of languages and in some townships develop a dialect made up of words from a variety of African languages, English and Afrikaans. However, it is also true that they may not be fluent in all of these languages or even truly fluent in even one language (Howie, 1999).

In predominantly monolingual areas like KwaZulu-Natal, learners in rural areas seldom speak English or Afrikaans in out-of-school and home environments. In these areas English is a foreign language, whereas it is a second or additional language in most urban areas (Soudien & Sayed, 2003). The most recent language-in-education policy is mother tongue instruction for the first four years of schooling, followed by a switch to the language of learning and instruction chosen by the school governing body, usually English (DoE, 2001).

While the learner demographics of certain South African schools may have changed dramatically over the past ten years, the racial profile of the teachers in most schools is largely unchanged (Soudien & Sayed, 2003). Most of the teachers in former African schools are African, and likewise for previously Indian, Coloured and White schools. Thus, African learners who move from African schools to other schools are likely to be taught in English by teachers for whom English is a first or second language. African learners who remain in African schools are likely to be taught by African teachers for whom English is a second or third language (Dempster and Reddy, in press).

In the vast majority of the South African schools, English is the official language of learning and teaching despite the fact that the common language for most learners and teachers is not English. Effective instruction is largely dependent on communication under-pinned by competence by both teachers and learners in the language of instruction (Rollnick, 2000).

The results in Table 1.3 showed that the language of the TIMSS 2003 test is related to learners' science achievement, with learners who wrote the test in Afrikaans achieving higher scores than learners who wrote the test in English. More than 70% of the learners who wrote the TIMSS 2003 test in English were English second language (ESL) speakers. The results in Table 1.2 showed that learners from the former White schools, where English is taught as a first language, achieved scores which were more than twice the scores achieved by learners in the former African schools, where English is taught as a second (or even third) language.

This chapter has established the historical and current context in which the TIMSS 2003 study was conducted. It is a context of inequality in educational provision, compounded by conflicting language policies which further disadvantaged non-English or non-Afrikaans-speakers. The period 1994 – 2002, during which three TIMSS studies were conducted, was also characterized by radical transformation in the school curriculum, which is still ongoing. The next chapter will look specifically at the challenges faced by second language learners in the learning of science, though some of the work cited has been done with first language learners.

CHAPTER 3

LEARNING SCIENCE FOR ENGLISH SECOND LANGUAGE LEARNERS

3.1 INTRODUCTION

'Language is a system of resources for making meanings...any particular concept or idea makes sense only in terms of the relationship it has to other concepts and ideas...' (Lemke, 1990).

Language is one of the most important ways by which ideas are communicated. At one level, the importance of language to the learning of science has long been recognized: in order to understand science subjects, learners need to become familiar with a wide range of specialist vocabulary. Understanding science is more than just knowing the meaning of particular words and terms, it is about making meaning through exploring how these words and terms relate to each other. For this to happen, teachers and learners need to be able to communicate effectively with each other, and this places language at the heart of science teaching (Rollnick, 2000).

Rollnick (1998) has commented that decisions concerning the use of language in the classroom are frequently based on political grounds rather than based on findings related to best practice in education, and, further, the implications of these decisions may reach far beyond the classroom.

With 11 official languages in South Africa recognized by the New Constitution of South Africa, the language of instruction is a complex and sensitive issue. Faced with the overwhelming problems of reconstructing the education system, language in education has been somewhat neglected (Webb, 1999).

Most South Africans speak at least two languages, but many African people speak four or five languages including English and Afrikaans. However, it is unusual for many native English or Afrikaans-speaking people to speak African languages fluently (the exceptions are often those people who have grown up in rural areas). Most African teachers are able to converse in several languages, but cannot teach fluently in any one of them. Alternatively, many native English or Afrikaans-speaking teachers cannot speak an African language and therefore cannot communicate and clarify concepts in a learner's main language when this is an African language (Rollnick, 2000).

This chapter looks specifically at the challenges faced by second language learners in the learning of science, though some of the work cited has been done with first language learners. This chapter examines some recent findings related to the learning of science through a second language (3.2), followed by a look at the research on the effect of bilingualism on science learning (3.3). Next, some perspectives on the place of culture in relation to language are provided (3.4) and the research on language and teaching approaches is appraised, particularly the strategy of code switching (3.5).

3.2 SECOND LANGUAGE LEARNING OF SCIENCE

Brodie (1989) states that encouragement to develop first language skills is necessary if the learner is to develop competence in a second language, and if the learner receives instruction in a foreign language without simultaneous support in his or her mother tongue, both languages as well as the learner's cognitive development and school performance will suffer.

Rollnick (1998) pointed out that second language (L2) learners of science fall into two broad categories:

- those who have come to a country having received part or all of their schooling in another language. These learners are usually referred to as learning English as a Foreign Language (EFgnL), where English is the language of instruction; and
- those who are citizens of a multilingual country where the language of official communication and economy is a former colonial language appropriated for social use and who are “officially” taught at school through the medium of that language. These learners are usually referred to as learning English as a Second Language (ESL) (Rollnick, 1998).

For both EFgnL and ESL learners, the problems of learning science through a second language are often compounded by other factors contributing to disadvantage, such as poor education (Garraway, 1994).

Whilst researchers still disagree on when and how learners should be introduced to or learn a second language, there does seem to be consensus that additional languages enrich learners' own main language and contribute to the other important societal goals such as understanding different cultures. Nevertheless, when learners are compelled to learn through a second language, this can become a serious obstruction to the learners' learning process (Rollnick, 2000).

In South Africa the majority of children in higher primary and secondary schools speak an indigenous language at home, but are taught through the medium of English at school, by teachers who are not home-language speakers of English. If learners do not speak English at home, but are taught through the medium of English at school, the skills of the learners' main language and the additional language are not well developed. This means that their spoken fluency and writing skills are limited and are insufficient for the learners to handle subject matter in English (Rakgokong, 1994). Heugh (1999) claims that by the end of four years of home language instruction, accompanied by English as a subject, (as is current practice in South Africa), learners have acquired a vocabulary of about 800 English words, far short of the 5000 she considers to be necessary to cope with English as a medium of instruction.

Berry (1995) suggested that fluency in the second language does not guarantee success in science. Therefore whilst learners with some conversational-level ability in a second language may appear to be ready for instruction in a second language, this is not necessarily the case. In essence, learners at this level may fail to understand the curriculum

content and will therefore fail to engage in higher order cognitive processes in the classroom.

It should also be borne in mind that language problems in science are not confined to second language learners. Science has a language of its own. Halliday & Martin (1993) suggest that even first language English-speakers recognize scientific discourse as a type of English, but not like the one they commonly use, and they are alienated by it. Garraway (1994) points out that the difference between everyday language and science terminology also leads to first language speakers learning a new language when learning science.

Lemke (1997) maintains that learning science is learning to participate in a new social practice. The learning of a new language is itself part of another social practice, so a learner learning science through a second language is trying to become initiated into two social practices at once.

The most immediately apparent language problem in science is the vast technical vocabulary with which learners need to become familiar in order to be able to make sense of what they hear, read and have to use when writing in their lessons. As Wellington & Osborne (2001) note, concept words pose the most problems: first, because they are abstract; second, because language development in science results in some words changing from naming words to concept words; and third, because some may have both everyday and scientific meanings.

While the work described above has confirmed that the language of science can pose difficulties for learners, other research has suggested that the problem is less to do with the technical vocabulary of science than might be expected. In a classroom-based study by Barnes, Britton & Rosen (1969), the observation of the lessons revealed that, when compared with other subjects, not only did science lessons contain the highest proportion of specialist words, but that science teachers also drew extensively on a specialist vocabulary that was not explained to learners – “specialist vocabulary not presented” (teacher assuming that terms would be understood by learners).

Barnes *et al.* (1969) also use the term “language of secondary education” to describe words one would expect to find in textbooks and other official documents which set out to discuss topics in an impersonal manner, but which would not normally be encountered except in schools. “Specialist vocabulary not presented” and “the language of secondary education” all add to the difficulties faced by learners in science lessons.

3.3 BILINGUALISM

Although much of the above argument suggest that being a second language speaker of the language of instruction in school is necessarily a disadvantage, it is important to realize that bilingualism can be an advantage in concept acquisition, as it helps the learner to see different representations of the same ideas (Swain & Cummins, 1979; Opoku, 1983). There has been extensive research internationally on the effects of bilingualism. There is overwhelming support in the literature for either home language instruction or bilingual

programmes with strong home language support extending for a substantial number of years into schooling (Cummins, 1999).

A number of methodological problems have also been reported (Clarkson, 1992; JET, 1998; amongst others). These include the confounding of bilingualism and socio-economic status, the degree of bilingualism, the degree of difference between two languages, and the age at which the second language is learned (Garden & Livingstone, 1989).

Research on subtractive bilingualism (use of L2 as the language of instruction without development of L1) programmes in African schools revealed that not only did learners resort to rote-learning content that they did not understand, but that learners also failed to achieve adequate levels of academic language proficiency in both their main language and English (Clarkson, 1992). Dawe (1983) found that whilst English second language may be a problem in science, reasoning factors like linguistic distance and culture are also important in bilingual learners' achievement.

3.4 LANGUAGE AND CULTURE

The term culture generally refers to a social heritage – those characteristic behaviours which are transmitted from one generation to the next. While the notion of culture includes collective mental artifacts such as symbols, ideas, beliefs and aesthetic perceptions, it also embodies the distinctive forms of discourse (Mousley & Clements, 1990).

In science education, cognitive ideas have been supported by the “world view theory” of Cobern (1996), who maintains that traditional theories of conceptual change are flawed, because a concept or belief will only have force in a learner’s belief system if it fits in with his or her world view. Jegede (1995) also provides a cognitivist theory which he calls “collateral learning”. This type of learning results, in Jegede’s view, when duality in thought and actions are created in the schema of learners, within a resilient prior or indigenous knowledge framework. Children draw on an appropriate belief/cognitive system in the school environment and a different system within the social context of the community.

If language is indeed the expression of culture, then it is particularly important and necessary to look at strategies which have been used by teachers and learners where there is a need to use more than one language in the classroom.

3.5 CODE SWITCHING

Evidence and beliefs about best practice in science teaching methods are often developed in first world and first language teaching situations and then simply transferred to economically disadvantaged, developing country and second language contexts. The ambivalent status of English referred to in the introduction has made the decisions about medium of instruction in schools a thorny one.

On the one hand, English is regarded as indispensable for communication of science internationally and for explaining clearly the concepts of science. Many languages, it is

argued, do not possess the vocabulary needed for scientific concepts and produce inappropriate associations when coined words are used (Isa & Maskill, 1982). Furthermore, Strevens (1980) stresses the importance of non-science-specific words, such as logico-grammatical items. He claims that those who cannot handle such items in English, will not be able to handle science in English.

On the other hand it is acknowledged that expecting learners to learn a new and difficult subject through the medium of a second language is unreasonable, giving them a double task of mastering both science content and language (Rollnick, 2000). As has been seen above, it is frequently the most disadvantaged learners who are given this double task. It is worthwhile mentioning, though, that Singapore appears to have mastered the teaching of science in a second language extremely successfully (not only second language, but a language that uses a completely different set of characters from English).

Fradd & Lee (1999) found that the teachers who share the language and cultures of the learners often bring to the teaching situation styles of teaching which are more appropriate to learners' needs. Officially, the language of instruction in the vast majority of South African schools is still English or Afrikaans from Grade 5 onwards, although it is common practice for teachers and learners to switch between these and African languages.

Code switching refers to switching between two languages where the speaker has some measure of competence in both languages (Rollnick, 1998). In South Africa, code-switching applies to situations where the teacher switches between English and the home

language of learners in order to ensure that learners grasp the concepts (Rollnick, 2000; Setati, Adler, Reed & Bapoo, 2002). This phenomenon has been observed at all levels of education, from early primary school to teacher training level.

An example at the primary level is provided by Martin (1999) who considers the learner's home language to be potentially the most valuable resource in the classroom. In his study he saw how two languages were used to provide contexts for meaning in two classrooms. Switches between languages were very clearly indexed by the teacher and were used to explain difficult concepts, at one end of the spectrum, and chorus-type gap filling answers at the other end.

At the secondary level, Adendorff (1996) looks at switches between isiZulu and English in South African classrooms. He views these switches as "guiding the participants' interpretations of academic goals and intentions as well as their interpretation of social relationships in the classroom" (p 406). In the Biology lesson, the switches to isiZulu provide contextualization cues which are semantically empty but alert learners to the fact that a key term is about to be introduced for the first time.

Among South African teachers, Rutherford & Rollnick (1996) obtained some interesting insights into code switching through the taping of groups of SiSwati-speaking pre-service teachers engaged in experimental work. Transcripts of mainly SiSwati group discussion were examined in an attempt to determine why changes to English occurred. In some cases

language into which the word is being translated. Minimizing the reduction in freedom for the original linguistic symbols is one of the challenges and responsibilities which the translator undertakes and this is done by a process where the translator brings the two languages as close as possible – s/he minimizes the linguistic distance between the two languages, rather than highlighting it (McNaught, 1994).

Research by McNaught (1991) suggests that there are considerable problems around constructing meaning at the interface between isiZulu and English. Despite this, Dlodlo (1999) argues strongly for the development of Nguni (isiZulu, isiXhosa, isiNdebele and SiSwati languages) scientific words in order to enable the learning of science through the medium of these languages.

English language proficiency has been found to be a contributory factor in the South African learners' achievement in the TIMSS studies (Howie, 2001, HSRC, 2004). The present research studies the isiZulu-speaking learners who participated in the TIMSS 2003 in the province of KwaZulu-Natal, particularly isiZulu-speaking learners' difficulties when answering science questions in English. The results will contribute to the study of the relationship between language and learning in a bilingual situation such as we find in KwaZulu-Natal.

The aim here is not to review second language teaching but rather to examine the “language position” in which the isiZulu-speaking learner finds her/himself in the present South African multilingual classroom, especially in science education. The research

evidence will draw attention to the fact that the isiZulu-speaking learner may be at a disadvantage in a traditional science test that does not take heed of his/her language background.

This study acknowledges that language is not the only factor affecting learners' performance. Damonse (1996), for example, investigated science achievement scores of isiZulu-speaking and English-speaking learners at a high school where the language of teaching and learning was exclusively English. The isiZulu-speaking learners' performance improved on some but not all questions when the test was conducted in isiZulu.

The present study explores, in more depth, some of the difficulties experienced and strategies used by isiZulu-speaking learners when answering science questions. It does so by employing focus-group interviews with learners, in addition to formal tests conducted in English and in isiZulu. My own experience of being an isiZulu speaker and also a science graduate places me in a position where, unlike McNaught (1991) and Damonse (1996) I have first-hand experience of teaching and learning in an African school, and am able to provide an "expert's" translation of questions into isiZulu. I am also able to conduct interviews in isiZulu, thus eliciting more information from the learners than would be the case if interviews were conducted in English by a non-Zulu person.

CHAPTER 4

RESEARCH DESIGN AND METHODS

4.1 INTRODUCTION

In this chapter, the issues related specifically to the design of the study are described and discussed. Firstly, the research focus is described (4.2), followed by the theoretical framework (4.3) and research questions (4.4). Thereafter design issues related to the sample, data sources, and procedures followed are discussed (4.5).

4.2 RESEARCH FOCUS

The aim of this study is to describe the performance of and explore the strategies used by isiZulu-speaking learners when answering questions in the TIMSS 2003 test. Personal experience and anecdotal evidence from undergraduate and postgraduate university students confirms that learners who lack confidence and proficiency in English translate questions into their home language before they attempt to answer the question. Where a written answer is required, they compose the answer in their home language and translate it into English before answering. The first hypothesis tested is that important meaning is lost when test items are translated into isiZulu, and when answers are translated into English. The work of McNaught (1994) and Rutherford & Nkopodi (1990) amongst others, suggests that loss of meaning, particularly with regard to prepositions and logical connectives, occurs when science is translated into indigenous African languages. This hypothesis was tested by “expert” translation of items into isiZulu, by myself, followed by back-translation from isiZulu to English by isiZulu-speaking senior science students, without reference to

the original English version. The prediction was that back-translations would differ from the original English in significant and important ways that affect the meaning of the question.

The second part of the research describes the performance of the South African isiZulu-speaking learners in the TIMSS 2003 science test, and the performance of 36 isiZulu-speaking learners on a selection of TIMSS 2003 science questions. The learners wrote the isiZulu version of the test and the English version of the test on the same day. The hypothesis tested here was that learners would obtain higher scores when tested in isiZulu than in English, if the main reason for poor performance in TIMSS 2003 was the language of the test. Tests were followed by interviews with learners, where their strategies were probed in more detail, and the reasons for their choices were explored.

4.3 THEORETICAL FRAMEWORK

In order to address these objectives of the study, it is clear that the theoretical framework for this research must allow for developing research questions that explore linguistic factors influencing isiZulu-speaking learners' achievement in science within the context of South Africa described previously.

Two theoretical models were influential in informing the theoretical framework of this research. The first is that of critical research theory. This theory provides an orientation to practice through enabling individuals to understand the relations among value, interest and action, and, to paraphrase Marx, "to change the world, not to describe it" (McNaught,

1994). Within a critical research framework the context needs to be explored to facilitate a clearer understanding of science concept development in general and particularly in the developing country context.

The theoretical perspective on learning and knowledge which is congruent with the critical perspective is that of constructivism. Current constructivist views of learning see individual learners as building up personal, internal conceptual maps as a result of interactive processes between each learner and his/her environment. Learning occurs as an active construction of meaning as a result of reflection on experiences (Driver, 1983).

Often constructivism is seen as being in opposition to the behaviourist learning theory and sees the individuality of learners and the uniqueness of their previous experiences as being ignored. The present study will adopt a framework where knowledge (in this case scientific knowledge) is negotiated and individually constructed within a social context. The social context explored in this study is the learners' interaction with science at the interface between English and isiZulu.

The second model is that of question answering process, derived by Pollitt & Ahmed (2001); see Figure 4.1. This model consists of six phases from learning the subject through to writing the answer. It can be used to form an understanding of the psychological processes that occur when a student answers a particular exam question, and so to anticipate the sorts of answers learners will give to a question.

0	Learning the subject
1	Reading the question
2	Searching the memory
3	Matching question to memory
4	Generating an answer
5	Writing the answer

Figure 4.1 Model of question answering

Source: Pollitt & Ahmed, 2001

In Phase 0 learners learn the subject before the exam; then in Phase 1 the learner reads the question forming a mental representation of the task. Since TIMSS assesses general scientific literacy, there is no particular content that is learned before the exam, therefore phase 0 does not apply. In Phases 2, 3 and 4 learners search their mental representation of the whole subject, a rather fuzzily defined subset of their memory, looking for relevant concepts to match those in their representation of the question, and use these to generate an answer. In Phase 5 the learner's mental representation of the answer is turned, in most cases into a string of words (Pollitt & Ahmed, 2001).

The order of the phases is, to some extent, logically necessary. However, Phases 2-4 are likely to occur rapidly, automatically and pre-consciously. In some questions these phases will occur simultaneously or there will be repeated cycles of Searching, Matching and Generating.

The model is a generalization and will be different for different question types. In several familiar question types, such as multiple choice, there may be no discrete phase of generating the answer. Faced with a multiple choice answer set, learners will very often identify an answer during the Searching and Matching phases and the Generating phase will not occur; the Writing phase, in this case, is simply ticking an answer. The Generating phase will vary for other question types: for problem solving tasks there will be an explicit phase of generating an answer, while for essay answers the Generating phase is intimately bound up with the Writing phase.

4.4 RESEARCH QUESTIONS

The main research question in this research is: *What strategies do Grade 8 isiZulu-speaking learners use to answer selected TIMSS 2003 science items?* A sub-question that this research tries to answer is: *Can TIMSS science items be translated accurately into isiZulu, without significant loss of meaning?*

4.4.1 PHASE 1: Descriptive research questions

Phase 1 is a descriptive phase of this study driven by the central research question: *What was the performance of the South African learners in TIMSS 2003 science test?* The main guiding research questions in phase one are:

1. Who were the South African participants in TIMSS 2003 study?
2. How did South African learners perform in the TIMSS 2003 science test?
3. How do learners from different language groups perform in the science test?
4. How did KwaZulu-Natal isiZulu-speaking learners perform in the selected TIMSS

2003 science questions?

To answer these questions, a set of South African learners who participated in the TIMSS 2003 study was extracted from the TIMSS 2003 database (n = 8 952), a sub-set of KwaZulu-Natal learners attending schools originally designated for the African population was extracted from the set of South African learners who participated in this study (n = 1 632). A selection of 12 items (see Appendix 2) was extracted from the TIMSS 2003 Released Set of Science items.

4.4.2 PHASE 2: Exploratory analysis

This phase of the study was divided into two parts: the first part estimated how much change in meaning has occurred when the translated question items were back-translated into English without reference to the original version. Two levels of expertise were tested: it first presents a “best-case-scenario” where the released set of TIMSS 2003 science items were translated into isiZulu by an isiZulu-speaking science graduate who is also competent in English, in this case the researcher. The translations mimicked the strategies that would most likely be used by most isiZulu-speaking teachers and learners. This included incorporating English terminology in the questions, rather than providing a direct translation into “pure” isiZulu. This was applied particularly where the English term was more accurate than the isiZulu term and where there were no direct translations of the terms from English into isiZulu, e.g. *i-nervous system*, *i-species*, *ama-organism*, etc. This strategy is commonly used by isiZulu-speaking teachers in classes where the majority of learners are isiZulu-speakers.

The next level of expertise was to estimate how much change in meaning has occurred. The isiZulu translated questions were back-translated into English by three isiZulu-speaking science post-graduates without any reference to the original English version (“blind” back-translation). If McNaught (1994) and Dlodlo (1999) are correct, we predict that significant changes in meaning will arise when the English versions of TIMSS items are translated into isiZulu, and then back-translated into English.

This was followed by selecting a group of isiZulu-speaking learners, and testing them on a set of TIMSS items in both English and in isiZulu. This was an attempt to isolate the effects of language from the effects of knowledge on understanding reasons for South African learners’ poor performance in TIMSS 2003.

The second part of this phase was driven by the central research question, namely *what are the strategies used by isiZulu-speaking learners when answering selected TIMSS 2003 science questions?* A number of specific research questions guided the research in this part:

1. How did the research sample group perform in the selected science questions?
2. How did isiZulu-speaking research sample’s performance compare with the equivalent TIMSS sample’s performance in the selected items?
3. How did the research sample perform in the isiZulu version test of selected science questions?
4. How does the performance of research sample in the English version of the test

- compare with the performance in the isiZulu version?
5. What strategies do isiZulu-speaking learners use when answering the selected science questions?

4.5 SOME DESIGN ISSUES

4.5.1 Sample

The descriptive analysis phase of this research studied the sample of South African learners as analyzed in the TIMSS 2003 International Report (n = 8 952), and in more detail the sample of isiZulu-speaking learners in KwaZulu-Natal who participated in the TIMSS 2003 study (n = 1 632). The exploratory analysis phase of this research was conducted at three different schools where all learners and teachers were isiZulu first language speakers and English was taught as a second language. Two of these schools were ex-Department of Education and Culture (DEC) schools: one was on the farm near Eston, and the other was on a rural area in Edendale. The third school was an ex-Department of Education and Training (DET) school (better resourced) on a township in Imbali.

The question items used were designed for Grade 8 learners and since this phase was conducted at the beginning of the year, February, learners who had passed Grade 8 in the same school in the previous year, i.e. the current Grade 9 learners, participated in this study. TIMSS 2003 was conducted in November, 2002, at the end of Grade 8 year, therefore, testing Grade 9 in February made fair comparison than testing Grade 8 in February.

Consent was obtained from the Department of Education & Culture, the school principal, the teachers, the learners and the parents or guardians of the selected learners. In each school, a list of Grade 9 learners was compiled in alphabetical order according to learners' surnames. A total of 12 learners per school, i.e. 36 learners in total, were randomly selected to participate in this study. The learners were selected by throwing a dice and the number appearing on the dice corresponded to the first number selected from the learners' list. The other learners were selected by dividing the total number of the learners in the list by 12 to get an interval "n". Every "nth" learner was selected for the study, giving a total of 12 learners from each school.

4.5.2 Instruments

The instruments used for the descriptive phase of this study included the TIMSS 2003 International Science Report and the report for South Africa (Reddy, 2006), in which the sample and performance of the South African learners who participated in TIMSS 2003 science study were described. Results for individual items were extracted from the TIMSS 2003 database (HSRC, 2004).

The instruments used for estimating the changes in meaning when English questions are translated into isiZulu, and then "blind" back-translated into English, included all the TIMSS 2003 released set of Life Science items, excepting the last six items, which were not covered in the South African curriculum. One additional question item was excluded in the study to reduce the set to 20 items. Translation of the original questions was carried out by the researcher, and translations checked by a second isiZulu-speaking science graduate.

Back-translations were done by three senior science students who are all isiZulu-speakers, but are studying science in the medium of English. The back-translators were encouraged to provide the most likely alternatives for each question, e.g. *amandla = power/energy*.

The second part of the exploratory phase used science items extracted from the TIMSS 2003 released set of science items. The 12 items consisted of eight multiple choice questions and four free-response questions. The researcher personally administered the tests. The tests were completed in two sessions on the same day, with a break in between. In the first session, learners were randomly selected so that six learners completed the English version test first (see Appendix 3) and the other six learners completed the isiZulu version test first (see Appendix 4). At this stage no discussion of the test or answers took place between the researcher and the learners.

In the second session, learners who had completed the English version test in the first session completed the isiZulu version test and learners who completed the isiZulu version test in the first session completed the English version test. The mark schemes used were consistent with those used for the TIMSS 2003 study. All scripts were marked and coded by the researcher with help from an isiZulu-speaking science graduate.

On the next day, learners were arranged into three groups, with each group consisting of four learners. Each group of learners was interviewed on four selected question items from the original English version test, to identify the problems they experienced and the

strategies they used in answering these questions. Each set of questions consisted of two question items testing conceptual understanding, one testing factual knowledge, and one testing reasoning and analysis. Thus, across the three schools, three interviews were conducted on each question item. The interviews were recorded on audio-tapes. The language used in the interviews was mostly isiZulu with some code switching into English. The transcribed conversations were translated into English by the researcher and cross-checked by an isiZulu-speaking science post-graduate student (see Appendix 5).

4.5.3 Statistical testing

Mean scores for the TIMSS 2003 sample were compared with the mean scores obtained by the research sample by means of a t-test. Similarly, the mean scores obtained by learners in the isiZulu version were compared with their scores on the English version by means of a paired-samples t-test.

Patterns of selection across the four or five alternatives on each MCQ were compared by means of chi-squared (χ^2) goodness-of-fit tests (Siegel & Castellan, 1989). Comparisons were made between the TIMSS 2003 sample and the research sample on the English version of the test, and between the English version and the isiZulu version of the test in the research sample.

CHAPTER 5

RESULTS

5.1 INTRODUCTION

This section presents the results of this study. It first presents and describes the results of translations and back-translations as done by the “experts” (5.2). Then, it presents and compares the frequency and percentage of the TIMSS 2003 KZN sample and the research sample answering each selected item correctly and incorrectly (5.3). In this part, the strategies used by the research group to answer the selected items are described as elicited during the interviews, and the statistical analyses testing the significance of differences from random are presented.

5.2 PART I: Translations & back-translations

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Original question item

1. A son can inherit traits
 - A. only from his father
 - B. only from his mother
 - C. from both his father and his mother
 - D. from either his father or his mother, but not from both

IsiZulu translation

1. Indodana ingathola ufuzo
 - A. kubaba wayo kuphela
 - B. kumama wayo kuphela
 - C. kubo bobabili ubaba wayo kanye nomama wayo
 - D. Kubaba wayo noma kumama wayo, kodwa hhayi kubona bobabili

Back-translations

A

1. A son can inherit genetic information from
- A. his father only
 - B. his mother only
 - C. both his father and mother
 - D. either his father or his mother, but not both.

B

1. A son can inherit genes from
- A. his father only
 - B. his mother only
 - C. both his father and mother
 - D. either his father or his mother, but not from both

C

1. A son can inherit from
- A. his father only
 - B. his mother only
 - C. both his father and mother
 - D. either his father or his mother, but neither both.

Question item 12026 was easily translated into isiZulu. The scientific term that was used in the original English version (traits) had a literal translation into isiZulu which is commonly used with the same meaning as in English. A grammatical change in the first two options was noted whereby in the original English version, the options began with “only” whereas in the isiZulu it appeared at the end of the option as “kuphela”. This was attributed to the phonology in isiZulu and no meaning was changed. In the last option, it was noted that no translation of “either” was done in isiZulu but this has not changed the meaning of the option.

Back-translations captured the meaning of the question, although the original “traits” eventually became “genetic information” or “genes” in two of the back-translations, while the other back-translation did not include it at all. It is noticeable that all three back-translations had “only” at the end in the first two options and have all omitted “from” in the

last two options. It was interesting to note that there was no literal translation of “either” in isiZulu translation of the last option, and all back-translations included it.

12028

Original question item

2. A person sorted some animals into the two groups listed on the table. Which characteristic of animals was used for the sorting?

Group 1	Group 2
Humans	Snakes
Dogs	Worms
Flies	Fish

- A. legs
B. eyes
C. nervous system
D. skin

IsiZulu translation

2. Umuntu wehlukana ezinye zezilwane ngamaqoqo amabili abhalwe kuleli-*table*. Yisiphi isici salezilwane esasetshenziswa ekuzahlukaniseni?

Iqoqo 1	Iqoqo 2
Abantu	Izinyoka
Izinja	Ama-worms
Izimpukane	Izinhlanzi

- A. imilenze
B. amehlo
C. i-nervous system
D. isikhumba

Back-translations

A

2. A person separates animals from the table below into two groups. Which characteristic was used to separate these animals?

- A. legs
B. eyes
C. nervous system
D. skin

Group 1	Group 2
Humans	Snakes
Dogs	Worms
Flies	Fish

B

2. A person classifies some of the animals into two categories as written in this table. Which animal feature is used to classify animals?

- A. legs
B. eyes
C. nervous system
D. skin

Group 1	Group 2
Humans	Snakes
Dogs	Worms
Flies	Fish

C

2. A person categorized/differentiated some of the animals into two groups which are written/ found in the table below. What was the diagnostic feature used to differentiate these animals?

- A. legs
B. eyes
C. nervous system
D. skin

Group 1	Group 2
Humans	Snakes
Dogs	Worms
Flies	Fish

Question 12028 was easily translated into isiZulu, with the exception of three important words. “Nervous system” has no direct translation into isiZulu. “Worms”: in isiZulu there is no one word for the worm “family” but all worms are referred to by their individual “names”. The word “table”, when translated into isiZulu, will have had a different meaning from the original use, thus the English word was more appropriate in this context. It was decided to incorporate the English word in the translation so that learners can understand what “type” of a table the statement refers to. It is noticeable that in all three back-translations the term “sorted” in the original became “categorized/differentiated” or “separates” or “classifies”, and two back-translations used “diagnostic feature” or “feature” instead of “characteristic” as in the original.

22235

Original question item

3. A girl has an idea that green plants need sand in the soil for healthy growth. In order to test her idea she uses two pots of plants. She sets up one pot of plant as shown below.

Diagram

Which ONE of the following should she use for the second pot of plants?

Diagram

IsiZulu translation

3. Intombazane inesu lokuthi izitshalo eziluhlaza zidinga isihlabathi emhlabathini ukuze zikhule kahle. Ukuze ihlole isu layo isebenzisa izitshalo ezisemabhodweni ezimbili. Yazilungiselela eyodwa yalezitshalo njengoba kukhonjiswe ngezansi.

Yikuphi OKUKODWA kwalokhu Okulandelayo okumele ikusebenzise njengesitshalo sesibili?

Back-translations

A

3. A girl has an idea that green plants need soil for them to grow. To test her idea she used two pot plants. She prepared one of the plants as shown below.

From the plants below which ONE plant should she use for her second plant?

B

3. A girl has an hypothesis that green plants need sandy soil for healthy growth. To prove her hypothesis she uses two pot plants. She prepared one of the two plants as shown

below.

Which ONE of the following she needs to use as the second plant?

C

3. A girl has an idea that green plants need sand in order to grow well in the soil/A girl has an idea that in order for the green plants to grow well they need sand in the soil. In order for her to test her idea, she uses two pot plants. She prepared one of these plants as shown below.

Which ONE of the following must she use as the second plant?

Question 22235 was easily translated into isiZulu. There were no scientific terms in this question which needed translation. The words/terms appearing in the diagrams were not translated and the grammar was changed in the isiZulu translation to match isiZulu phonology.

It is noticeable that one back-translation used “hypothesis” instead of “idea” as in the original. This term could lead to difficulties for the Grade 8 ESL learners to understand and answer a question correctly. The first sentence in the original mentions the specific requirement: *sand in the soil*, the two back-translations seemed to have lost this important information: the meaning of the statement has changed; making it more challenging for a Grade 8 ESL learner to choose the correct option. All three back-translations used “prepared” instead of “sets up” as in the original. It has to be highlighted that after

“losing” that important information given, it will be not easy to choose the correct option in this question item.

22117

Original question item

4. Why would male insects be treated to prevent sperm production?
- A. To increase the number of female insects
 - B. To reduce the total population of insects
 - C. To produce new species of insects
 - D. To prevent insects from mating.

IsiZulu translation

4. Kungenziwa yini ukuba izinambuzane zesilisa zelashwe ukuze kuvikelwe ukuba zikhiqise ama-sperm?
- A. ukuze kwandiswe inani lezinambuzane zesifazane
 - B. ukuze kuncishiswe isamba se-population yezinambuzane
 - C. ukuze kukhiqizwe i-species esisha sezinambuzane
 - D. ukuze kuvikelwe ukwandisana kwezinambuzane.

Back-translations

A

4. Is it possible that male insects/flyes can be treated/injected/given medication to prevent them from producing sperms?
- A. to increase the number of female insects
 - B. to decrease the insect population
 - C. to produce a new species of insects
 - D. to prevent the increase in the number of insects.

B

4. Why would male insects be treated in order that they don't produce sperms?
- A. so that female insects could be multiplied
 - B. to decrease the quantity/amount of insect population
 - C. to produce a new insect species
 - D. to prevent insect replication/increase

C

4. What can be done to prevent male insects from producing/secreting sperms?
- A. by increasing number of female insects
 - B. by reducing the insect population number
 - C. by secreting/producing new insect species
 - D. by preventing the spread of insects

In question 22117, the word “sperm” was not translated into isiZulu, because the literal translation of this term in isiZulu is not commonly used and many isiZulu-speaking people do not know it. The term “population” was also not translated since in isiZulu there is no difference between population and community as in the scientific context. There was no direct translation of the term “species” in isiZulu. The English versions of these terms were more appropriate and incorporated into the isiZulu sentence. The grammatical changes were noted in the translation.

The original question item required an underlying scientific principle, “why”? One of the back-translations changed the question to ask “what can be done...?”, which is rather more interpretive, and thus had options beginning with “By...” whereas in the original English version the options begin with “To...”. This makes it difficult to make sense of the question and affects the chances of choosing the correct option, since the meaning has changed. The other back-translation completely changed the meaning of the question by asking “if there is a possibility”, which does not make sense at all with the options given. It is noticeable that “treated” in the original became “injected” or “given medication” in two back-translations, which have a specific meaning in science context and can lead the ESL learners into activating memories which are more “health-based”, thus choosing the wrong option.

22160

Original question item

5. What is the advantage of having two ears to hear with rather than one ear?

IsiZulu translation

5. Buyini ubuhle bokuba nezindlebe ezimbili ukuze uzwe kunokuba nendlebe eyodwa?

Back-translations

A

5. What is the advantage of having two ears for hearing, other than having one ear?

B

5. What is the advantage of having two ears for hearing, instead of having one ear?

C

5. What is the advantage of having two ears in order to hear, other than one ear?

There were no scientific terms in question 22160. It used commonly used English words which all have direct translations into isiZulu. Though some grammatical changes occurred in the translation, the meaning was not changed; and this was attributable to the phonology used in isiZulu.

The original version used the phrase “to hear with” while two back-translations used “for hearing” and the third back-translation used “in order to hear”, the latter misses the function/context in which the ear is used and learners may be distracted by this expression. It is noticeable that in all three back-translations “rather than” became “other than” (which changes the meaning, although colloquially, African people tend to use “other than” when they mean “rather than”) and “instead of” (which denotes one option instead of another).

12014

Original question item

6. When a person sees something, what carries the message from the eyes to the brain?
- A. arteries
 - B. glands
 - C. muscles
 - D. nerves
 - E. veins

isiZulu translation

6. Uma umuntu ebona into ethile, yini ethatha imilayezo esuka emehlweni iye engqondweni?
- A. ama-*artery*
 - B. ama-*gland*
 - C. ama-*muscle*
 - D. ama-*nerve*
 - E. ama-*vein*.

Back-translations

A

6. When a person is looking at something/object, what takes the message from the eyes to the brain?

- A. arteries
- B. glands
- C. muscles
- D. nerves
- E. veins

B

6. If a person sees something, what transmits messages from the eyes to the brain?

- A. arteries
- B. glands
- C. muscles
- D. nerves
- E. veins

C

6. If someone/when a person sees something, what takes messages from the eyes to the brain?

- A. arteries
- B. glands
- C. muscles
- D. nerves
- E. veins

Question 12014 was easily translated into isiZulu with no loss of meaning. All the words used in this question item were commonly used words which had direct translations into isiZulu. The answers used only scientific terms which had no direct translations into isiZulu, thus they were incorporated as they were into isiZulu format. It was interesting to note that in isiZulu there is only one word for both arteries and veins. In the original

English question, the options were given in plural form and in the isiZulu translations this was presented with the prefix “ama-“, which is the plural prefix in isiZulu, with the omission of the English suffixes in the terms.

The original version began with “When” and one back-translation began with “If”. The original question used “sees” whereas another back-translation used “looking at”. The original question item also used the term “carries” whereas two back-translations used “takes” and the third one used “transmits”. The meaning of the question remains unchanged; in fact, “transmits” is probably a more accurate description of signals moving from eyes to brain.

12001

Original question item

7. Which of the following organs is NOT situated in the abdomen?
- A. liver
 - B. kidney
 - C. stomach
 - D. bladder
 - E. heart.

IsiZulu translation

7. Iyiphi kulama-*organ* alandelayo ENGATHOLAKALI kwi-*abdomen*?
- A. isibindi
 - B. inso
 - C. isisu
 - D. isinye
 - E. inhliziyo.

Back-translations

A

7. Which of the following organ is NOT found in the abdomen?
- A. liver
 - B. kidney
 - C. stomach
 - D. bladder
 - E. heart

B

7. Which one of the following organs is NOT found from the abdomen?
- A. liver
 - B. kidney
 - C. stomach
 - D. bladder
 - E. heart

C

7. Which of the following organ does not found in the abdomen?

A. liver

B. kidney

C. stomach

D. bladder

E. heart

In question 12001, the term “organ” has a direct translation in isiZulu, however, most teachers and learners do not translate it into isiZulu. The term “abdomen” has no direct translation into isiZulu and was thus incorporated as it was in the translation. There was a change in grammar but it did not affect the meaning of the question, instead making it clearer. The options had commonly used terms which had direct translations and were also commonly used in isiZulu. It is noticeable that all three back-translations used “found” instead of “situated”, and that back-translator C used the preposition “from” instead of “in” with reference to the abdomen.

32202

Original question item

8. The diagram below shows a community consisting of mice, snakes and wheat plants. What would happen to this community if people killed the snakes?

Diagram

IsiZulu translation

8. Lomdwebo ongenzansi ukhombise i-*community* ehlanganise amagundane, Izinyoka kanye nezitshalo zikakolweni. Kungenzakalani kule-*community* uma abantu bebulele izinyoka?

Back-translations

A

8. The drawing below has a community that consists of rats, snakes and wheat. What would happen to the community if humans would kill the snakes?

B

8. The drawing below is showing a community that is constituted by mice, snakes and wheat plantation. What could happen to this community if human beings were to kill snakes?

C

8. The following drawing shows a community that/which consists of rats, snakes and wheat plants. What can happen in this community if people killed snakes?

No changes in grammar were observed in question 32202, which was easily translated into isiZulu. It was decided not to translate the term “community” as it has the same meaning as population in isiZulu. Most teachers and learners would find the English word to be more acceptable and would use it as in this translation to distinguish between the two scientific terms: population and community. The three back-translations captured the meaning of the question, but it is noticeable that one back-translation used “constituted” instead of “consisting” as in the original, and “people” became “humans” or “human beings” in two back-translations.

12038

Original question item

9. What is the main function of red blood cells?
- A. To fight diseases in the body
 - B. To carry oxygen to all parts of the body
 - C. To remove carbon monoxide from all parts of the body
 - D. To produce materials which cause the blood to clot.

IsiZulu translation

9. Yimuphi umsebenzi omkhulu owenziwa ama-red blood cell?
- A. ukulwa nezifo emzimbeni
 - B. ukuphatha i-oxygen iyiyise kuzozonke izicubu zomzimba
 - C. ukususa i-carbon monoxide ephuma kuzozonke izicubu zomzimba
 - D. ukukhiqiza izakhi ezenza ukuba igazi lome.

Back-translations

A

9. What is the major function of red blood cells?
- A. to fight against diseases in the body
 - B. to carry oxygen to all parts of the body
 - C. to remove carbon monoxide that is released from all body parts
 - D. to secrete components that makes blood to clot.

B

9. What is the main function of the red blood cells?
- A. to fight diseases in the body
 - B. to transport oxygen to all parts of the body
 - C. to remove carbon monoxide that comes from all parts of the body
 - D. to produce substances that causes clotting of blood.

C

9. What is the main function of red blood cells? from all body parts
- A. to fight diseases in the body D. to secrete components that makes blood to clot.
- B. to carry oxygen to all body parts
- C. to transport carbon monoxide that comes

Question 12038 was easily translated into isiZulu. There was no direct translation of the terms: “red blood cells”, “oxygen” and “carbon monoxide”; most isiZulu-speaking teachers and learners would use the English words for these terms. The grammatical changes that occurred did not affect the meaning of this question item. Two back-translations used the word “secrete” in answer D instead of the original “produce”, but this does not alter the meaning of the answer, and one back-translation used “major” instead of the original “main”.

12039

Original question item

10. Traits are transferred from generation to generation through the
- A. sperm only
- B. egg only
- C. sperm and the egg
- D. testes.

IsiZulu translation

10. Ufuzo ludluliselwa kusuka kwisizukululwane kuye kwesinye isizukulwane
- A. ngama-*sperm* kuphela
- B. ngeqanda kuphela
- C. ngama-*sperm* kanye neqanda
- D. ngamasende.

Back-translations

A

10. Heredity/genetic information is passed from one generation to the next through
- A. sperm only
- B. egg only
- C. sperm and egg
- D. penis

B

10. Genes are passed from one generation to the other through
- A. sperm only
- B. egg only
- C. sperm and egg
- D. testicles

C

10. Inheritance is passed from one generation to the next generation by
- A. sperm only
B. egg only
C. sperm and egg
D. testicles

Question 12039 was easily translated into isiZulu with minor grammatical changes in support of the isiZulu phonology. As for item 22117, the term “sperm” was not translated into isiZulu. The term “traits” was back-translated as “inheritance”, “heredity/genetic information” and “genes” by the three back-translators, and they back-translated the isiZulu equivalent of “testes” as “testicles” (2 back-translators) or “penis”. No change in meaning occurred in this item, although answer D resulted in back-translations that were substantially different from the original.

22152

Original question item

11. What processes take place in the human body that prevent it from overheating during exercise?

IsiZulu translation

11. Yimaphi ama-*process* enzakalayo emzimbeni womuntu awuvikela ekubeni ungashisi ngokweqile lapho ezilolonga?

Back-translations

A

11. Which processes that occur in a human body to prevent it from overheating during/when exercising?

B

11. What processes in the human body prevent the body from overheating during exercise?

C

11. Which processes take place in the human body that prevent it from overheating during exercise/which processes enable the human body to maintain constant body temperature during exercise?

Question 22152 had an almost exact literal translation into isiZulu. The term “processes” was not translated since most isiZulu-speaking teachers and learners find the English word acceptable in this context and incorporate it as it is in their translations. This term was, however, given an isiZulu prefix “ama-“, and the English plural suffix “-es” was omitted. The original question item begins with “what” whereas two back-translations began this question with “which”, which could affect the way learners answer this question.

22154

Original question item

12. *Sipho* went to school with a cold. Several days later, half of his classmates also had colds. What is one likely reason some classmates had colds but others did not?

IsiZulu translation

12. U-*Sipho* waya esikoleni ephethwe umkhuhlane. Ngemuva kwezinsukwana ezimbalwa, ingxenye yalabo afunda nabo yaphathwa umkhuhlane. Yisiphi isizathu esingenza ukuba abanye balabo afunda nabo baphathwe umkhuhlane kodwa abanye ungabaphathi?

Back-translations

A

12. *Sipho* had a cold/flu and he went to school. After a few days, half of his classmates had the flu/cold. What was the reason behind the fact that only half of his classmates had flu/cold?

B

12. *Sipho* went to school while suffering from flu. After a few days, half of his classmates were suffering from flu. What could be the reason that some learners would catch flu while others would not?

C

12. *Sipho* went to school whilst he had a cold. A few days later some pupils from his class developed a cold. Why is it that some pupils developed a cold whilst others did not?

It has to be noted that question 22154 was modified to use a person's name which would be more familiar to the learners. The original English version used *Salil*, which was modified to *Sipho*. The word "cold" has multiple meanings, and is not generally used in the context of illness. The isiZulu word "umkhuhlane" is generally used to describe flu-like symptoms, and therefore it is more likely that learners would associate its use with flu. This emerged in two back-translations. This item had a literal translation into isiZulu, no scientific terms were used and all the words were commonly used. The back-translations captured the meaning of the question and improved its understanding by changing "cold" in the original to "flu".

22161

Original question item

13. Briefly explain how eyeglasses and contact lenses help some people to see more clearly.

IsiZulu translation

13. Chaza kafushane ukuthi izibuko kanye nama-*contact lenses* abasiza kanjani abanye abantu ukuze babone ngokugqame kakhulu.

Back-translations

A

13. Briefly explain/discuss how do spectacles/glasses and contact lenses help people to see clearly and better.

B

13. Explain briefly how the spectacles and contact lenses help to improve other people's sight/vision.

C

13. Explain briefly/shortly how glasses and contact lenses aid/help other people to be able to see clearly/brighter.

Question 22161 had a literal translation into isiZulu with some changes in grammar in support of the isiZulu phonology. The term “contact lenses” has no direct translation into isiZulu, and would be an unfamiliar term in the isiZulu cultural context. The back-translations captured the meaning of the question, but it is noticeable that two back-translators used the word “other” instead of “some” as in the original.

32595

Original question item

14. Cats are more closely related to which of the following animals?
- A. crocodiles
 - B. whales
 - C. frogs
 - D. penguins.

IsiZulu translation

14. Amakati ahlobene kakhulu nasiphi isilwane kulezi ezilandelayo?
- A. izingwenya
 - B. ama-whale
 - C. amaselesele
 - D. ama-penguin.

Back-translations

A

14. Cats are closely related to which of the following animals?
- A. crocodiles
 - B. whales
 - C. frogs
 - D. penguins.

B

14. Cats are closely related to which of the following animals?
- A. crocodiles
 - B. whales
 - C. frogs
 - D. penguins.

C

14. From which of the following animals are cats closely related to?
- A. crocodiles
 - B. whales
 - C. frogs
 - D. penguins.

Question 32595 had a literal translation into isiZulu but grammatical changes were noted. There are isiZulu words for “whales” and “penguins” but they are not commonly used, their English names are more likely to be incorporated into an isiZulu sentence. It was interesting to note the changes between the English and isiZulu plurals in terms of the prefix and the suffix. Two back-translators captured almost the exact wording of the original item, while one substituted the preposition “from” at the beginning of the question. All three back-translators omitted the word “more” as in the original English version. This affects the meaning of the question, since it indicates levels of relatedness among a group of vertebrates.

32607

Original question item

15. Which of the following organs in fish has the same function as the human lung?
- A. kidney
 - B. heart
 - C. gill
 - D. skin.

IsiZulu translation

15. Iyiphi i-*organ* yenhlazi kulawa alandelayo enomsebenzi ofana nowamaphaphu omuntu?
- A. inso
 - B. inhliziyoy
 - C. i-gill
 - D. isikhumba.

Back-translations

A

15. Which organ in fish has the same function as that of lungs in human?
- A. kidney
 - B. heart
 - C. gill
 - D. skin.

B

15. Which fish organ from the following that has the function similar to that of human lungs?
- A. kidney
 - B. heart
 - C. gill
 - D. skin/scales.

C

15. Which organ in fish has similar function to human lungs?
- A. kidney
 - B. heart
 - C. gill
 - D. skin.

Question 32607 had a lot of grammatical changes after translation. The term “organ” has a direct translation in isiZulu, which is unfamiliar to most teachers and learners. The term “gill” has no direct translation in isiZulu; most isiZulu-speaking teachers and learners would refer to it as written in this translation. The back-translations captured the original meaning, although back-translator C’s attempt resulted in a clumsy question.

32008

Original question item

16. Which of the following takes place during fertilization in animals?
- A. production of sperm and egg
 - B. joining of sperm and egg
 - C. division of egg
 - D. development of embryo.

IsiZulu translation

16. Yikuphi kulokhu okulandelayo okwenzeka ngesikhathi se-*fertilization* ezilwaneni?
- A. ukukhiqizwa kwama-*sperm* kanye neqanda
 - B. ukuhlangana kwama-*sperm* kanye neqanda
 - C. ukwahlukaniseka kweqanda
 - D. ukwakheka kwe-*embryo*.

Back-translations

A

16. From the following what is it that occurs during fertilization in animals?
- A. production of sperm and egg
 - B. fusion of sperm and egg
 - C. division of the egg
 - D. development of embryo.

B

16. Which of the following takes place during fertilization process in animals?
- A. production of sperm and egg
 - B. fusion of sperm and egg
 - C. egg division
 - D. embryo formation.

C

16. Which of the following happens during fertilization in animals?
- A. secreting/ producing sperm and egg
 - B. fusion of sperm and egg
 - C. separation/ breakdown of an egg
 - D. formation of embryo.

In question 32008, “fertilization” is a process; there is a direct translation of this process into isiZulu, but it is not commonly used. The term “embryo” also has a direct translation into isiZulu but also not commonly used. It was then decided to incorporate the English terms into the translation since most isiZulu-speaking teachers and learners would commonly incorporate them as they are in their code-switching. The term “sperm” was not translated into isiZulu.

Back-translations captured the meaning of the question, although the original “takes place” eventually became “happens”, or “occurs” in two of the back-translations. “Development” became “formation” in two back-translations, “joining” became “fusion” in all three back-translations, and “division” became “separation/breakdown” in one back-translation, which is somewhat different in meaning from division.

32083

Original question item

17. The fossils that are found in the oldest layers of sedimentary rock were formed from which types of organisms?

- A. only organisms that lived in the sea
- B. only organisms that lived on land
- C. only organisms that lived in the air
- D. organisms that lived on the land, in the sea and in the air.

IsiZulu translation

17. Ama-fossil atholakala emadwaleni amadala akheka ukusuka kuziphi izinhlobo zama-*organism*?

- A. kulawo ma-*organism* ahlala olwandle kuphela
- B. kulawo ma-*organism* ahlala emhlabeni kuphela
- C. kulawo ma-*organism* ahlala emoyeni kuphela
- D. kulawo ma-*organism* ahlala emhlabeni, olwandle kanye nasemoyeni.

Back-translations

A

17. Fossils that are found from old rocks they are made from what types of organisms?

- A. from the organisms that live in the ocean/sea only
- B. from the organisms that live on earth/land only
- C. from the organisms that live in the air only
- D. from the organisms that live on earth/land, in the ocean/sea and in the air.

B

17. Fossils found from ancient rocks are formed from which types of organisms?

- A. from the organisms that live in the sea only
- B. from the organisms that live on land only

C. from the organisms that live in the atmosphere

D. from the organisms that live on land, in the sea and in the atmosphere.

C

17. Fossils found on aging rocks originated/formed from which types of organisms/ from which types of organisms do fossils found on aging rocks originate/d?

- A. from the organisms found in the ocean only
- B. from the organisms found on land only
- C. from the organisms that flies
- D. from the organisms that are found on land, in the ocean and that flies.

In question 32083, the term “fossil” has no direct translation into isiZulu. The term “organism” was not translated since most isiZulu-speaking teachers and learners would incorporate it as it is in their lessons. The word “oldest” is key to understanding this question, and was variously back-translated as “aging”, “old” and “ancient”, which loses the connotation that layers of sedimentary rock contain a sequence of fossils, with the oldest fossils found in the oldest layers of rock, and the youngest fossils in the most recently formed layers of rock. A second change that arose in back-translations was in answers C and D: “in the air” became “flies”, or “in the atmosphere”. The preposition “in” became “from” in two back-translations and “on” in a third back-translation.

32637

Original question item

18. Eating leafy vegetables is important for human health. This is because leafy vegetables are a good source of which of the following?

- A. protein
- B. carbohydrates
- C. minerals
- D. fat.

IsiZulu translation

18. Ukudla izitshalo eziluhlaza ezinamaqabunga kubalulekile empilweni yomuntu. Lokhu kwenziwa ukuthi izitshalo eziluhlaza ezinamaqabunga zingumthombo omuhle wakuphi kulokhu okulandelayo?

- A. *ama-protein*
- B. *ama-carbohydrate*
- C. *ama-mineral*
- D. amafutha.

Back-translations

A

18. It is important for a human/person's health to eat green leafy vegetables. This is because the green leafy vegetables are the source of which of the following?

- A. proteins
- B. carbohydrates
- C. minerals
- D. fats.

B

18. Eating plants with green leaves is very important for the health of a human being. This is because plants with green leaves are a good source of which of the following?

- A. proteins
- B. carbohydrates
- C. minerals
- D. fats.

C

18. Eating green plants with leaves is important for human health. This is because green plants with leaves are good sources of which of the following?

- A. proteins
- B. carbohydrates
- C. minerals
- D. fats/oil.

In question 32386, the term “blood stream” has no direct translation in isiZulu. Most of the options had literal translations into isiZulu and included commonly-used terms in English and isiZulu. The back-translations captured the meaning of the item accurately, although two back-translations substituted the preposition “to” instead of “into”.

32682

Original question item

20. Animals and plants are made up of a number of different chemical elements. What happens to all of these elements when animals and plants die?
- A. They die with the animal or plant
 - B. They evaporate into the atmosphere
 - C. They are recycled back into the environment
 - D. They change into different elements.

IsiZulu translation

20. Izilwane kanye nezitshalo zakhiwa ama-*chemical element* ehlukene. Kwenzakalani kulama-*element* uma isilwane kanye nesitshalo kufa?
- A. afa nalesosilwane noma isitshalo
 - B. ayahwamuka aye kwi-*atmosphere*
 - C. abuyiselwa emuva kwi-*environment*
 - D. ayashintsha abe ngamanye ama-*element* ahlukile.

Back-translations

A

20. Animals and plants are made from different chemical elements. What happens to these elements when an animal or a plant dies?
- A. they die together with that animal or plant
 - B. they evaporate to the atmosphere
 - C. they return to the environment
 - D. they change and become different elements.

B

20. Animals and plants are formed by different chemical elements. What happens to these elements when the animal and plant dies?
- A. they die with that animal or plant
 - B. they evaporate into the atmosphere
 - C. they are returned back to the environment
 - D. they change into other different elements.

C

20. Animals and plants are made up of different chemical elements. What happens to these elements if an animal and plant dies?
- A. they die with that particular animal or plant
 - B. they dry out and go to the atmosphere
 - C. they are taken back into the environment
 - D. they change into new/ different elements.

There was no direct translation of the scientific terms “chemical element” and/or “element” in question 32682. There are direct translations of the terms “atmosphere” and “environment” but they are not commonly used in isiZulu. The changes in grammar that occurred did not affect the meaning of this question item. The back-translators captured the meaning of the question and the four options, although it is noticeable that the term “recycled” is back-translated to “taken back”, “return”, and “returned back”. The term “evaporate” is back-translated as “dry out” by one back-translator, but is correctly translated as “evaporate” by two.

The process of translation into isiZulu was conducted with care and all questions were successfully translated without the loss of meaning. During the back-translation process, 13 question items were accurately back-translated, and seven question items lost meaning and became more challenging for a Grade 8 learner to understand and answer the question correctly.

5.3 PART II: Learners performance in selected TIMSS 2003 science questions

Table 5.1: Percentage of learners answering 12 TIMSS 2003 science questions correctly (sample sizes in parentheses).

Item number	TIMSS 2003 sample (isiZulu-speakers)	Research learners (English test)	Research learners (isiZulu test)
MULTIPLE CHOICE QUESTIONS (MCQ)			
12026	48.1 (208)	63.9 (36)	47.2 (36)
12028	19.6 (199)	16.7 (36)	30.5 (36)
22117	16.4 (195)	33.3 (36)	44.4 (36)
12039	52.4 (206)	66.7 (36)	75.0 (36)
12014	16.2 (198)	22.2 (36)	16.8 (36)
12001	21.5 (195)	36.1 (36)	27.8 (36)
12038	29.3 (208)	22.2 (36)	30.6 (36)
22235	30.1 (173)	30.6 (36)	25.0 (36)
Mean	29.2	36.5	37.2
SD	14.0	18.9	18.2
FREE-RESPONSE QUESTIONS (FRQ)			
22160	4.3 (192)	14.0 (36)	27.8 (36)
22152	5.6 (108)	13.9 (34)	16.7 (33)
22154	5.0 (100)	36.1 (35)	55.6 (36)
22161	2.9 (105)	2.8 (35)	27.8 (34)
Mean	4.5	16.7	32.0
SD	1.2	14.0	16.6
MCQ	Level of significance	0.1 ¹ (n.s.)	0.9 ² (n.s.)
FRQ	Level of significance	0.2 ¹ (n.s.)	0.1 ² (n.s.)

¹ t TIMSS 2003 sample vs Research learners writing test in English

² t Research learners writing test in English vs writing test in isiZulu

n.s. Not significant

In the multiple choice questions, the mean \pm SD was 29.2 \pm 14.0% for the TIMSS 2003 sample, 36.5 \pm 18.9% for the research sample writing the test in English and 37.2 \pm 18.2% for the research sample writing the test in isiZulu. More learners answered correctly in the research sample writing the test in isiZulu. More learners answered correctly in the research sample writing the test in English than the TIMSS 2003 sample in five multiple choice questions, and about the same percentage answered correctly in the remaining three multiple choice questions. The research sample's performance in English compared to their performance in isiZulu showed an even split: 4 questions had more correct answers in

the English version test, and 4 in the isiZulu test. The statistical analysis, t-test ($t = 0.1$, $p > 0.05$), shows no significant difference in performance overall. The t-test ($t = 0.9$, $p > 0.05$) for the research sample writing the test in English vs isiZulu shows no significant difference in performance on the multiple choice questions.

Three of the four free-response questions had more learners in the research sample writing the test in English answering correctly than the TIMSS 2003 sample. One question (22154) was much better; this was attributed to the fact that the question in the original TIMSS items used the term *cold* and in the research test this term was modified to the term *flu* as commonly used in the South African context, therefore, learners in the research sample may have understood the question better than the TIMSS 2003 sample. The t-test ($t = 0.2$, $p > 0.05$) shows no significant difference in the overall performance.

More learners in the research sample answered three free-response questions correctly in isiZulu than in English, and answered about the same in the other free-response question. The t-test ($t = 0.1$, $p > 0.05$) shows no statistically significant difference in performance overall, although the mean percentage correct on the isiZulu version test was almost twice as high as the mean percentage correct on the English version test.

During the “interviews”, all the research learners said that they translate questions into isiZulu before attempting to answer, and if they do not understand the question and/or terms used in the question they resort to guessing the answer. The next section looks at patterns of choices across the alternatives on each multiple choice question item – if

learners were guessing randomly, we expect equal chances of choosing any of the alternatives.

The Chi-Square (χ^2) goodness-of-fit test (Siegel & Castellan, 1989) was used to test the hypothesis that choices are randomly distributed across the alternatives, i.e. that there was an equal chance of any alternative being selected. This was followed by a χ^2 test for two independent samples using contingency tables to test the hypothesis that there is no difference in the pattern of choice between the TIMSS 2003 sample and the research sample writing the test in English, and between the research sample writing the test in English and in isiZulu.

12026

English version

A son can inherit traits

- A. only from his father
- B. only from his mother
- C. from both his father and his mother
- D. from either his father or his mother, but not from both.

IsiZulu version

Indodana ingathola ufuzo

- A. kubaba wayo kuphela
- B. kumama wayo kuphela
- C. Kubo bobabili obaba wayo kanye nomama wayo
- D. Kubaba wayo noma kumama wayo, kodwa hhayi kubo bobabili.

Table 5.2: Frequency of learners selecting each alternative for item 12026

Sample	A	B	C	D	n	χ^2	p
TIMSS 2003 sample	24	32	100	52	208	67.08	< 0.001
Research sample (English test)	3	2	23	8	36	31.33	< 0.001
Research sample (isiZulu test)	9	1	17	9	36	14.22	< 0.001

Random vs non-random selection

The χ^2 goodness-of-fit indicated that in all samples, the choice was significantly different from random ($p < 0.001$). Thus, random guessing was unlikely to be the dominant strategy that learners used when answering this question.

This question relates to inheritance, and was surprisingly answered relatively well by isiZulu-speaking learners in the TIMSS 2003 sample and the research sample, whereas this topic is not included in the syllabus for Grade 8 in South Africa and 57% of the teachers in TIMSS 2003 study said they had not yet taught “Reproduction and Heredity” at the time that the TIMSS test was written.

The correct answer in this question is C and when answering this question all learners interviewed said they ‘...*first read the question over and over again...for about four times...to try and understand what the question is about, then translate it into isiZulu to understand it very well...then read the answers to see which one is the correct answer*’.

The reasons given for choosing the correct answer included ‘...*I think the answer is C because the child is made by both the father and the mother and then it can inherit the traits from both of them*’, ‘*I think the answer is C because sometimes there are children who resemble both their parents*’ and ‘*This question was quite easy because I used my general knowledge and I chose the answer C*’. These answers indicate some understanding of genetic inheritance.

One of the learners interviewed ‘...*did not understand the question, this word ‘trait’ gave a problem, it made it harder to understand what the question requires and then ended up guessing the answer’.*

Comparison between TIMSS 2003 sample and research sample answering in English

A large percentage of research learners writing the test in English (63.9%) answered this question correctly compared to the TIMSS 2003 sample (48.1%). Over 20% of learners in both samples favoured the distracter D. An example of a reason given for choosing this alternative was ‘*I will say it is D because he cannot inherit the traits from both of his parents, it’s better to inherit from either his father or his mother’.* Learners in both samples seemed to have rejected distracters A and B. The χ^2 test (contingency table) indicated that there was no significant difference in the pattern of choice between the TIMSS 2003 sample and the research sample writing the test in English ($\chi^2 = 3.99$, $p > 0.05$).

Comparison between research sample answering in English and in isiZulu

More of the research sample answered this question correctly in the English version (23) compared with the isiZulu (17). Over 20% of learners in both samples favoured the distracter D. When the test was written in isiZulu, more learners (9) chose the distracter A (compared to 3 in English). This could be explained in terms of the cultural context where normally a son ‘takes’ after his father, for example, inherits money, belongings, responsibilities, etc. Learners seemed to have rejected distracter B in both tests. The χ^2 test (contingency table) indicated that there was no significant difference in the pattern of

choice between the research sample writing the test in English and in isiZulu ($\chi^2 = 4.29$, $p > 0.05$).

12028

English version

A person sorted some animals into the two groups listed on the table. Which characteristic of animals was used for the sorting?

Group 1	Group 2
Humans	Snakes
Dogs	Worms
Flies	Fish

- A. legs
- B. eyes
- C. nervous system
- D. skin.

IsiZulu version

Umuntu wehlukana ezinye zezilwane ngamaqoqo amabili abhalwe kuleli-table. Yisiphi isici salezizilwane esasetshenziswa ekuzahlukaniseni?

Iqoqo 1	Iqoqo 2
Abantu	Izinyoka
Izinja	Ama-worms
Izimpukane	Izinhlanzi

- A. imilenze
- B. amehlo
- C. i-nervous system
- D. isikhumba.

Table 5.3: Frequency of learners selecting each alternative for item 12028

Sample	A	B	C	D	n	χ^2	p
TIMSS 2003 sample	39	50	49	61	199	4.87	n.s.
Research sample (English test)	6	6	10	14	36	4.89	n.s.
Research sample (isiZulu test)	11	6	6	13	36	4.22	n.s.

Random vs non-random selection

The χ^2 goodness-of-fit indicated that in all samples, the choice was not significantly different from random. Thus, random guessing could not be excluded as the dominant strategy that learners used when answering this question. During the interviews, one learner said '*In this question, I had a problem of not knowing whether I have to select the*

answer between group 1 and group 2 or between A, B, C and D; so I ended up guessing the answer', and another learner said *'I also did not understand this question...I did not know whether to tick the answer in the table or in the alternatives given...and so I ended up guessing the answer'*. These quotations support an interpretation that the learners did not understand the format of the item.

The correct answer to this question is alternative A, and learners did not tend to see this answer as the defining characteristic of the animals given in the table. Examples of reasons given during the interviews for the selection of this alternative included *'I did not understand the question in English and so I tried to read it in isiZulu (meaning translating it) then I understood what was happening and chose the answer A...'*, *'I chose A because all the animals in Group 1 have legs...'*, and *'Ja, it's A because the animals in Group 2 have no legs while those in Group1 have the legs'*.

More than 30% of learners in each sample favoured the distracter D and the reasons for this choice were given as *'...I first read the question and I realized that the snake skin and the human skin are different...'*, *'it's D, because the human does not have the same skin as all the other animals written here'*. These findings suggests that learners might have related the "hair" covering the animals in Group 1 and "scales" covering animals in Group 2 when answering rather than the means of locomotion.

Comparison between TIMSS 2003 sample and research sample answering in English

The χ^2 test (contingency table) indicated that there was no significant difference in the pattern of choice between the TIMSS 2003 sample and the research sample writing the test in English ($\chi^2 = 1.84$, $p > 0.05$). When the test was written in English the distracter (C) was the next best choice for the research sample and the reasons for choosing this alternative were given as '*...I chose the answer C because I knew the other words and I could not see them fitting in with the question and then I selected this word because I did not know it...*' and '*I also thought that the answer is C because it was the word I could use to bring together the animals in Group 1 and in Group 2.*' This finding suggests that this question was answered based on recognition of the given possible alternatives, and that learners chose the word they do not know from the possible alternatives when answering.

Comparison between research sample answering in English and in isiZulu

The χ^2 test (contingency table) indicated that there was no significant difference in the pattern of choice between the research sample writing the test in English and in isiZulu ($\chi^2 = 2.51$, $p > 0.05$). When the test was written in isiZulu 11 learners (as compared to six in English) answered this question correctly. The translation of the term '*sorted/ sorting*' into isiZulu may have contributed to the understanding of the question and thus to the improved number of learners answering correctly.

22117

English version

Why would male insects be treated to prevent sperm production?

- A. To increase the number of female insects
- B. To reduce the total population of insects
- C. To produce new species of insects
- D. To prevent insects from mating.

IsiZulu version

Kungenziwa yini ukuba izinambuzane zesilisa zelashwe ukuze kuvikelwe ukuba zikhiqise ama-sperm?

- A. ukuze kwandiswe inani lezinambuzane zesifazane
- B. ukuze kuncishiswe isamba se-population yezinambuzane
- C. ukuze kukhiqizwe i-species esisha sezinambuzane
- D. ukuze kuvikelwe ukwandisana Kwezinambuzane.

Table 5.4: Frequency of learners selecting each alternative for item 22117

Sample	A	B	C	D	n	χ^2	<i>p</i>
TIMSS 2003 sample	63	32	43	57	195	11.98	< 0.01
Research sample (English test)	8	12	7	9	36	1.55	n.s.
Research sample (isiZulu test)	5	16	2	13	36	14.44	< 0.01

Random vs non-random selection

The χ^2 goodness-of-fit indicated that in the TIMSS 2003 sample and the research sample writing the test in isiZulu, the choice was significantly different from random ($p < 0.01$), thus, random guessing was unlikely to be the dominant strategy that learners used when answering this question. In the research sample, the choice was not significantly different from random when the test was written in English, thus, guessing could be the dominant strategy used to answer this question. The TIMSS 2003 sample favoured answer A, followed closely by answer D, while the research sample answering in English favoured the correct answer B, followed closely by D, A and C. The research sample answering in isiZulu favoured answer B, followed by D.

During the interviews, six learners said they guessed the answer because they '*...did not understand what the word 'treated' mean...and could not understand what the question required...and this affected the way the question was answered*'. When guessing, learners used the strategy of looking at '*...the words which are similar...so (they) can see that since this word appeared in the question and also appears in the answer, therefore the answer will fit in with the question...*'.

Comparison between TIMSS 2003 sample and research sample answering in English

The χ^2 test (contingency table) indicated that there was no significant difference in the pattern of choice between the TIMSS 2003 sample and the research sample writing the test in English ($\chi^2 = 5.73$, $p > 0.05$). The correct answer to this question is alternative B and more learners answered correctly in the research sample (33.3%) than the TIMSS 2003 sample (16.4%). Reasons given during the interviews for choosing answer B were '*...the way I understand this question is: Yinindaba izinambuzane zitreated ukupreventa i-sperm production...*', '*I chose the answer B and this is according to how I understood this question...*', '*I chose the answer B because when I was reading the question for the first time I could not understand what it says, I read it again in isiZulu but still I could not understand very well what it means, then I read it again in English and I chose the answer B...*', and '*My answer is B because many people do not like insects, so they can treat them so as to reduce the total population of those insects*'. These answers suggest that the phrase in the question: "...to prevent sperm production" did not seem to be a useful piece of information when this question was answered. Several key words could not be

translated into isiZulu – *treated, prevent, sperm* and *production* – these words may pose challenges to learners’ understanding and interpretation of the question when learners do not know their meanings in both English and isiZulu.

Learners in both samples favoured the distracters A and D; this could be attributed to the strategy they used to answer this question. Distracter A was chosen by matching the term ‘males’ with ‘females’ and distracter D chosen by matching the term ‘prevent’ which appeared in the question stem and also in this alternative. Distracter C was chosen by matching the term ‘production’ in the question stem with ‘produce’ in this alternative as was noted during the interviews that ‘...*the question has the word ‘production’ and this answer here has the word ‘produce’...*’.

Comparison between research sample answering in English and in isiZulu

The χ^2 test (contingency table) indicated that there was no significant difference in the pattern of choice between the research sample writing the test in English and in isiZulu ($\chi^2 = 4.77, p > 0.05$). More learners answered correctly when the test was written in isiZulu (16) compared to the English version test (12). When the test was written in isiZulu, 13 learners (compared to 9 in English) chose the distracter D, and avoided alternatives A and C. This finding suggests that the translation of this question into isiZulu improved its understandability.

12039

English version

Traits are transferred from generation to generation through the

- A. sperm only
- B. egg only
- C. sperm and the egg
- D. testes.

IsiZulu version

Ufuzo ludluliselwa kusuka kwisizukulwane kuye kwesinye isizukulwane

- A. ngama-sperm kuphela
- B. ngeqanda kuphela
- C. ngama-sperm kanye neqanda
- D. ngamasende

Table 5.5: Frequency of learners selecting each alternative for item 12039

Sample	A	B	C	D	n	χ^2	<i>p</i>
TIMSS 2003 sample	35	29	108	34	206	83.06	< 0.001
Research sample (English test)	4	1	24	7	36	35.33	< 0.001
Research sample (isiZulu test)	6	1	27	2	36	49.55	< 0.001

Random vs non-random selection

This question relates to the topic of inheritance and the learners answered it relatively well, though this topic is not included in the syllabus for Grade 8 in South Africa. During the interviews, seven learners said they '*...did not understand what does the term 'traits' mean...and ended up guessing the answer*', but the χ^2 goodness-of-fit indicated that in all samples, the choice was significantly different from random ($p < 0.001$). Thus, random guessing was unlikely to be the dominant strategy that learners used when answering this question.

The correct answer to this question is alternative C; although during the interviews learners said that they did not understand what the word 'traits' mean they seemed to have known that sperm and egg are required to make a baby, for example, '*...I think it's C...because in*

order to fall pregnant, you have to sleep with a man, thus traits cannot be transferred through the woman only...’, ‘...because when you sleep with another person, the sperm end up fusing with the egg...’, ‘...I used my general knowledge and chose the answer C...’, ‘...I believe that a child can inherit traits from both the sperm and the egg, it cannot inherit the traits from only one of these two things...’ and ‘...the sperm fuses with the egg to make a baby...’.

Comparison between TIMSS 2003 sample and research sample answering in English

The χ^2 test (contingency table) indicated that there was no significant difference in the pattern of choice between the TIMSS 2003 sample and the research sample writing the test in English ($\chi^2 = 5.17$, $p > 0.05$). More learners in the research sample answered this question correctly when the test was written in English (66.7%) compared to the TIMSS 2003 sample (52.4%). Alternatives A and D were distracters for the TIMSS 2003 sample and the research sample writing the test in English. Perhaps the learners were thinking of inheritance of culture and/ or that inheritance is only transferred by ‘males’. Learners avoided distracter B in both samples and this suggests that learners may have thought that traits cannot be transferred through females and/or were guessing the answer.

Comparison between research sample answering in English and in isiZulu

The χ^2 test (contingency table) indicated that there was no significant difference in the pattern of choice between the research sample writing the test in English and in isiZulu ($\chi^2 = 3.35$, $p > 0.05$). More learners answered correctly in the isiZulu version (27) compared to the English version (24), and alternative A was a distracter when the test was written in

isiZulu. Learners avoided distracters B and D in the isiZulu version and this finding suggests that translation of the question into isiZulu improved the understanding of what the question required.

12014

English version

When a person sees something, what carries the message from the eyes to the brain?

- A. arteries
- B. glands
- C. muscles
- D. nerves
- E. veins.

IsiZulu version

Uma umuntu ebona into ethile, yini ethatha imilayezo esuka emehlweni iye engqondweni?

- A. ama-artery
- B. ama-gland
- C. ama-muscle
- D. ama-nerve
- E. ama-vein.

Table 5.6: Frequency of learners selecting each alternative for item 12014

Sample	A	B	C	D	E	n	χ^2	<i>p</i>
TIMSS 2003 sample	23	43	68	32	32	198	30.54	< 0.001
Research sample (English test)	6	7	8	8	7	36	0.40	n.s.
Research sample (isiZulu test)	4	7	7	6	12	36	4.84	n.s.

Random vs non-random selection

During the interviews, 9 learners said that they ‘...*did not know the words in the given alternatives...*’ and used the strategy of ‘...*guessing the answer...*’. The χ^2 goodness-of-fit indicated that the choice by the research sample was not significantly different from random in both the English and isiZulu versions, thus, random guessing cannot be excluded as the dominant strategy that learners used when answering this question; however, the χ^2 goodness-of-fit indicated that in the TIMSS 2003 sample, the choice was significantly different from random ($p < 0.001$).

Comparison between TIMSS 2003 sample and research sample answering in English

The correct answer to this question is alternative D and more learners in the research sample answered this question correctly when the test was written in English (22.2%) than the TIMSS 2003 sample (16.2%). The most popular choice for the TIMSS 2003 sample was distracter C (34.3%) whereas this distracter was equally as popular as the correct answer for the research sample writing the test in English (22.2%). Among learners interviewed on this item, four learners said they chose this alternative '*... because it was the only word they know, they had not met all the other words given in the other alternatives*'. The χ^2 test (contingency table) indicated that there was no significant difference in the pattern of choice between the TIMSS 2003 sample and the research sample writing the test in English ($\chi^2 = 2.94, p > 0.05$).

Comparison between research sample answering in English and in isiZulu

Fewer learners in the research sample answered this question correctly when the test was written in isiZulu (6) compared to the English version test (8). This finding suggests that the translation of the question into isiZulu did not help with the answering of this question. The most popular answer in the isiZulu version was distracter E (12). It was noted in this question that there is only one isiZulu term for 'arteries' and 'veins', and the two blood vessels are usually referred to in the isiZulu context as blood veins with the term 'artery' less commonly used. The χ^2 test (contingency table) indicated that there was no significant difference in the pattern of choice between the research sample writing the test in English and in isiZulu ($\chi^2 = 2.07, p > 0.05$).

12001

English version

Which of the following organs is NOT situated in the abdomen?

- A. liver
- B. kidney
- C. stomach
- D. bladder
- E. heart.

IsiZulu version

Iyiphi kulama-organ alandelayo ENGATHOLAKALI kwi-abdomen?

- A. isibindi
- B. inso
- C. isisu
- D. isinye
- E. inhliziyu.

Table 5.7: Frequency of learners selecting each alternative for item 12001

Sample	A	B	C	D	E	n	χ^2	<i>p</i>
TIMSS 2003 sample	44	37	42	30	42	195	3.28	n.s.
Research sample (English test)	5	5	4	9	13	36	7.89	0.1>p>0.05
Research sample (isiZulu test)	5	9	3	9	10	36	5.11	n.s.

Random vs non-random selection

The χ^2 goodness-of-fit indicated that the choice was not significantly different from random in the TIMSS 2003 sample and the research sample writing the test in isiZulu, thus, random guessing was likely to be the dominant strategy that learners used when answering this question. The χ^2 goodness-of-fit for the research sample writing the test in English is very close to significant (0.1>p>0.05), thus, the strategy of guessing cannot be eliminated as the possible strategy used to answer this question.

The common strategy used to answer this question was that of translating the question into isiZulu, for example, '*Iyiphi i-organ ebhalwe la ngezansi engekho situated kwi-abdomen?*' Three key words were not translated, which probably affected learners' comprehension of

the question. During the interviews, all learners said they '*...did not understand the word 'abdomen'...don't know what it means even in isiZulu...*', this '*...has affected the way the question was answered...*' and learners, thus, resorted to the strategy of '*...guessing the answer...*'. Some "understanding" of this term included '*...a male does not have an abdomen...*' and '*...because C (stomach) is not in the abdomen...*'.

The "typical guessing procedure" in this question was to '*...look at all the words given in the options and knew that some of these words will not fit in with the question (will not give an answer to the question), so did not look at those words any further but considered the other three possible ones, then guessed from them ...*'. This finding suggests that learners did not understand all of the words in the alternatives - and coupled with not understanding the terms "abdomen", "organ" and "situated" - the question was thus difficult to answer.

Comparison between TIMSS 2003 sample and research sample answering in English

The correct answer to this question is alternative E. The χ^2 test (contingency table) indicated that there was no significant difference in the pattern of choice between the TIMSS 2003 sample and the research sample writing the test in English ($\chi^2 = 7.46$, $p > 0.05$). When the test was written in English, more learners in the research sample answered this question correctly (36.1%) than in the TIMSS 2003 sample (21.5%). The most popular choice for the TIMSS 2003 sample was alternative A and these learners seemed to have rejected alternative D, whereas this distracter was the second choice for the research sample writing the test in English.

Comparison between research sample answering in English and in isiZulu

When the test was written in isiZulu, fewer learners (10) answered this question correctly (compared to 13 in English), this finding suggests that the translation of this question into isiZulu made it more difficult to answer, most likely because the learners were not familiar with the terms in isiZulu. The second choices for these learners were distracters B and D. Among the reasons given for the choice, one was *'...I have left out the words 'stomach' and 'heart' because they will not fit in with this question and also I know these words, then look at the other three words: 'liver', 'kidney' and 'bladder', but also did not know the words 'liver' and 'bladder' and so did not select them but selected the word 'kidney' because it sounded familiar...'*.

Learners in the research sample seemed to have rejected distracter C in both test versions, suggesting that learners recognized the word "stomach" and might have tried to choose from the distracters they did not know. Alternatively, they may have known that the stomach is in the abdomen. The χ^2 test (contingency table) indicated that there was no significant difference in the pattern of choice between the research sample writing the test in English and in isiZulu ($\chi^2 = 1.68, p > 0.05$).

12038

English version

What is the main function of red blood cells?

- A. To fight diseases in the body
- B. To carry oxygen to all parts of the body
- C. To remove carbon monoxide from all Parts of the body
- D. To produce materials which cause the blood to clot.

IsiZulu version

Yimuphi umsebenzi omkhulu owenziwa ama-red blood cell?

- A. ukulwa nezifo emzimbeni
- B. ukuphatha i-oxygen iyiyise kuzozonke izicubu zomzimba
- C. ukususa i-carbon monoxide ephuma kuzozonke izicubu zomzimba
- D. ukukhiqiza izakhi ezenza ukuba igazi lome.

Table 5.8: Frequency of learners selecting each alternative for item 12038

Sample	A	B	C	D	n	χ^2	p
TIMSS 2003 sample	59	61	38	50	208	6.35	n.s.
Research sample (English test)	9	8	7	12	36	1.54	n.s.
Research sample (isiZulu test)	12	11	5	8	36	3.33	n.s.

Random vs non-random selection

The χ^2 goodness-of-fit indicated that in all samples, the choice was not significantly different from random. Thus, random guessing was likely to be the dominant strategy that learners used when answering this question. During the interviews, six learners said they ‘...did not know what ‘red blood cells’ are...and have never heard of them before...’ and this lead the learners into ‘...guessing the answer...’.

Comparison between TIMSS 2003 sample and research sample answering in English

The correct answer to this question is alternative B. When the test was written in English, more learners in the TIMSS 2003 sample answered correctly (29.3%) than in the research sample (22.2%). The most popular choice for the research sample was distracter D and

learners may have answered this question by matching the word in the question stem with that appearing in alternative D – blood. The second choice for the research sample (most popular choice for the TIMSS 2003 sample) was distracter A. When answering this question, learners said they translated the question into isiZulu and translated the ‘red blood cells’ as ‘*amasosha omzimba*’ (soldiers of the body) then chose distracter A. These learners confused the functioning of the white blood cells with that of the red blood cells, and may have matched the word “soldiers” with “fight” when choosing the answer. Learners in both samples seemed to have rejected distracter C. The χ^2 test (contingency table) indicated that there was no significant difference in the pattern of choice between the TIMSS 2003 sample and the research sample writing the test in English ($\chi^2 = 1.70$, $p > 0.05$).

Comparison between research sample answering in English and in isiZulu

More learners in the research sample answered this question correctly when the test was written in isiZulu (11) compared to 8 in English. Nevertheless, the most popular choice for the research sample writing the test in isiZulu (second choice in English) was distracter A. This can be attributed to the confusion created during translation between the functioning of the white blood cells with that of the red blood cells. Learners in the research sample seemed to have rejected distracter C in both test versions. The χ^2 test (contingency table) indicated that there was no significant difference in the pattern of choice between the research sample writing the test in English and in isiZulu ($\chi^2 = 2.04$, $p > 0.05$).

22235

English version

A girl has an idea that green plants need sand in the soil for healthy growth. In order to test her idea she uses two pots of plants. She sets up one pot of plant as shown below.

Diagram

Which ONE of the following should she use for the second pot of plants?

Diagrams

IsiZulu version

Intombazane inesu lokuthi izitshalo eziluhlaza zidinga isihlabathi emhlabathini ukuze zikhule kahle. Ukuze ihlole isu layo isebenzisa izitshalo ezisemabhodweni ezimbili. Yazilungiselela eyodwa yalezizitshalo njengoba kukhonjiswe ngezansi.

Diagram

Yikuphi OKUKODWA kwalokhu okulandelayo okumele ikusebenzise njengesitshalo sesibili?

Diagrams

Table 5.9: Frequency of learners selecting each alternative for item 22235

Sample	A	B	C	D	E	n	χ^2	<i>p</i>
TIMSS 2003 sample	25	64	16	16	52	173	56.39	< 0.001
Research sample (English test)	6	13	3	3	11	36	11.78	< 0.01
Research sample (isiZulu test)	8	11	4	4	9	36	5.39	n.s.

Random vs non-random selection

The χ^2 goodness-of-fit indicated that when the test was written in English the choice was significantly different from random in both the TIMSS 2003 sample and the research sample, and not significantly different from random in the research sample writing the test in isiZulu. Thus, random guessing was unlikely to be the dominant strategy that learners used when answering this question in English and was likely to be the dominant strategy

used when answering this question in isiZulu version, despite the fact that 11 out of 36 learners chose B, while only four chose options C and D.

Comparison between TIMSS 2003 sample and research sample answering in English

The correct answer to this question is alternative E. Just above 30% (in each sample) of the learners in both the TIMSS 2003 sample and the research sample writing the test in English answered this question correctly. An example of a reason for this choice given during the interviews was ‘...*in this plant she used sand, soil and water; so, for the other plant that she wants to test – most of the plants come from soil and water – so, I chose E which has soil and water ...*’. This finding suggests that the phrase in the question stem ‘...need sand in the soil...’ was not seen as a useful piece of information.

The most popular choice for the TIMSS 2003 sample and the research sample writing the test in English was distracter B. To answer this question correctly, learners needed to know that the girl’s idea was about sand not about the sunlight. Because “sunlight” is more salient than “sand”, many of the learners thought that the girl’s idea is to test the effect of sunlight and therefore that she should now place the plant in the dark, keeping the other factors constant. Some learners answered this question by ‘... *first reading the question and then looking at the pictures in the bottom ...*’. These learners chose distracter B because when looking at the pictures, the first picture shows the Sun as the main concept.

Other learners may have focused on the girl’s idea not as placing the plant in the Sun but more generally as “doing a controlled experiment”. They may have then related to the

experiments done in school or read about in textbooks, and may choose any condition in which just one factor is changed, e.g. distracter A. Distracter D could have fallen into this category but learners seem to have realized the effect of the absence of water in the growth of plant, and distracter C could also have been included in this category, however, two factors had already been changed and learners ignored these options in both samples when the test was written in English. The χ^2 test (contingency table) indicated that there was no significant difference in the pattern of choice between the TIMSS 2003 sample and the research sample writing the test in English ($\chi^2 = 0.20, p > 0.05$).

Comparison between research sample answering in English and in isiZulu

When the test was written in isiZulu 9 learners (compared to 11 in English version) answered this question correctly. The χ^2 test (contingency table) indicated that there was no significant difference in the pattern of choice between the research sample writing the test in English and in isiZulu ($\chi^2 = 0.94, p > 0.05$). This finding suggests that translation of this question into isiZulu made no difference in answering this question, therefore, the problem lies in knowledge rather than language.

22160

English version

What is the advantage of having two ears to hear with rather than one ear?

IsiZulu version

Buyini ubuhle bokuba nezindlebe ezimbili ukuze uzwe kunokuba nendlebe eyodwa?

Table 5.10: Percentage of learners answering item 22160 correctly and incorrectly

Sample	Correct response	Incorrect response	n
TIMSS 2003 sample	4.3%	95.7%	92
Research sample (English test)	14.0%	86.0%	36
Research sample (isiZulu test)	27.8%	72.2%	36

Credit for the correct response in this question was given when learners made reference to locating the source of sound, hearing sounds from both sides and retaining hearing if one ear does not function; and given for the incorrect response when the learner gives only a general or vague response relating to how well one can hear, mentioning only that hearing is uneven/unbalanced with one ear.

Comparison between TIMSS 2003 sample and research sample answering in English

When the test was written in English, 14.0% of the learners (compared to 4.3% for the TIMSS 2003 sample) answered this question correctly; and reference was made mostly to hearing sounds from both sides and mentioning that if hearing is lost in one ear, the other may still function, for example *'...because you can hear both sides if you have two ears, but if you have only one you can't hear good like you have both...sometimes ears don't work the same so it helps when the other ear is lacking to work, the other will'*. Only one learner made reference to locating the source of sound when answering this question, *'...because when you cross the road you can hear when the car is coming...'*

Learners who responded incorrectly to this question – 95.7% for the TIMSS 2003 sample and 86.0% for the research sample – related their responses to how well one can hear, for example *'...you can hear better than when you have one ear...you can hear more than a*

person with only one ear...because sometimes you don't hear clearly, if I am speaking to you I need to speak louder so you can hear what I'm saying'. The χ^2 test (2x2 contingency table) indicated that there was no significant difference in the percentage correct and incorrect between the TIMSS 2003 sample and the research sample writing the test in English ($\chi^2 = 3.42, p > 0.05$).

Comparison between research sample answering in English and in isiZulu

When the test was written in isiZulu, 27.8% of the learners responded correctly to this question. More learners mentioned being able to locate the position, direction and/or distance of the source of sound; and that if hearing is lost in one ear, the other may still function, for example '*...izindlebe ezimbili zikuzwisa kahle uma umuntu ekhuluma nawe noma ekude kangakanani, akadingi ukuze asondele eduze (...two ears makes you hear well when someone is talking to you even if s/he is far away, s/he does not need to come closer), ...uyakwazi ukuzwa nemoto uma iza ngemuva (...you can hear a car when it's coming from behind), ...zikusiza ukuthi ukwazi ukuzwa ndawozombili (...they help you to be able to hear from both sides), ...uma eyodwa ivalekile noma igula lenye iyakwazi ukuzwa (...when one is blocked or infected, the other one can still hear)'*.

The strategies used by learners when answering this question were '*...translating the question into isiZulu to understand it well...*', for example '*Yibuphi ubuhle bokuba nezindlebe ezimbili kunokuba neyodwa ukuze uzwe kahle?...*'; using "picture memory", for example '*...I thought of a person, I have never seen a person with only one ear, so I thought that maybe someone with one ear only cannot hear very well...I pictured a person*

with one ear and I thought it could be abnormal and that person cannot hear very well.

During the test sessions, it was interesting to note learners putting a hand over an ear as if trying to experience having one ear.

Learners said they ‘...*think of the answer in isiZulu and translate it into English so as to write it...*’ and noted the difficulty presented by this “process”, for example ‘...*my answer came into my mind in isiZulu and I translated it back into English...and it is difficult to write what I want to say in English but I know what to say in isiZulu...it could have been easier if I had to write it (answer) in isiZulu. There are some words that are easy to write down if the answer is in isiZulu but they (words) are difficult to write in English...*’. The χ^2 test indicated that there was no significant difference in the percentage correct and incorrect between the research sample writing the test in English and in isiZulu ($\chi^2 = 2.10, p > 0.05$).

22152

English version

What processes take place in the human body that prevent it from overheating during exercise?

IsiZulu version

Yimaphi ama-process enzakalayo emzimbeni womuntu awuvikela ekubeni ungashisi ngokweqile lapho ezilolonga?

Table 5.11: Percentage of learners answering item 22152 correctly and incorrectly

Sample	Correct response	Incorrect response	n
TIMSS 2003 sample	5.6%	94.4%	108
Research sample (English test)	13.9%	86.1%	34
Research sample (isiZulu test)	16.7%	83.3%	33

To get credit for this question, learners had to refer to sweating AND the cooling effect of evaporation OR without explicitly mentioning the cooling effect of evaporation, and/or refer to increased blood flow to the skin, or refers only to drinking water to cool down or refers to an effect of exercise but does not specifically address overheating and/or cooling.

Comparison between TIMSS 2003 sample and research sample answering in English

Two learners did not respond to this question when the test was written in English and 13.9% responded correctly. Though these learners referred to sweating, they did not explicitly mention the cooling effect of evaporation, for example '*...you begin to sweat in your body so you don't get to be overheating because you replace that water in your body...your body release all the excess sweat...when you exercise you sweat so in that way you are prevented from overheating...sweating and blood gives you more oxygen so that you can go on exercising...*'.

Learners who responded incorrectly to this question referred to the effect of exercise and drinking water, for example, '*...drinking water...eat healthy food, e.g. food with starch more vegetables and more water...need water...muscles get bigger...must have energy first and get proteins of the body...*'. Most of the incorrect responses were off task, for example '*...wearing a summer dress...heart will prevent people from overheating...have good breath and oxygen...breath out, coughing...exercising is good for you, you feel good...that process is called high blood pressure...exercise when the sun is not out like in the mornings and afternoons...loose weight...*'. The χ^2 test indicated that there was no significant

difference in the percentage correct and incorrect between the TIMSS 2003 sample and the research sample writing the test in English ($\chi^2 = 3.15$, $p > 0.05$).

Comparison between research sample answering in English and in isiZulu

Three learners did not respond to this question when the test was written in isiZulu. More learners, 16.7% (compared to 13.9% in English), responded correctly to this question by mentioning sweating, but did not refer to the cooling effect of evaporation. One learner gave a very good response to this question: '*...uyajuluka, kuphume amanzi ukuze umzimba wakho uphole. Ngalesosikhathi inhliziyo yakho ishaya ngokushesha okusho ukuthi kufanele uphuze amanzi amaningi ukuze igazi lihambe kahle emzimbeni (...you sweat, loosing water so that your body will cool. During that time your heart beats faster meaning that you have to drink lots of water so that your blood can flow well in your body)*'.

When responding to this question learners said they '*...translated the question into isiZulu and had a better understanding of it...then thought of a person who is exercising/pictured an exercising person/had a picture in mind of a person exercising, how he looks like/what happens when the person exercises: he sweats, loses weight and gain more energy*'. This strategy is confirmed by the responses to this question given by learners who tended to refer to the "physical" effects of exercise.

Some learners said they '*...did not understand the question in both the English and isiZulu tests...did not understand how you can prevent overheating in the body when exercising...and ...never met this at school before...and so wrote what is thought could be*

the answer, and contributed to learners whose responses were off task. The χ^2 test indicated that there was no significant difference in the percentage answering correctly and incorrectly between the research sample writing the test in English and in isiZulu ($\chi^2 = 0.14, p>0.05$).

22154

English version

Sipho went to school with a flu. Several days later, half of his classmates also had flu. What is one likely reason some classmates had flu but others did not?

IsiZulu version

U-*Sipho* waya esikoleni ephethwe umkhuhlane. Ngemuva kwezinsukwana ezimbalwa, ingxenywe yalabo afunda nabo yaphathwa umkhuhlane. Yisiphi isizathu esingenza ukuba abanye balabo afunda nabo baphathwe umkhuhlane kodwa abanye ungabaphathi?

Table 5.12: Percentage of learners answering item 22154 correctly and incorrectly

Sample	Correct response	Incorrect response	n
TIMSS 2003 sample	5.0%	95.0%	100
Research sample (English test)	36.1%	63.9%	35
Research sample (isiZulu test)	55.6%	44.4%	36

It is important to note that in this question the term “flu” was used for the South African context rather than the term “cold” which was used in the original question. The TIMSS 2003 sample wrote the original question with the term “cold” and the research sample wrote the question with the term “flu”. The term “cold” has multiple meanings: it can be in the context of “weather” and also in the context of “health”. Learners in the TIMSS 2003 sample may have been distracted by this and may have been attracted to the context of weather. The difference in percentage correct response between the TIMSS 2003 sample

and the research sample writing the test in English can be partly explained by this adaptation.

To receive full credit for this question, responses should have included some reference to transmission of “germs” (viruses, bacteria, etc.), either explicitly or through a description of a method of transmission (sneezing/coughing, direct physical contact, etc.), or to defense mechanisms (immunity, resistance, etc.). A response that included only a general reference to proximity without any description of a method of transmission was scored as an incorrect answer. The χ^2 test indicated that there was a significant difference in the percentage correct and incorrect between the TIMSS 2003 sample and the research sample writing the test in English ($\chi^2 = 22.91, p < 0.001$).

Comparison between research sample answering in English and isiZulu

All research learners answered this question when the test was written in isiZulu and one learner did not attempt to respond to this question when the test was written in English. More learners (55.6%) answered correctly when the test was written in isiZulu than when the test was written in English (36.1%). Responses given by the research sample writing the test in English gave no description of a method of transmission, for example ‘...*Sipho gave to other learners...those who were his friends and sitting with/next to him got the flu...others were not sitting with him and did not get it (flu)*’. Some correct responses included reference to a method of transmission, for example ‘...*coughing in classroom...sneezing around them (classmates)*’.

Learners said they ‘...understood this question better in isiZulu than in English...the answer is easy to think about because everything is in isiZulu...and can answer it better in isiZulu than in English...’. This was shown in their responses when the test was written in isiZulu. Most of the responses included methods of transmission, “germs”, defense mechanisms and physical contact/exposure, for example ‘...kwakufanele avale umlomo uma ekhwehlela noma ethimula (...he was supposed to cover his mouth when coughing or sneezing), ...wayebathelela ngamagciwane uma ekhwehlela ekilasini (he was infecting them with “germs” when coughing in class), ...abanye ababehlala naye babengawugomele umkhuhlane base betheleleka umkhuhlane ka-Sipho (others who were sitting with him were not immunized for flu and were infected by Sipho’s flu), ...abanye babemtshela ukuthi akavale umlomo uma ekhwehlela mhlambe laba abanye babengamtsheli (some were telling him to cover his mouth when coughing and maybe others were not telling him), ...kwakufanele ayobona udoketala noma aye ekliniki (he was supposed to go and see the doctor or go to the clinic). The χ^2 test indicated that there was no significant difference in the percentage correct and incorrect between the research sample writing the test in English and in isiZulu ($\chi^2 = 2.45, p>0.05$).

22161

English version

Briefly explain how eyeglasses and contact lenses help some people to see more clearly.

IsiZulu version

Chaza kafushane ukuthi izibuko kanye nama-contact lenses abasiza kanjani abanye abantu ukuze babone ngokugqame kakhulu

Table 5.13: Percentage of learners answering item 22161 correctly and incorrectly

Sample	Correct response	Incorrect response	n
TIMSS 2003 sample	2.9%	97.1%	105
Research sample (English test)	2.8%	97.2%	35
Research sample (isiZulu test)	27.8%	72.2%	34

Correct credit in this question was given for responses that demonstrated knowledge of vision by describing how lenses modify the way light enters the eyes and hits the back of the eye as well as responses based on helping eyes to focus, to see objects at different distances or to magnification. Responses referring only to “near-sighted” or “far-sighted” people without further explanation of correcting vision of objects at different distances as well as explanations based on corrections for the eye disorders such as astigmatism were marked incorrect.

Comparison between TIMSS 2003 sample and research sample answering in English

When the test was written in English, one learner did not attempt to answer this question. Only 2.8% of the research sample gave a correct response and only 2.9% of the TIMSS 2003 sample gave a correct response, for example ‘...*maybe they have pain in their eyes and need to see small things big and far things to be next to them...*’. Learners said they ‘...*translated this question into isiZulu...since there were some words they did not understand clearly in English*’, examples of their translations included ‘...*uma umuntu egqoka izibuko, ku-contacteka kanjani nokuthi abone kangcono emehlweni?*’ (‘...if a person wears eyeglasses/spectacles, how does it contact with seeing better in the eyes’) ‘...*uma umuntu egqoka izibuko ubona kanjani emehlweni?*’ (‘...if a person wears eyeglasses/spectacles how does s/he see in the eyes?’) ‘...*uma umuntu egqoke izibuko*

zimusiza kanjani ukuthi abone kakhulu kunomuntu ongazigqokile?’ (‘...if a person is wearing spectacles, how do they help her/him to see more than a person who is not wearing them?’).

It was clear that learners did not understand what ‘contact lenses’ are: the first translation tries to find *contact* between wearing eyeglasses/spectacles and seeing better, and the other translations have omitted ‘contact lenses’ without changing the meaning of the question. This was reflected in their responses which mentioned only eyeglasses/spectacles and gave only a vague reference to eyeglasses/spectacles helping people see more clearly, for example ‘...*spectacles help them to see (more) clearly/better...have medicine in them and people see better...eyeglasses help them to see things big*’.

Learners said they ‘...*have found it hard to answer this question...because there were some words they thought about in isiZulu but could not write them in English...did not know what and how to write...did not know how to put down an answer...had never worn spectacles and contact lenses or suffer from eyes... and answered the question using general knowledge...what I think happens to someone who wears spectacles, and according to what I heard people saying about the spectacles and the contact lenses*’. The χ^2 test indicated that there was no significant difference in the percentage correct and incorrect between the TIMSS 2003 sample and the research sample writing the test in English ($\chi^2 = 0.00$, $p > 0.99$).

Comparison between research sample answering in English and in isiZulu

More learners – 27.8% - responded correctly to this question when the test was written in isiZulu than in English. The adaptation of the term “contact lenses” in the isiZulu sentence may have clarified the understanding of this term as an “object” for modifying vision. Responses given by learners in isiZulu were based on seeing objects at different distances and on magnification, for example ‘...into ekude uyibona kahle iseduze (something far is seen better and nearer)...*abanye bagqoka izibuko uma befunda khona bezobona amagama emakhulu* (some people wear eyeglasses/spectacles when reading so that they can see the words to be bigger)...*bakwazi ukubona amagama emakhulu ebhodini mhlambe uma behlala emuva* (so that they can see bigger words at the chalkboard maybe when they sit at the back)’. Two learners, however, did not attempt to respond to this question when the test was written in isiZulu. The χ^2 test indicated that there was a significant difference in the percentage correct and incorrect between the research sample writing the test in English and in isiZulu ($\chi^2 = 9.16, 0.01 > p > 0.001$).

CHAPTER 6

DISCUSSION

The aim of this study is to describe the performance of and explore the strategies used by isiZulu-speaking learners when answering questions in the TIMSS 2003 test.

The first phase's objective is to describe:

- the South African participants in TIMSS 2003 science study,
- the performance of all South African learners in the science test of TIMSS 2003,
- the performance of learners from different language groups,
- the performance of KwaZulu-Natal isiZulu-speaking learners in selected TIMSS 2003 science questions.

The objective of the second phase is to explore:

- the performance of a research sample in selected questions in English format and the same questions translated into isiZulu,
- the strategies used by isiZulu-speaking learners when answering selected questions,
- the changes in meaning when the original English items are translated into isiZulu, and
- the changes in meaning when these items are back-translated from isiZulu to English without reference to the original English version.

The results show that of the 265 South African schools selected for TIMSS 2003, 255 schools and 8 952 learners participated in the TIMSS 2003 study. The South African learners answered the TIMSS 2003 test in either Afrikaans (n = 1 040) or English (n = 7 912). Learners taking the test in Afrikaans were first-language users while most learners taking the test in English were attending ex-DET schools and English was not their first language (Reddy, 2006). The average age of South African learners participating in TIMSS 2003 study (administered in November 2002) was 15.1 years, and they were near the end of the eighth grade of school.

The South African learners performed very poorly on the TIMSS 2003 science test and have been previously described as “falling short of international benchmarks” (Taylor, Muller & Vinjevold, 2003). The lack of content specification and the low overlap between the national objectives of the South African curriculum and the performance indicators assessed by TIMSS 2003 study contributed to a low score (HSRC, 2004). These findings partially confirm the questions raised on content validity (whether content tested matches content taught) of the TIMSS instruments in both TIMSS-R and TIMSS 2003 (Howie, 2001; Reddy, 2006).

South Africa’s scores reflected the largest spread of scores in science of all the countries that participated in the study, indicated by very low as well as a few very high scores. Analysis showed that the large distribution is a reflection of the continuing inequalities in education in the South African society (HSRC, 2004). Those learners who took the test in

Afrikaans (11.6%) scored higher than learners who took the test in English (88.4%): mean scaled scores were 376 and 231, respectively (Reddy, 2006).

Most of the learners who took the test in English were African (84%) and were attending schools that served the African population group under the apartheid system of government. Analysis of performance of learners according to categories reflecting the former racially based departments of education, indicates that learners in the African schools have the lowest score (199 ± 3.9), and learners in the former White schools have the highest scores (483 ± 17.3) (HSRC, 2004). Learners in the former White schools have a score just below the international mean (474 ± 0.6).

Provincial scores show that the KwaZulu-Natal (KZN) province was among the three provinces with the lowest performance. In total, KZN province had 46 schools and 1 632 learners participating in TIMSS 2003 study. Of the 46 participating schools, 37 (80.4%) were ex-DET schools where English is taught as a second (or even third) language, and all schools took the test in English only. The majority of learners (and teachers) in these schools would be isiZulu-first language speakers.

An analysis of 12 Life Science items extracted from the TIMSS 2003 Released Set of Science items showed a very poor performance by isiZulu-speaking learners at ex-DET schools in the KZN province. Most of the ex-DET schools in the province are in rural areas where learners seldom speak English in out-of-school and home environments, i.e. where English could be regarded as a foreign language (Soudien & Sayed, 2003).

The language of the TIMSS tests has been found to have an effect on South African ESL learners' achievement in other TIMSS studies (Howie, 2001; HSRC, 2004, Dempster and Reddy, in press; and Reddy, 2006). The research evidence suggests that learners learning and completing tests in an alternative language may be disadvantaged (Clarkson, 1991; Ellerton & Clements, 1991). It is clear from this and other studies that when learners are compelled to learn through a second language, this can seriously obstruct the learners' progress. Thus a possible explanation for the South African learners' poor performance in TIMSS could be that language prevented them from understanding the questions and selecting the correct answer or constructing a free response in English.

McNaught (1991) suggests that there are considerable problems around constructing meaning at the interface between isiZulu and English, especially with logical connectives and locative constructions. The present study eliminated the language bias by making the English test – comprising the 12 items – available in isiZulu. The translation of these items into isiZulu and back-translation into English by advanced science students show that very little change in meaning occurred, and logical connectives were rarely used.

The results of the translations show that when English terminology is incorporated in the isiZulu sentence during translation of questions from English into isiZulu, the meaning of the question does not always change. However, the changes that occurred in the sentences supported isiZulu phonology. The hypothesis that science questions cannot be translated into isiZulu was, therefore, rejected based on the evidence presented in this study.

The fact that the meaning of a question does not change when English terminology is included in isiZulu sentences does not mean that the terminology is well understood by the learners in the isiZulu sentences. The evidence presented in this study reveals that the questions are easier to understand when written in isiZulu, but the scientific terms are still not understood by the learners because they may be unfamiliar to learners and/or the terms do not coincide with their frames of reference.

The present study has noted that during the translations, some English (and scientific) terms had literal translations in isiZulu but were either not known or not commonly used by both teachers and learners in their code-switching, e.g. *sperm = isidoda, organ = isitho somzimba, whale = umkhomo, etc*; other terms had dual meanings e.g. *table* and in some terms one word in isiZulu translates to two words in English, which have multiple meanings in everyday language and in science, e.g. *community* and *population*.

The results according to the main guiding research questions of the exploratory phase show that more learners in the research sample answered the selected TIMSS items correctly when the test was written in English than the isiZulu-speaking learners in the TIMSS 2003 sample. This finding suggests that learners in a smaller group (research sample) performed better than in a bigger group (TIMSS 2003 sample). However, the statistical analysis showed no significant difference in the mean percentage correct in the two samples.

More research learners answered some, but not all, items correctly when the test was written in isiZulu than when written in English. Translation of the items into isiZulu may have improved the learners' understanding of the items and, thus, a higher percentage answering correctly. However, these results were not as high as expected but did partially indicate that the language of the test has an effect on learner achievement in science; especially the "foreign/new" terms on the questions seemed to have a definable effect on learners' achievement. The t-test, however, showed no significant difference in the mean percentage answering correctly in both test versions. This may be because a small number of questions was used.

The results of this stage of the study confirmed the findings of other studies in South Africa (e.g. Damonse, 1996; McNaught, 1994; Rutherford & Nkopodi, 1990, and Setati *et al.*, 2002, among others) involving the use of African languages in science, all of which show that language has an impact on the achievement of the South African learners in science. The findings of the present study revealed a need to develop the cognitive/academic language proficiency (CALP) of the ESL learners in both English language and isiZulu language to improve their science learning and achievement.

During the interviews, the research sample said that they translate the English questions into isiZulu before attempting to answer; and if they do not understand the question and/or terms used in the question, they resort to guessing the answer. The χ^2 goodness-of-fit indicated that in the multiple choice questions, the pattern of choices was not significantly different from random in three items consisting of (abstract) scientific terms; however, it

was significantly different from random in the other five items. This means that learners did not guess randomly, but used a strategy to select the answer.

The χ^2 test (contingency table) indicated that there was no significant difference in the pattern of choice across all alternative answers between the TIMSS 2003 sample and the research sample writing the test in English; and the difference was significant in one free-response item between the research sample writing the test in English and in isiZulu, where learners favoured the correct answer more frequently in the isiZulu version than in the English version.

The present study has found that the learners' translations, compared to the 'expert's' translations, showed that learners were often unable to translate key words from English to isiZulu, e.g. item 22117: 'Yinindaba izinambuzane *zi-treated* uku-*preventa* i-*sperm production*?'. In the expert's translation, only the term *sperm* was not translated. Learners were unable to translate three key terms, and therefore translation did not help them to understand the question. The back-translations were performed by senior science students, who are familiar with the discourse of science. The learners were clearly unfamiliar with this discourse.

The strategies used by learners when answering the selected TIMSS 2003 science questions differed in the multiple choice questions and the free response questions. In the multiple choice questions, following the reading and translation of the question, learners read the given alternatives and if they don't know the correct answer, they "guessed" it. When

guessing, learners use the method of ‘...*looking for the ‘familiar’ words*’ and choose among them, e.g. item 12014: the familiar word was *muscles*, or they ‘...*look at the words in the alternatives which are similar to/fit in with the words used in the question*’, e.g. item 22117: *prevent, production–produce*.

In the free response questions, learners have used their ‘...*general knowledge*’ and ‘*picture memory*’ when answering, e.g. item 22160: ‘*I pictured a person with one ear and I thought it could be abnormal and that person cannot hear very well*, and item 22152: ‘...*pictured an exercising person/had a picture in mind of a person exercising...*’.

Common problems experienced by learners when answering these questions were “foreign” words: words they have not met before and never learnt at school. These words affected the way the questions were answered: learners try to relate these words to their “frames of reference” and if they do not overlap with these frames, learners try to think of what the words possibly mean and answer questions based on this understanding of the words.

One other problem mentioned by the learners in the free response type questions involves the challenge of writing their answers. After translating the question into isiZulu and thinking about the answer in isiZulu, learners had difficulty in translating their answer back into English so as to write it, ‘...*it is easy to write the answer in isiZulu than in English...and then my answer was not put in the same way that I thought in isiZulu...*’.

However, the results show improvement in some, but not all, questions when the test was written in isiZulu.

The findings of this stage of the study related to the model of question answering as described by Pollitt & Ahmed (2001) and provided extended details when applied to isiZulu-speaking learners. In phase 0 of this model (learning the subject), the research learners had not learnt some of the 'content' on the questions and this affected the way they answered the questions. This reflects on science teaching in South Africa, where more than half of the science teachers had not qualified in science (Howie, 2001). It reflects also on the school syllabus for science, which omits many fundamental concepts in science.

In phase 1 of this model (reading the question), learners first read the question as it is in English and then try to translate it into isiZulu so as to understand it better. The translation process helps the learners' understanding of the question only if all the words in the questions can be translated into isiZulu or if learners are familiar with the English terms. If some words cannot be translated accurately, the understanding of the question is affected and the learners still fail to answer the question correctly.

In phase 2 (searching the memory) and phase 3 (matching question to memory), learners search their memories to look for relevant concepts to match those in their interpretation of the question. When the concepts exist in their memories in phase 4 (generating an answer), the questions are easy to answer correctly whereas if the concepts do not exist in their memories or do not match with their memories the questions are more likely to be

incorrectly answered and/or answered according to what learners think the question requires. It was noted that for isiZulu-speaking learners in phase 4, the answer was generated in isiZulu and needed to be translated back into English for the next phase of the model.

In phase 5 (writing the answer), isiZulu-speaking learners translate the answers they have generated in phase 4 from isiZulu back into English so as to write it. This back-translation of the answer affects the way the question is answered and does not provide a true reflection of the answer in the learners' memories. This is attributed to difficulty with scientific terms which normally do not exist or are literally translated into the isiZulu language but play a major role in English and science contexts. Then we would expect much better scores on the test conducted in isiZulu, but this was not the case.

The findings of the present study indicate that when the model of question answering is applied to isiZulu-speaking learners, the order of the phases will be extended and become:

Phase 0	Learning the subject
Phase 1	Reading the question
<i>Phase 2</i>	<i>Translating the question from English into isiZulu</i>
Phase 3	Searching the memory
Phase 4	Matching question to memory
Phase 5	Generating an answer
<i>Phase 6</i>	<i>Back-translating the answer from isiZulu into English</i>
Phase 7	Writing the answer

Figure 6.1 Model of question answering process as applied to isiZulu-speaking learners. (Amended from Pollitt & Ahmed, 2001).

The model will, however, be different for different question types as noted in Pollitt & Ahmed (2001) study.

CHAPTER 7

CONCLUSION & RECOMMENDATIONS

7.1 Conclusion

The aim of this study is to describe the performance of and explore the strategies used by isiZulu-speaking learners when answering questions in the TIMSS 2003 test. The first phase's objective was to describe the performance of the South African learners in TIMSS 2003 science test. The objective of the second phase was to explore the strategies used by isiZulu-speaking learners when answering selected TIMSS 2003 science items. A sub-question that this research tried to answer was: Can TIMSS science items be translated accurately into isiZulu, without significant loss of meaning?

The findings of this study confirms the findings of other studies on TIMSS in South Africa showing the poor performance of the South African Grade 8 learners on TIMSS 2003 science test (HSRC, 2004; Dempster & Reddy, in press; and Reddy, 2006). However, this poor performance does not exist in isolation; it reflects the inequalities many learners are confronted by within the education system itself.

Provincial scores show that the KwaZulu-Natal (KZN) province was among the three provinces with the lowest performance. In this province, 80.4% of the learners were at ex-DET schools where English is taught as a second (or even third) language, and all schools took the test in English only. The statistical analysis shows no significant difference in

mean percentage correct between the research sample in this study and the TIMSS 2003 KZN sample; thus, the findings of this study can be generalized to the KZN learners.

Interviews conducted with learners revealed that almost all the learners felt they would be able to answer the questions more easily if the tests were conducted in isiZulu, yet the results presented in this study showed no statistically significant difference between the scores obtained in English and isiZulu.

Research has shown that language has an effect on the learning and teaching of science (Rollnick, 1998); the majority of the teachers and learners at ex-DET schools in the KZN province are first language isiZulu-speakers. McNaught (1991) suggested that there are considerable problems around constructing accurate scientific meaning at the interface between isiZulu and English. The findings of the present study differed with McNaught (1991) and Rutherford & Nkopodi (1990) since the meaning of most questions did not change substantially when translated into the isiZulu sentences, and incorporating “Zulufied” English terminology. Most questions were back-translated by isiZulu-speaking senior science students into a format closely resembling the original.

However, this does not mean that the scientific concepts and/or terminology are well understood by the learners when they are answering the questions translated into isiZulu. The evidence presented in this study reveals that the questions are easier to understand when written in isiZulu, but the scientific terms and concepts are still not understood by the learners because they may be unfamiliar to them, i.e. the knowledge base remains

unknown/elusive. The findings of this study suggest that the lack of content knowledge overshadows the effect of language on achievement. I agree with this statement.

There has been considerable debate about the reliability of TIMSS tests in providing information on educational achievement and its validity for exploring scientific understanding (Reddy, 2006; Atkin & Black, 1997; Harlen, 1999). The present study, unlike other published secondary analysis of TIMSS studies which tend to concentrate on the written responses to TIMSS items, further explored the learners' reasons for their responses by conducting interviews asking them how they think about their answers and why they chose those answers.

The interviews were unstructured as the flexibility to follow learners' thoughts was important and individual responses determined the direction of each interview, however, guiding questions were asked to focus the interviews on the study. There were times when it was deemed necessary to ensure that what the learners were saying was not said to please the interviewer or because they thought that was what they should say. At times interpretations and generalizations were provided to be either confirmed or rejected by the learners.

The interviews provided a better understanding of the learners' reasoning and strategies used when answering science questions than post hoc analysis of the answers. Learners reported that they used a range of strategies to answer questions, including the following:

- translating the question into isiZulu before trying to answer it,
- choosing an answer containing a word/term common in the question stem and in the options,
- choosing the answer containing a familiar/unfamiliar word in the options,
- guessing,
- looking at patterns of previous choices,
- ‘picture memory’, and
- ‘general knowledge’.

These strategies have been confirmed in an analysis of 20 TIMSS items where more than 40% of children attending a random sample of ex-DET schools selected one incorrect answer (Dempster, in press).

These strategies were incorporated into a model of the question answering process devised by Pollitt & Ahmed (2001) to understand what may be occurring in isiZulu-speaking learners’ minds when they answer the science questions. Two “new” phases (2 and 6) were introduced into the original model when applied to isiZulu-speaking learners:

Phase 0	Learning the subject
Phase 1	Reading the question
Phase 2	Translating the question from English into isiZulu
Phase 3	Searching the memory
Phase 4	Matching question to memory
Phase 5	Generating an answer
Phase 6	Back-translating the answer from isiZulu into English
Phase 7	Writing the answer

Figure 7.1 Model of question answering process as applied to isiZulu-speaking learners. (Amended from Pollitt & Ahmed, 2001).

The first phase introduced: *translating the question from English into isiZulu*, improves learners' understanding of the question when all the words/terms in the question can be translated into isiZulu, and if these words/terms overlap with their frames of reference. The success of the following phases in the model will be strongly affected by operation at this phase.

The second phase introduced: *back-translating the answer from isiZulu into English*, poses challenges in that learners have to use "scientific language" when writing the answer. Learners cannot write what is in their minds, because of their limited competence in English. This inability to articulate their answers in English affects free response items more than multiple choice items, where learners are required to recognize the correct answer, rather than construct an answer. It should also be noted that Phase 1 in the Pollitt

& Ahmed's (2001) model may not be met in South African schools, since the intended curriculum (C2005) deliberately under-specified content in favour of learning outcomes.

The evidence presented in this study reveals that the intersection between cognitive development and language is difficult to access and tease apart. The findings of this study suggest the need for the development of CALP in both English and isiZulu languages, or in one of them, which should then be the language of instruction.

7.2 Recommendations

The South African constitution has committed South Africa to the development of multilingualism in the country. In line with the call for the development of multilingualism, all educational institutions are expected to have developed a language policy (Howie, 2001). The South African Constitution has made provision for schools to select any of the eleven official languages of South Africa as the language of learning and teaching (LoLT). Despite this provision, the majority of South African schools have selected English as the medium of instruction (MoI), with a smaller number choosing Afrikaans (Howie, 2001; Reddy, 2006).

Dlodlo (1999) believes that home languages can serve important functions in expressing alternative concepts, in clarifying concepts, in eliminating misconceptions and in formulating ideas. If schools decide to use English as a MoI, then they should do it properly, or if home language is to be used as a MoI, then it needs to be implemented

properly. In cases where English remains the principal medium of instruction, home languages still need to be developed as supporting languages for learning. Research has attributed the failure of modern science and technology to become established on the African continent to the use of non-indigenous languages as languages of instruction in schools (Dlodlo, 1999).

Many of the arguments against the use of African languages as languages of learning list the following conditions as contributing to the problem: lack of translation equivalence, underdevelopment of lexicons (i.e. paraphrase or ambiguity) and the question of a standard versus dialect variety (Foley, 2002; Murray, 2002), and publishers have been understandably reluctant to translate textbooks into all eleven official languages of the country.

A study by Young & Abrahams (2002) investigated “concept literacy” in Mathematics and Natural Sciences. The rationale for this study was the problems experienced by African language-speaking learners when trying to understand and use crucial mathematics and science terms, concepts, and the language that contextualizes them, which is often abstract and complex. The aim of this study was to develop a teachers’ guide which would provide home language terminology for specific scientific and mathematical concepts. These annotations in the home languages would provide further language samples for analysis and back-translation into English, in order to determine whether they lose their specificity (and core meaning) under translation.

Dlodlo (1999) proposes the use of the Nguni language in the learning and teaching of science. The Nguni language comprises isiZulu, isiXhosa, isiNdebele and SiSwati languages; there is a slight difference in the dialects of these languages. Dlodlo (1999) makes the point that English non-technical terms have acquired scientific meaning through their use in Physics. The same applies to Biology. He suggests that suitable equivalents need to be found in the African languages. Afrikaans is a uniquely South African language, which creates vocabulary needed for educational subjects such as Biology, Physics and Chemistry.

Dlodlo (1999) further warns that certain lexical items have acquired distinct scientific meanings in English but translation of these items into the African languages often involves under-differentiation where one word in the home language covers two or three distinct meanings in English. There is thus a need to study the instances where translation from English to the home language is not as efficient in conveying the precise meaning of a concept. The present study has shown that close translation is possible if conducted with care by expert teachers. The method used in this study and in many schools is to retain the English terminology, with the appropriate isiZulu prefix, but intervening and linking words are translated into isiZulu. The resulting “interlanguage” facilitates comprehension.

Research focusing on the problems of translatability, coupled with home language to carry the precise meanings of scientific concepts must be conducted. Transfer of CALP across languages is understood to take place when it exists, initially, in the home language, what Cummins (2000) refers to as a “common underlying proficiency”. It is easier for learners

to understand difficult terms in English when they are first understood in the home language. However, this can only occur when both languages have reached a 'threshold level' of development, i.e. where the home language has developed a strong cognitive base. This does not yet appear to be the case in South African education.

Botswana learners were also tested in English, although their first language and that of most of their teachers is not English. Nevertheless, they achieved significantly higher scores in TIMSS 2003 than the South African learners. This points to less effective teaching of science in South Africa than in Botswana. In Singapore, three language groups co-exist (Tamil, Chinese and Malaysian), but English is the MoI in all secondary schools, and yet Singapore has consistently scored among the highest of all countries in successive TIMSS studies.

Language of learning and teaching is not the only factor influencing learners' achievement in science; it is compounded by poor teaching and learning in science, poor resources, and many dysfunctional schools. Reddy (2006) reported that in the South African TIMSS 2003 study, one-third of the teachers were teaching mathematics and science without appropriate knowledge and skills. Sanders & Nhlapho (1993) also identified teachers themselves as a major source of learners' misconceptions about scientific concepts. It is possible that the teachers either do not themselves know the core meanings of concepts, or they code-switch into the home language which then results in an inaccurate representation of this core meaning. This was a problem also identified by Young & Abrahams (2002) who claimed

that many African language teachers themselves lacked command of the core meanings of concepts and other language forms.

The immediate challenge to the education system is to ensure that the one-third of teachers who teach mathematics and science without possessing the appropriate knowledge and skills be given the requisite training and qualifications. A parallel challenge is to ensure an effective intervention in a quality input of the professional development courses by continuous evaluation of teachers, and monitoring the impact these courses have on performance, bearing in mind that inputs of this nature must be directly aimed at improving learner knowledge and skills. While it is acknowledged that the training will take place over a period of time, it is crucial for investments in teacher development to be of high quality. Teachers can be supported in the classroom with the provision of high quality teaching materials. There should be textbooks for learners, paralleling what is taught in the classrooms, enabling them to work independently.

The findings of the present study suggest that language factors are embedded within other factors, importantly, the appropriate level of cognitive proficiency to enable correct answering of science questions. Noting this, it is thus crucial that teaching quality and the cognitive demands made of learners are of a sufficiently high standard, and target language proficiency of learners. Where children do not possess the knowledge required to answer TIMSS questions, they resort to alternative strategies that have little to do with understanding what the question is asking. This has been shown clearly by Dempster (in

press) in an analysis of the patterns of answering in 20 TIMSS items where more than 40% of children in ex-DET schools selected one incorrect answer.

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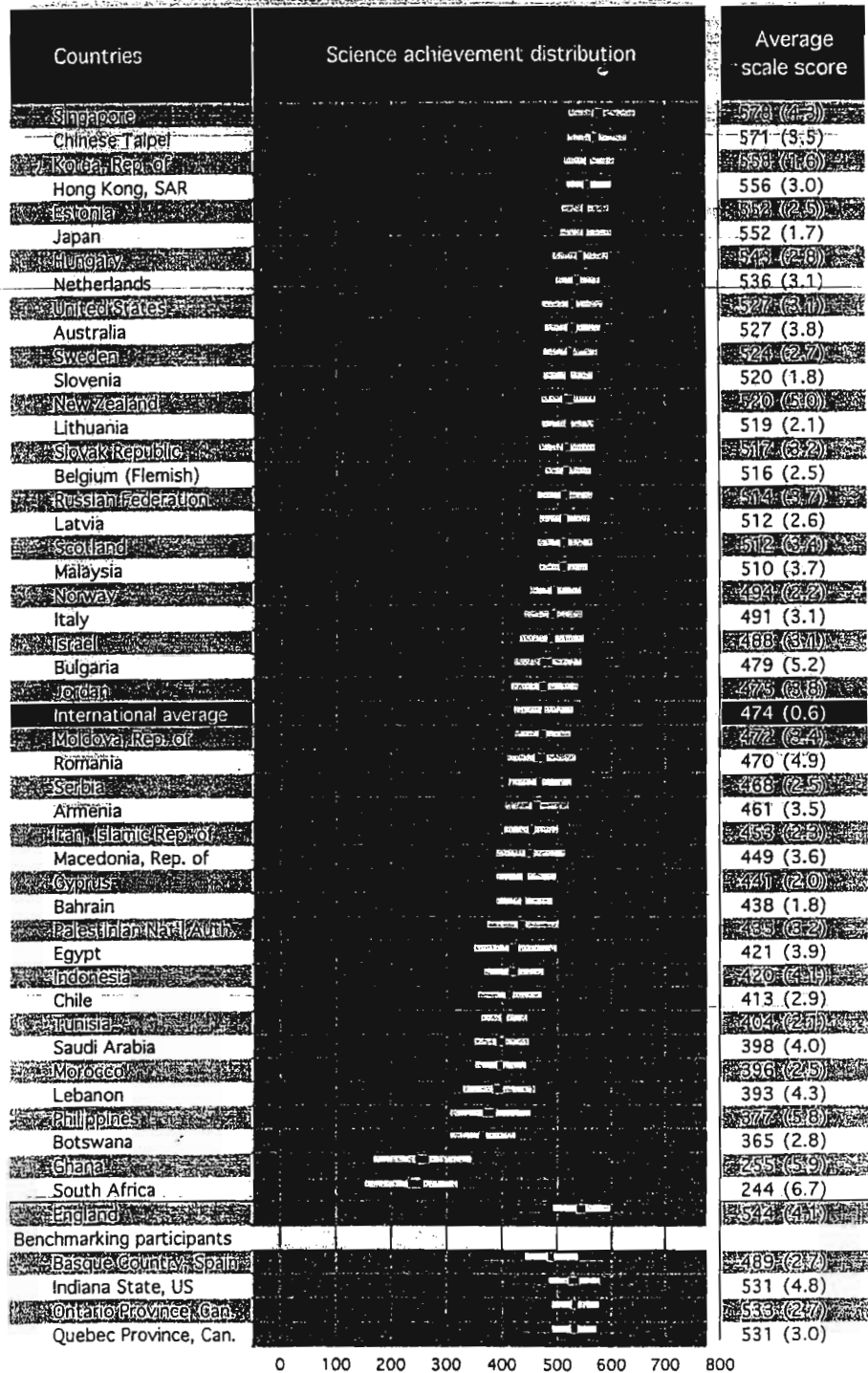
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APPENDIX 1

Distribution of Science Achievement



APPENDIX 2

TIMSS 2003 Trend Items

UniqueID **S012026**

Subject **S** Grade **8**

MSBlock **S01**

MSBlockSeq **02**

A son can inherit traits

- (A) only from his father
- (B) only from his mother
- (C) from both his father and his mother
- (D) from either his father or his mother, but not from both

TIMSS 2003

Content Domain

Life Science

Main Topic

Reproduction and heredity

Cognitive Domain

Conceptual Understanding

Key

C

TIMSS

A person sorted some animals into the two groups listed on the table.
Which characteristic of animals was used for the sorting?

- (A) Legs
- (B) Eyes
- (C) Nervous system
- (D) Skin

Group 1	Group 2
Humans	Snakes
Dogs	Worms
Flies	Fish

Content Domain

Life Science

Main Topic

Types, characteristics and classification of living things

Cognitive Domain

Conceptual Understanding

Key

A

TIMSS

Why would male insects be treated to prevent sperm production?

- (A) To increase the number of female insects
- (B) To reduce the total population of insects
- (C) To produce new species of insects
- (D) To prevent insects from mating

Content Domain

Life Science

Main Topic

Reproduction and heredity

Cognitive Domain

Conceptual Understanding

Key

B

TIMSS

Content Domain

Life Science

Main Topic

Development and life cycle of organisms

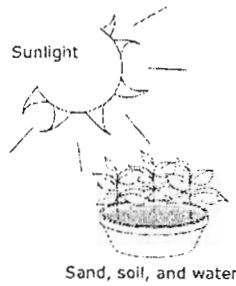
Cognitive Domain

Reasoning and Analysis

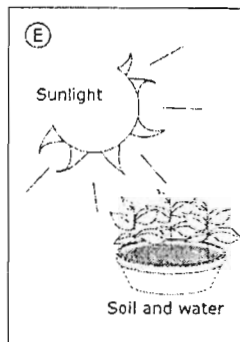
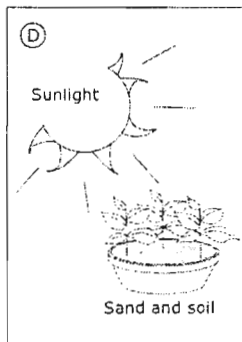
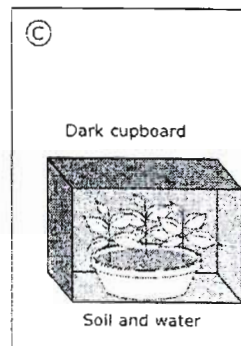
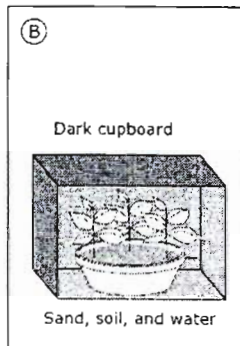
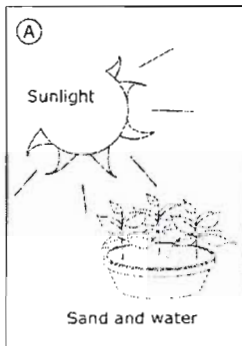
Key

E

A girl has an idea that green plants need sand in the soil for healthy growth. In order to test her idea she uses two pots of plants. She sets up one pot of plants as shown below.



Which ONE of the following should she use for the second pot of plants?



TIMSS

What is the advantage of having two ears to hear with rather than one ear?

Content Domain

Life Science

Main Topic

Structure, function and life processes in organisms

Cognitive Domain

Conceptual Understanding

Key

See scoring guide

Note: Credit is given for both higher-level responses referencing locating the source of sound (Code 10) as well as less sophisticated responses referencing hearing sounds from both sides and retaining hearing if one ear does not function (Codes 11,12). Priority is given to Code 10. If locating source of sound is mentioned, use Code 10 even if other correct codes also apply.

Code	Response	Item: S022160
	Correct Response	
10	Mentions being able to locate the position, direction and/or distance of the source of sound. <i>Examples: By having two ears, you can actually tell where a sound came from. With two ears you could hear which direction a noise is coming from. With two ears you can judge the distance the sound is away from you. With two ears you can tell if the sound is near or far.</i>	
11	Mentions hearing sounds from both sides (direction) with no mention of locating the source. <i>Examples: You can hear on both sides of you. You can hear sounds from all around, not just one side. With two ears you can hear from more than one way.</i>	
12	Mentions that if hearing is lost in one ear, the other may still function. <i>Examples: In the result of being deaf in one ear, you have another one that is used. If you lost the hearing in one ear, the other one might still work.</i>	
19	Other correct	
	Incorrect Response	
70	Gives only a general or vague response relating to how well one can hear. <i>Examples: You hear better. You can hear half as much with one ear. Two ears lets you hear a lot more. The volume is greater.</i>	
71	Mentions only that hearing is uneven/unbalanced with one ear. <i>Examples: If you had one ear, the sound would be uneven. Your hearing would be out of balance. You hearing gets balanced better with two ears.</i>	
79	Other incorrect (including crossed out/erased, stray marks, illegible, or off task)	
	Nonresponse	
99	Blank	

TIMSS

When a person sees something, what carries the message from the eyes to the brain?

- (A) arteries
- (B) glands
- (C) muscles
- (D) nerves
- (E) veins

Content Domain

Life Science

Main Topic

Structure, function and life processes in organisms

Cognitive Domain

Factual Knowledge

Key

D

TIMSS

Content Domain

Life Science

Main Topic

Structure, function and life processes in organisms

Cognitive Domain

Factual Knowledge

Key

E

Which of the following organs is NOT situated in the abdomen?

- (A) liver
- (B) kidney
- (C) stomach
- (D) bladder
- (E) heart

TIMSS

What is the main function of red blood cells?

- (A) To fight disease in the body
- (B) To carry oxygen to all parts of the body
- (C) To remove carbon monoxide from all parts of the body
- (D) To produce materials which cause the blood to clot

Content Domain

Life Science

Main Topic

Cells and their functions

Cognitive Domain

Factual Knowledge

Key

B

TIMSS

Content Domain

Life Science

Main Topic

Reproduction and heredity

Cognitive Domain

Conceptual Understanding

Key

C

Traits are transferred from generation to generation through the

- (A) sperm only
- (B) egg only
- (C) sperm and the egg
- (D) testes

TIMSS

Content Domain

Life Science

Main Topic

Structure, function and life processes in organisms

Cognitive Domain

Conceptual Understanding

Key

See scoring guide

What processes take place in the human body that prevent it from overheating during exercise?

Note: Priority is given to Codes 10 and 11. If perspiration or sweating is mentioned, use Code 10 or 11, even if other correct responses such as increased blood flow to the skin are also included.

Code	Response	Item: S022152
	Correct Response	
10	Refers to perspiration (sweating) AND the cooling effect of evaporation. <i>Examples: When people sweat, it evaporates to cool them down. Sweating. When the sweat evaporates, it cools the skin. Perspiration cools you down when it evaporates.</i>	
11	Refers to perspiration (sweating), without explicitly mentioning the cooling effect of evaporation. <i>Examples: The body sweats. Perspiration keeps you from overheating. The perspiration cools you off and you don't stay hot.</i>	
12	Refers to increased blood flow to the skin. <i>Examples: The blood rushes to your face and cools you down.</i>	
19	Other correct	
	Incorrect Response	
70	Refers only to drinking water to cool down.	
71	Refers to an effect of exercise but does not specifically address overheating and/or cooling. <i>Examples: The blood pumps faster. Breathing increases. Your body is working hard and using up more food energy.</i>	
79	Other incorrect (including crossed out/erased, stray marks, illegible, or off task)	
	Nonresponse	
99	Blank	

TIMSS

Content Domain

Life Science

Main Topic

Human health

Cognitive Domain

Reasoning and Analysis

Key

See scoring guide

Salil went to school with a cold. Several days later, half of his classmates also had colds. What is one likely reason some classmates had colds but others did not?

Note: To receive credit, responses must include some reference to transmission of ‘germs’ (viruses, bacteria, etc.), either explicitly or through a description of a method of transmission (sneezing/coughing, direct physical contact, etc.), or to defense mechanisms (immunity, resistance, etc.). A response that includes only a general reference to proximity without any description of a method of transmission will be scored as incorrect. Priority is given to Code 10. If a response includes transmission of ‘germs’ (viruses, bacteria, etc.), use Code 10 even if other correct codes also apply. Otherwise, if more than one reason is given, assign the code corresponding to the first correct reason, giving priority to diagnostic codes (Code 11, then 12) over the ‘other’ code (Code 19).

Code	Response	Item: S022154
	Correct Response	
10	Refers explicitly to transmission of ‘germs’ (viruses, bacteria, etc.) from Salil to some classmates (or not to others). <i>Examples: Some students were hanging around Salil with him sneezing his germs onto them. The ones exposed to the virus caught it.</i>	
11	Refers to some students having better defense mechanisms (immunity, resistance). <i>Examples: Some of the students have just got over a cold. Some students' immunity was low because they went outside in the cold.</i>	
12	Refers to a specific method of transmission involving physical contact or exposure without mentioning germs explicitly (e.g. sneezing/coughing, shaking hands, drinking from same glass, breathing same air). <i>Examples: He sneezed on the ones that got it. They touched something Salil touched.</i>	
19	Other correct	
	Incorrect Response	
70	Includes ONLY a general or vague response relating to proximity or “catching the cold” from Salil. [No explicit description of a method of transmission is given.] <i>Examples: Some of his classmates did not like him so probably were not near him a lot. The ones who were his friends got it. The kids who sat by him caught the cold. Some caught it from Salil. Salil gave it to some of the class.</i>	
79	Other incorrect (including crossed out/erased, stray marks, illegible, or off task)	
	Nonresponse	
99	Blank	

*The scoring guide for this trend item has been simplified from the version used in 1999. Original Codes 70 and 71 were combined into Code 70.

TIMSS *2003*

Briefly explain how eyeglasses and contact lenses help some people to see more clearly.

Content Domain

Life Science

Main Topic

Structure, function and life processes in organisms

Cognitive Domain

Reasoning and Analysis

Key

See scoring guide

Note: Credit is given for higher-level responses that demonstrate knowledge of vision by describing how lenses modify the way light enters the eye and hits the **retina** or back of the eye (Code 10) as well as less sophisticated responses based on helping eyes to focus, to see objects at different distances or to magnification. Use the highest level code applicable (Code 10, 11, 12, then 13). Responses referring only to “near-sighted” or “far-sighted” people without further explanation of correcting vision of objects at different distances receive Code 70. Explanations based on corrections for other eye disorders such as astigmatism, lazy eye, etc., are given Code 19.

Code	Response	Item: S022161
	Correct Response	
10	Mentions that glasses/contact lenses bend (refract) or focus light rays onto the retina (or back of the eye). [May use a diagram to show this]. <i>Examples: The glasses focus the light onto the retina.</i>	
11	Mentions the curvature (shape) of lenses (concave/convex) and/or bending of light by lenses. [Based primarily on the properties of lenses with no explicit mention of the focusing of light on the retina or back of eye.] <i>Examples: You can focus better because glasses bend the light into your eye.</i>	
12	Mentions that glasses/contact lenses help the eyes focus and/or allow (near-sighted/far-sighted) people to see images at a distance or close up. <i>Examples: Some people can see close up but need glasses in order to see things far away. Far-sighted people can only read with glasses that correct their close-up vision. Eyeglasses can help your eyes to focus more clearly on things.</i>	
13	Mentions that glasses/contact lenses magnify or enlarge (images). <i>Examples: They magnify. The magnification in the glasses make things more clear and bigger. The lenses make things look bigger.</i>	
19	Other correct	
	Incorrect Response	
70	Gives only a vague reference to glasses/contact lenses helping people see more clearly or containing prescriptions (chemicals, special type/shape/thickness of glass, etc.) without further explanation of vision or how lenses work. <i>Examples: They make you see more clearly. If you are near sighted, you need glasses to help you see. Contacts help vision because of the prescription injected into them. Lenses are prescribed to fix eye problems. The lenses in glasses are made thick so you can see better.</i>	
79	Other incorrect (including crossed out/erased, stray marks, illegible, or off task)	
	Nonresponse	
99	Blank	

*The scoring guide for this trend item has been simplified from the version used in 1999. Original Codes 70 and 71 were combined into Code 70.

APPENDIX 3

English Version Test

Research based on TIMSS 2003 study

Life Science Test

February 2005

Researcher: Mr. S. C. Zuma

Institution: University of KwaZulu-Natal

Learner code:.....

School name:.....

Section A

Read each question carefully and circle the answer you think is best. If you decide to change your answer, put an 'X' over your first choice and then circle your new choice.

1. A son can inherit traits

- A. only from his father
- B. only from his mother
- C. from both his father and his mother
- D. from either his father or his mother, but not from both.

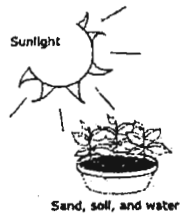
2. A person sorted some animals into the two groups listed on the table. Which characteristic of animals was used for the sorting?

Group 1	Group 2
Humans	Snakes
Dogs	Worms
Flies	Fish

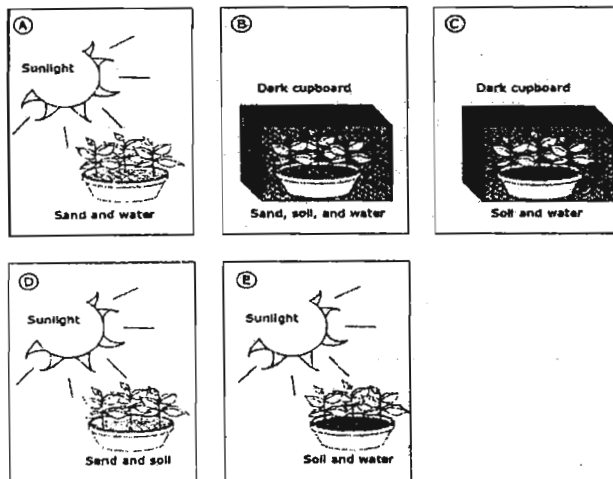
- A. legs
- B. eyes
- C. nervous system
- D. skin

3. Why would male insects be treated to prevent sperm production?
- A. To increase the number of female insects.
 - B. To reduce the total population of insects
 - C. To produce new species of insects
 - D. To prevent insects from mating.
4. Traits are transferred from generation to generation through the
- A. sperm only
 - B. egg only
 - C. sperm and the egg
 - D. testes.
5. When a person sees something, what carries the message from the eyes to the brain?
- A. arteries
 - B. glands
 - C. muscles
 - D. nerves
 - E. veins
6. Which of the following organs is NOT situated in the abdomen?
- A. liver
 - B. kidney
 - C. stomach
 - D. bladder
 - E. heart.

7. What is the main function of red blood cells?
- To fight diseases in the body
 - To carry oxygen to all parts of the body
 - To remove carbon monoxide from all parts of the body
 - To produce materials which cause the blood to clot.
8. A girl has an idea that green plants need sand in the soil for healthy growth. In order to test her idea she uses two pots of plants. She sets up one pot of plant as shown below.



Which ONE of the following should she use for the second pot of plants?



Section B

Answer the following questions on the spaces provided below each question.

9. What is the advantage of having two ears to hear with rather than one ear?

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10. What processes take place in the human body that prevent it from overheating during exercise?

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11. Sipho went to school with a flu. Several days later, half of his classmates also had flu. What is one likely reason some classmates had flu but others did not?

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12. Briefly explain how eyeglasses and contact lenses help some people to see more clearly.

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Thank you for your time, effort and thought in completing this test.

APPENDIX 4

IsiZulu Version Test

Research based on TIMSS 2003 study

Life Science Test

February 2005

Researcher: Mr. S. C. Zuma

Institution: University of KwaZulu-Natal

Learner code:.....

School name:.....

Section A

Fundisisa lemibuzo ebese ubeka isiyingi kuleyompendulo ocabanga ukuthi iyona engcono. Uma ufuna ukushitsha impendulo yakho, beka u 'X' ngaphezulu kwempendulo oyikhethe okokuqala ebese ubeka isiyingi kuleyompendulo entsha oyikhethayo.

1. Indodana ingathola ufuzo
 - A. kubaba wayo kuphela
 - B. kumama wayo kuphela
 - C. Kubo bobabili obaba wayo kanye nomama wayo
 - D. Kubaba wayo noma kumama wayo, kodwa hhayi kubo bobabili

2. Umuntu wehlukana ezinye zezilwane ngamaqoqo amabili abhalwe kuleli-table. Yisiphi isici salezizilwane esasetshenziswa ekuzahlukaniseni?

Iqoqo 1	Iqoqo 2
Abantu	Izinyoka
Izinja	Ama-worms
Izimpukane	Izinhlanzi

- A. imilenze
- B. amehlo
- C. i-nervous system
- D. isikhumba.

3. Kungenziwa yini ukuba izinambuzane zesilisa zelashwe ukuze kuvikelwe ukuba zikhiqise ama-sperm?

- A. ukuze kwandiswe inani lezinambuzane zesifazane
- B. ukuze kuncishiswe isamba se-population yezinambuzane
- C. ukuze kukhiqizwe i-species esisha sezinambuzane
- D. ukuze kuvikwelwe ukwandisana kwezinambuzane.

4. Ufuzo ludluliselwa kusuka kwisizukululwane kuye kwesinye isizukulwane

- A. ngama-sperm kuphela
- B. ngeqanda kuphela
- C. ngama-sperm kanye neqanda
- D. ngamasende.

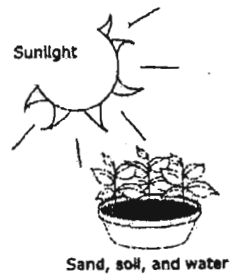
5. Uma umuntu ebona into ethile, yini ethatha imilayezo esuka emehlweni iye engqondweni?

- A. ama-artery
- B. ama-gland
- C. ama-muscle
- D. ama-nerve
- E. ama-vein

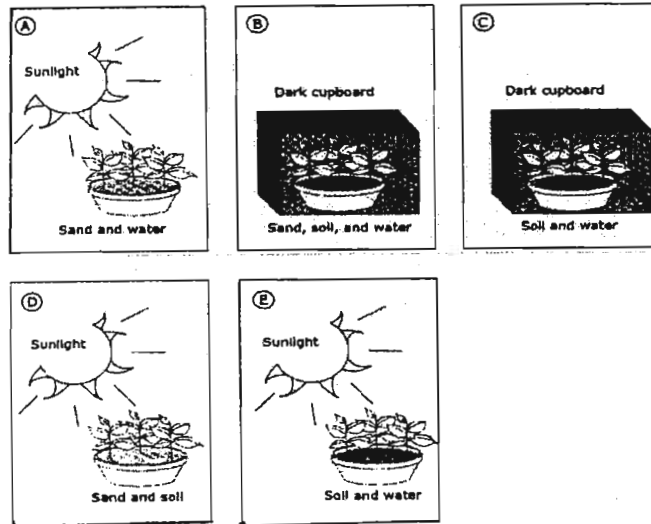
6. Iyiphi kulama-organ alandelayo ENGATHOLAKALI kwi-abdomen?

- A. isibindi
- B. inso
- C. isisu
- D. isinye
- E. inhliziyo.

7. Yimuphi umsebenzi omkhulu owenziwa ama-red blood cell?
- A. ukulwa nezifo emzimbeni
 - B. ukuphatha i-oxygen iyiyise kuzozonke izicubu zomzimba
 - C. ukususa i-carbon monoxide ephuma kuzozonke izicubu zomzimba
 - D. ukukhiqiza izakhi ezenza ukuba igazi lome.
8. Intombazane inesu lokuthi izitshalo eziluhlaza zidinga isihlabathi emhlabathini ukuze zikhule kahle. Ukuze ihlole isu layo isebenzisa izitshalo ezisemabhodweni ezimbili. Yazilungiselela eyodwa yalezizitshalo njengoba kukhonjiswe ngezansi.



Yikuphi OKUKODWA kwalokhu okulandelayo okumele ikusebenzise njengesitshalo sesibili?



Section B

Phendula lemibuzo elandelayo ezikhaleni ezinikeziwe ngaphansi kombuzo ngamunye

9. Buyini ubuhle bokuba nezindlebe ezimbili ukuze uzwe kunokuba nendlebe eyodwa?

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10. Yimaphi ama-process enzakalayo emzimbeni womuntu awuvikela ekubeni ungashisi ngokweqile lapho ezilolonga?

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11. U-Sipho waya esikoleni ephethwe umkhuhlane. Ngemuva kwezinsukwana ezimbalwa, ingxenye yalabo afunda nabo yaphathwa umkhuhlane. Yisiphi isizathu esingenza ukuba abanye balabo afunda nabo baphathwe umkhuhlane kodwa abanye ungabaphathi?

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12. Chaza kafushane ukuthi izibuku kanye nama-contact lenses abasiza kanjani abanye abantu ukuze babone ngokugqame kakhulu.

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Thank you for your time, effort and thought in completing this test.

APPENDIX 5

Interview Transcripts

12026

R: Let's say you are in a test situation, like you were writing yesterday, and you want to answer this question. What are the processes that you go through to understand this question and to select the correct answer?

NAT0309: *I read the question first.*

R: What is the next step after reading it?

NAT0309: *I then answer the question.*

R: How will you answer the question?

NAT0312: *I read all the answers so as to understand them.*

R: What do you do to understand them?

NAT0311: *I read the question first and I read all the answers, then I can see which one is the correct answer.*

R: How do you choose the correct answer?

NAT0311: *I chose the answer C because a child inherits the traits from its mother and father.*

NAT0309: *I first read the question then read the answers and I decided which answer to choose.*

R: What does the question ask you, what does it require, how did you understand it?

NAT0309: *I understood it by reading it as it is.*

NAT0312: *I think the answer is C because a child does inherit traits from its mother and its father.*

NAT0310: *I also think the answer is C.*

NAT0309: *Ja, the answer is C.*

R: You are in a test situation, what is the first thing to do that will lead you into understanding this question, if you are faced by the science question written in English, what do you do to understand it?

SBT0301: *You read it over and over again until you understand it.*

R: If you say over and over again, probably how many times?

SBT0301: *For about four times.*

R: As you are reading it, what is it that you are trying to do? Are you reading it in the same language or you also translate it into another language?

SBT0304: *I first read the question and then try to understand what it means.*

R: How do you understand it?

SBT0304: *I translate it into isiZulu so that I will understand it very well.*

R: Is it all the English written questions you meet that you translate or certain questions?

SBT0302: *I try to translate it so that I can understand it.*

SBT0301: *I first read it and try to understand what the question is about and then translate it into isiZulu so as to explain it well.*

R: What could be your answer to this question?

SBT0301: *I will say it's D, because he cannot inherit the traits from both his parents, it's better to inherit from either his father or his mother.*

R: Why does he have to inherit from either of them?

SBT0301: *I don't know!*

SBT0304: *I think the answer is C because sometimes there are children who resemble both their parents. I did not understand the question in isiZulu test but I understood it better in the English test.*

SBT0303: *The answer is B.*

SBT0302: *This question was quite easy because I used my general knowledge and I chose the answer C.*

SBT0306: *My answer is C because a child inherits from both his parents.*

SBT0307: *I did not understand the question, this word 'traits' gave me a problem, it made it harder for me to understand what the question requires and then I ended up guessing the answer.*

R: Let's say you are in a test situation like you were writing yesterday; you want to answer this question, what is the first thing that you are going to do?

MCT0304: *I read the question first and if there is something that I do not understand, I will call the invigilator to come and explain to me what that means.*

R: Would you expect that person to explain to you in English or in isiZulu?

MCT0304: *I would expect him to explain in isiZulu because it can happen that I know some words and he has to explain the other ones that I do not understand.*

MCT0305: *I read this question and I saw that what I will write will fit in with what has been asked in the question.*

MCT0307: *I translated this question into isiZulu so that I could answer it.*

MCT0305: *Ja, I have also translated it into isiZulu.*

MCT0304: *I did also translate it into isiZulu.*

R: Why did you have to translate it into isiZulu?

MCT0305: *I translated it so that I can understand it better.*

MCT0307: *Ja, for better understanding.*

R: So, you read the question in English, then again in isiZulu; now, how do you think about your answer: do you think about it in English or in isiZulu?

MCT0307: *The answer comes into my mind in isiZulu and then I will have to think of how I am going to translate it back into English so that it will make sense when I write it.*

R: How much challenge do you have when you have to translate your answer back into English?

MCT0307: *It is quite challenging because there are some isiZulu words which you cannot translate into English; then it is easier to answer in isiZulu than in English.*

R: What could be the answer to this question?

MCT0304: *I think the answer is C because a child inherits the traits from both his parents.*

MCT0310: *I think the answer is B.*

MCT0307: *I also think its B.*

MCT0305: *No, I think the answer is C because the child is made by both the father and the mother and then it can inherit the traits from both of them.*

12028

R: Let's say you are in a test situation, like you were writing yesterday, here is the question, what will you do to answer it?

NAT0302: *I will read the question and understand what that question is about, then after understanding it I can answer.*

R: What do you do to understand that question?

NAT0302: *I read it a couple of times.*

NAT0304: *Yes, read it over again.*

R: Is it common to all of us that you read the question more than once to understand it?

NAT0301/NAT0303: *Yes!*

R: Is there a difference in how you read it in the first time and maybe how you read it in the second time?

NAT0302: *I first read it in English and when I read it for the second time, I try to translate it into isiZulu since it is my home language and it is easy to understand in isiZulu.*

NAT0301: *Ja, so that you can have a better understanding of the question, and everything is easier in isiZulu.*

NAT0303: *It's also the same thing with me: I read it for the first time in English and then read it again trying to translate it into isiZulu.*

R: Now that you have read the question, you have an understanding in isiZulu of what the question requires, and you now want to write down the answer, how do you go about writing the answer?

NAT0304: *You think about the answer in isiZulu and you translate it into English to see how it will sound.*

NAT0303: *Since my answer is in isiZulu I translate it back into English so that I can answer the question.*

R: Does the translation back into English affect your understanding of the question, does it affect the way you answer the question?

NAT0301: *The answer will sound better if written in isiZulu than written in English.*

R: Why?

NAT0303: *There are difficult words in English which you sometimes don't understand and you will have to use a dictionary to get their meanings.*

R: So, are you saying how you thought of the question affects how you answer that question since you have to answer in English and there are some words you cannot translate into English?

NAT0301/NAT0303/NAT0304: *Yes!*

R: Who can tell us, in isiZulu, what the question requires?

NAT0304: *Yisiphi isilwane esingafani nezinye kulezi?*

NAT0303: *Umntu uhlanganise izilwane kulama-group womabili, u-A no B, you have to explain which characteristics of animals, and then you look at the table and answer.*

R: What could be answer and how did you select it?

NAT0301: *It's D. Because the human does not have the same skin as all the other animals written here.*

NAT0302: *I first read the question and then I chose B. I saw that all the animals written here have different eyes and that is why I chose B.*

NAT0303: *I also chose B. I saw that they all had different eyes.*

NAT0304: *I chose D. I first read the question and I realized that the snake skin and the human skin are different.*

R: Let's say you are in a test situation, how will you go about answering this question, what are the processes that you go through in understanding this question?

SBT0305: *I chose the answer B because all of them have eyes.*

SBT0307: *I chose B.*

SBT0308: *I chose A because all the animals in group 1 have legs.*

R: Did anyone of you tried to translate this question into isiZulu?

SBT0305/SBT0307: *Yes!*

SBT0308: *I did not understand the question in English and so I tried to read it in isiZulu then I understood what was happening and chose the answer A.*

R: How will you go about answering this question?

SBT0311: *I think you have to choose here in the given answers, I think the answer is A.*

SBT0309: *Ja, it's A, because the animals in Group 2 have no legs while those in Group 1 have the legs.*

R: You are in a test situation, you are faced with this question and you want to answer it, how will you go about answering it?

MCT0305: *You first have to read the question so that you will understand what it is about, and then answer it.*

R: How many times do you have to read the question?

MCT0305: *Sometimes you will have to read it two or more times to understand well what it requires.*

R: When you read it for the second time, do you read it in the same language as you read it on the first time?

MCT0305: *You read it in isiZulu so that you will understand it better.*

MCT0304: *Ja, I read it for the first time in English but I could not understand it and then I read it again in isiZulu and had a better understanding of it.*

MCT0307: *I read the question in English then when I read it for the second time, I looked at the words that I do not understand and tried to translate them into isiZulu so that I will understand them clearly, after that I will have my answer in isiZulu and then translate it back into English so that I can write it.*

MCT0305: *In this question, I had a problem of not knowing whether I have to select the answer between group 1 and group 2 or between the A, B, C and D; so I ended up choosing the answer at random.*

R: So, can you say that you have guessed the answer?

MCT0305: *Yes, I was just guessing the answer.*

MCT0304: *I also did not understand this question and so I ended up guessing the answer.*

R: What is it that led you into guessing?

MCT0304: *I did not know whether to tick the answer in the table or in the choices given.*

MCT0310: *I read it and understood it then I selected the answer C because I knew the other words and I could not see them fitting in with the answer and then I selected this word because I did not know it.*

MCT0307: *I also thought that the answer is C because it was the word I could use to bring together the animals in group 1 and in group 2.*

R: How do you go about guessing? Do you just choose any answer or you look for certain things in the answers?

MCT0305: *When guessing, you choose any answer because you do not understand what the question requires, and so you choose any answer.*

MCT0304: *Ja, I just put down any of those given answers.*

MCT0310: *I guess the answer when I do not understand the question.*

R: Do you guess because you do not understand the whole question or maybe because there are some words you do not understand in that question?

MCT0304: *When there are words I do not understand.*

MCT0305: *Sometimes when I do not understand the question or when there are some words in the question that I do not understand.*

R: How do you then go about selecting your guessed answer?

MCT0307: *I look for the words that can fit in with the question.*

22117

R: Once again, you are in a test situation, what will you do to understand this question? What problems do you encounter in this question and what strategies do you use to understand and answer this question?

NAT0302: *I have read this question and tried to analyze it in isiZulu, and then I read the answers and also translated them into isiZulu so that I can have a better understanding of the whole question.*

NAT0303: *The way I understood this question is: **Yinindaba izinambuzane zitreated ukupreventa i-sperm production?***

NAT0304: *I did not understand what the word 'treated' mean and I could not understand what the question required.*

NAT0302: *I have also find difficulty in understanding this word and this affected the way I answered this question.*

R: How did you arrive to your answer?

NAT0304: *It's C.*

NAT0303: *It's A, because they are treating the number of males to increase the number of females.*

NAT0302: *I also think it's A, so as to increase the number of females.*

NAT0301: *It's C, because they want to prevent the old ones and produce the new species of insects.*

R: So, the problem you experienced in this question was with the term 'treated', and the strategy you used was to read the question in English as it was and then read it again in isiZulu to have a better understanding?

NAT0301/NAT0302/NAT0303/NAT0304: *Yes!*

R: Is there a possibility that as you were thinking about the answer to this question, you guessed it because you did not understand the question very well?

NAT0302: *Ja, I guessed the answer.*

NAT0301: *Because I did not understand the word 'treated' I guessed the answer.*

NAT0303: *Ja, I was just guessing that it might be this one.*

NAT0304: *I have also guessed it.*

R: So, you did not answer according to your understanding of the question, but you have guessed the answer since you did not understand the question?

NAT0301/NAT0302/NAT0303/NAT0304: *Yes!*

R: Here is the first question, you are in a test situation, what is it that you first do to answer this question?

SBT0312: *You read the question first and understand it, after understanding it you then answer it.*

R: When you read the question and understanding it, how many times do you have to read it?

SBT0309: *It could be two or three times.*

R: As you read it, do you read it in the same language, which is English?

SBT0309: *No, you translate it into isiZulu, read it in isiZulu, so that you can have a clear understanding of it and then you read it again as it is written in English and then answer the question.*

R: What could be the answer for this question?

SBT0312: *I chose the answer B, because when I was reading the question for the first time I could not understand what it says, I read it again in isiZulu but still I could not understand very well what it means, then I read it again in English and I chose the answer B.*

R: When you chose your answer, were you guessing the answer or you chose the answer according to your understanding?

SBT0312: *I chose it according to my understanding.*

SBT0311: *I chose the answer to be B, and this is according to how I understood this question.*

SBT0309: *I also chose the answer B but I was guessing.*

R: What could be the answer to this question?

SBT0301: *I think it's D because if the insects can be treated to prevent mating that could prevent them to increase in number.*

SBT0303: *I think the answer is A, but I have guessed it.*

SBT0304: *My answer is B because many people do not like the insects, so they can treat them so as to reduce the total population of those insects.*

R: Let's say you are in a test situation like yesterday, and you want to answer this question. What is the first thing that you will do?

MCT0302: *I will read it first and look at the answers to see which one I can choose.*

R: How many times do you read the question?

MCT0302: *I read it a couple of times, maybe two or three times.*

R: Now that it is written in English, how will you try and understand what the question requires?

MCT0302: *I read the question even if I don't understand it well; I look at the answers and see that according to my thinking this could be the answer.*

MCT0306: *I first read the question then the answers, and then look at which answer I can select from the given ones.*

R: How do you see that this is the answer I have to select?

MCT0306: *I first read the question and all the answers then see which one is the answer.*

MCT0308: *I also read the question first and then read the answers; from there I will see which answer to choose, even though I could not understand the question very well.*

R: If you do not understand the question very well, how do you then choose your answer?

MCT0308: *I read the question over and over again.*

MCT0312: *When I read the question for the second time, I ask myself what each word in the question means in isiZulu so that when I compare the question and the answers I can see which one fits in with the question.*

R: So, in short you are saying that you read the question for the first time in English as it is written, and then you read it again for the second time translating it into isiZulu?

MCT0312: *Yes, translating it into isiZulu then look at the answers and see which answer fit in with the question.*

R: Does this also happen to anyone of you?

MCT0302/MCT0308: *Yes!*

MCT0306: *Yes, that happens to me most of the times.*

R: Does it happen in all the questions that you meet written in English or it only happen at certain types of questions?

MCT0312: *I do this to all the questions I meet. The understanding becomes easier when you translate into isiZulu because it is your home language.*

R: What do you then do when you have to write your answer, now that you have translated the question into isiZulu?

MCT0312: *I think about my answer in isiZulu but write it in English.*

R: How do you do that?

MCT0312: *I translate my answer back into English so that I can write it.*

MCT0302: *Yes, you translate your answer back into English.*

R: Do you have any difficulty in the way that you are going to write your answer in isiZulu or in English.

MCT0312: *There is no difficulty when you write the answer in isiZulu because you can think quickly in isiZulu but when you have to write it in English, it gives some challenges since sometimes there are words that you know their meanings in isiZulu, but difficult to*

translate them back into English, and when you write the answer you change your sentence in isiZulu and end up not writing what you were thinking in isiZulu, the sentence can just be away from what you wanted to say in the answer.

R: What could be the possible answer to this question?

MCT0308: *I think its D.*

MCT0306: *I think the answer is C.*

MCT0302: *I did not understand the question at all.*

R: What was the strategy that you then used to answer this question?

MCT0302: *I just thought that, though I did not understand well, the answer C will fit in with this question and I was not sure but I just thought it will fit in.*

R: So, are you saying that you were guessing the answer?

MCT0302: *Yes, I was guessing the answer because I did not understand the question at all.*

MCT0302/MCT0308: *I also guessed the answer.*

MCT0312: *I did not guess the answer but I translated it into isiZulu and I had a clearer explanation of the question and then I chose my answer and was sure that it fits in with the question.*

R: How do you go about guessing the answer?

MCT0302: *Sometimes you see the words which are similar, like in this question: the question has the word production and this answer here has the word produce, so you can see that since this word appeared in the question and also appears here in this answer, therefore this answer will fit in with the question.*

R: So, you look at the words which appear on the question and also on the answers?

MCT0302: *Yes!*

12039

R: Take as if you are in a test situation, and this is the question that comes up in a test. What do you do to understand this question?

NAT0306: *We read the question first.*

R: Then, what is the next step after reading the question?

NAT0305: *Then you try to describe it in the second time.*

R: How do you describe it in the second time?

NAT0305: *By explaining it.*

R: How do you explain it, do you explain it as it is in English or maybe in isiZulu asking yourself what exactly it means?

NAT0305: *You explain it in isiZulu, asking yourself very well...*

R: Does that happen to all of you that when you meet a question written in English, you first read it as it is in English and try to explain it in isiZulu?

NAT0308: *Yes, it is a normal process.*

R: Then what else do you do? Say now you have read the question, you have translated it into isiZulu, you have analyzed it so that you can understand it better, and you have now understood it in isiZulu, what is the next step?

NAT0307: *You then try to answer it.*

R: How do you answer it?

NAT0307: *By thinking about which answer is the correct one.*

R: Like here in the multiple choice, you think about which answer is the correct one and look at those answers...

NAT0305/NAT0307/NAT0308: *Yes!*

R: Now how do you choose that correct answer?

NAT0308: *You first read all the options and decide which one could be the answer.*

R: As you read the answers, does it happen as in the question that you read the answer and then translate it into isiZulu so that you can understand it better or you do something else?

NAT0308/NAT0306: *You translate it into isiZulu so that you can understand it better.*

R: Now, you have translated it into isiZulu, you have also looked at your answers, you now want to answer the question, remember you said you have thought of this question in isiZulu, you want to answer now, but the question was asked in English and you have to answer in English, what do you do?

NAT0306: *You then try to answer it in a way that you understood it.*

R: How? Do you take your answer as thought in isiZulu and translate it back into English?

NAT0306/NAT0308: *Yes!*

R: So, in this question, NAT0307 what could be your answer?

NAT0307: *I would say it's A.*

R: Why would you say it's A? What process did you go through to reach your answer A?

NAT0307: *Because the sperms are transferred from generation to generation.*

R: NAT0306?

NAT0306: *I think it's C.*

R: Why do you think it's C?

NAT0306: *Because in order to fall pregnant, you have to sleep with a man, thus they cannot be transferred through the woman only.*

R: NAT0305, what could be your answer?

NAT0305: *I would say it's C.*

R: Why do you think it's C?

NAT0305: *Because when you sleep with another person, the sperms end up fusing with the egg.*

R: NAT0308, what could be yours?

NAT0308: *I would say it's A.*

R: Why would you say that?

NAT0308: *Because sperms are moving from generation to generation.*

R: As you were asking yourselves this question, NAT0308, what does it say to you, as you were trying to understand it?

NAT0308: *In isiZulu?*

R: I wouldn't know, how did you understand this question, in isiZulu or in English?

NAT0308: *I understood it in isiZulu.*

R: And when you analyzed it, what does it ask you?

NAT0308: *It says: **Isizukulwane sandiswa kanjani esinye isizukulwane ukuze kwande abazukulu.***

R: So you are saying by the sperm only?

NAT0308: *Yes!*

R: What about you NAT0307, did you say the same thing?

NAT0307: *Yes!*

R: Is this so for all of us, has anyone have something different, has there been anyone who can say the question asked me this and I understood it as that?

NAT0308/NAT0306/NAT0307: *No!*

R: NAT0305, In the isiZulu test your chose your answer to be B and in the English test you chose C, can you tell me what was happening? Were you sure of your answers or maybe you guessed the answer?

NAT0305: *I was not sure, I did not think of the answer properly.*

R: NAT0307, yours was A on both tests, were you sure that it is A and why does your understanding gave you A as the answer?

NAT0305: *I cannot remember.*

R: How would you answer this question?

SBT0307: *I did not understand this question because I have never learnt about this thing before.*

R: What is it that you did not understand in this question?

SBT0307: *The words used, such as 'traits'.*

R: How did you then choose your answer, what was your answer to this question?

SBT0307: *I chose A, but I was not sure because I really did not understand the question.*

R: Were you actually guessing the answer?

SBT0307: *Yes!*

SBT0305: *I also guessed the answer because I did not understand what this word is: 'traits'.*

SBT0306/SBT0308: *I also guessed!*

SBT0304: *My answer is C because I think traits are transferred through the sperms and the egg.*

SBT0302: *I used my general knowledge and chose the answer C.*

SBT0301: *I think the answer is C because I believe that a child can inherit traits from both the sperm and the egg, it cannot inherit the traits from only one of these two things.*

R: Let's say you are in a test situation, you want to answer this question, what will you do to understand it, what is the first thing that you will do in trying to answer this question?

MCT0309: *You choose the correct answer.*

R: How do you go about choosing that correct answer?

MCT0309: *I look at the answer that fits in well with the question.*

R: How do you see that that answer will fit in well with the question?

MCT0309: *I look at the words in the question and see if the generations are kept through the sperms only or through the sperms and the egg.*

R: Can you tell me the process that you went through in coming up with your answer?

MCT0309: *I read it first then I looked at the answers to see which one I am more sure about, then I selected it.*

R: Did you, by any chance, try to translate this question into isiZulu?

MCT0309: *Yes, I translated it into isiZulu after I read it and did not understand what it requires, then I translated it into isiZulu and it then became easy to understand what it requires.*

MCT0301: *I chose the answer to be C because the sperms fuses with the egg to make a baby.*

MCT0303: *I did not understand this question but I also chose the answer C.*

R: Does that mean that you have guessed the answer?

MCT0303: *Yes, I guessed it.*

MCT0311: *I chose the answer D because I did not understand the question, so I can say that I have guessed the answer.*

R: How do you go about guessing your answer?

MCT0309: *When you guess you look at whether the answer you are choosing fits in with the question, see if, when you pronounce it, fits in with the question.*

12014

R: Again, take as if you are in a test situation, what will you do to arrive into the correct answer?

NAT0310: *I read the question and the answers, then I thought that the correct answer will be E.*

R: As you are telling me this in isiZulu, is it possible that you have translated this question into isiZulu?

NAT0310: *Yes, I read this question and I read it again in isiZulu.*

R: So, you read this question in English as it is then you translated it into isiZulu?

NAT0310: *Yes, I thought about the answer in isiZulu.*

R: You thought about the answer in isiZulu, now you want to write it down in English, how did you do that?

NAT0310: *I just chose the answer.*

NAT0311: *I read this question twice: I first read it in English as it is and then I read it again in isiZulu so that I can have a better understanding of what the question requires.*

R: Then how did you arrive at your answer?

NAT0311: *I thought of it in isiZulu and I read all these words, then I selected the best answer.*

NAT0312: *I read this question as it is in English and looked at all the possible answers given, then I chose the correct answer, it is E.*

NAT0309: *I also said it's E.*

NAT0311/NAT0310: *Ja, it is E.*

R: Have you ever met the words in these options before, do you know what do they mean, do you know where are they situated in the body?

NAT0309/NAT0311/NAT0312: *No, we have not met them before.*

NAT0310: *I have only met the word 'muscles', I have not met any of these other words.*

R: So, if you have not met these words before, how did you arrive at your answers? Were you sure of the answers that you were choosing or maybe you guessed the answer because you have not met any of these terms?

NAT0309: *I guessed the answer!*

NAT0312: *I was also guessing.*

NAT0311: *I guessed the answer, too.*

NAT0310: *It was the only word I did not know so I thought it could be the answer.*

R: What will you do to understand this question?

SBT0312: *I have just read the question; I have read it two times now.*

SBT0310: *I have also read it two times.*

SBT0312: *I have also translated this question into isiZulu.*

R: Why do you have to translate this question?

SBT0312: *When you read the question for the first time you cannot clearly understand what it means, you will have to translate it into isiZulu to understand it more clearly, and then you read it in English again to understand what it requires so that you can think about the answer.*

R: What could be the answer to this question?

SBT0310: *I chose A.*

R: Why did you choose A?

SBT0310: *I was guessing.*

R: Why did you guess?

SBT0310: *Because A is the only word that I do not know and so I chose it, I know all these other words and how do they function.*

SBT0311: *My answer was B, but I was also guessing because I do not know all these words in the options.*

SBT0309: *I chose C because it is the only word I know and I did not understand what the question requires.*

SBT0305: *I understand the question but I did not learn about any of these words in the possible answers, I have never met them before, I only know the word here at C: muscles, I don't know all the other ones.*

SBT0307: *I also guessed the answer because I never met those words.*

R: Once again, you are in a test situation, you are faced with this question as it is written in English, what will you do to understand and answer it?

MCT0302: *I first read the question then I looked at which one of these answers fits in with the question and then I chose it.*

R: How many times have you read this question?

MCT0302: *You first read the question and the answers, if you still feel that you do not understand you read the question again.*

R: When you read it for the second time, do you read it in English or you try to translate it into isiZulu?

MCT0302: *When I see that I cannot understand it in English, I read it again in isiZulu and have a better understanding.*

MCT0312: *I had a problem when I had to select the answer: there were some words I did not know their meanings in the answers given here.*

MCT0308: *I chose the answer A but I was guessing.*

R: Why did you have to guess?

MCT0308: *Because I did not know all these words given here in the answers.*

MCT0306: *I also did not understand these words, so I thought B will be better but I was not sure.*

R: So, in short you were guessing the answer?

MCT0306: *Yes!*

MCT0302: *I have also guessed from these words because I did not know any of them, I don't know them even in isiZulu.*

12001

R: Once again you are in a test situation; you meet this question and you have to answer it, what do you do in this question?

NAT0306: *You give it time and patience in reading it over again until you understand it.*

NAT0307: *Basically, to understand it more better you translate it into isiZulu and once you have understood it you take it back into English.*

NAT0305: *You try and put it in a way that you will understand it, if you understand it better in isiZulu you put it in isiZulu and if you understand it better in English you put it in English.*

NAT0306: *For me, as it is written in English, when I read it in my mind it comes in English, I understand it in English, I did not translate it into isiZulu.*

R: Has anyone translated it into isiZulu?

NAT0307: *What I did was to think what this word (abdomen) mean in isiZulu.*

R: When you thought of it in isiZulu, what does it ask you?

NAT0307: *Iyiphi i-organ ebhalwe la ngenzansi engekho situated kwi-abdomen?*

R: Do you notice that as you were translating into isiZulu, you did not translate the words *organ* and *abdomen*, right?

NAT0307: *Yes!*

R: As you were reading this question, did you think of these two words in English or in isiZulu?

NAT0307: *I read them in English and thought of them in English.*

R: Why, is it because they are the scientific terms?

NAT0307/NAT0308: *Yes!*

R: The scientific terms: in isiZulu, do we have words that define the scientific terms? For example, photosynthesis, can we define what photosynthesis is in isiZulu?

NAT0306: *If you cannot define it in isiZulu, you can define it in a way that you can understand it.*

R: Then what about those words you cannot translate, like in this question, when we read it some words are translated into isiZulu while other words are left as they are in English, right? Now, do those words which cannot be translated into isiZulu affect the way you understand a question? Does the fact that those words which were not translated into isiZulu, or you don't know them in isiZulu but know them only in English, affect your understanding of the question, do they make your understanding of the question easier or more complex?

NAT0307: *They differ.*

R: How do they differ?

NAT0307: *Sometimes you understand the word but when you translate it into isiZulu you cannot understand what it means.*

R: NAT0308, when you were reading this question, thinking about it, and having understood it, what was your answer?

NAT0308: *It's B.*

R: Why do you think it's B?

NAT0308: *Because when I was reading it I thought that the answer will be B.*

R: NAT0305, what was your answer?

NAT0305: *I also said it's B.*

R: Why the answer B?

NAT0305: *Because this word – abdomen – I did not know what it means.*

R: So, you did not understand what does the word abdomen mean, and then you chose B?

NAT0305: *Yes!*

R: NAT0306, what was your answer?

NAT0306: *It's A.*

R: Why the answer A?

NAT0306: *I took the word at the end of the question – abdomen – which I understood, and the fact that a male does not have the abdomen..*

NAT0307: *I said it's C.*

R: Why did you choose C?

NAT0307: *Because C is not in the abdomen.*

R: According to your understanding, are you saying that the word that gives you a problem is abdomen...?

NAT0307/NAT0308/NAT0305: *Yes!*

R: ...you do not understand what it is, but do you know where is it situated in the body?

NAT0307/NAT0308: *No, we do not know where it is situated in the body.*

R: Now, the fact that you do not understand where abdomen is situated: how does it affect your understanding of this question leading you to selecting the correct answer?

NAT0308/NAT0305/NAT0307: *It has a major effect on understanding the question.*

R: So in short, to answer the question very well you need to understand the word abdomen or all the terms used in that question.

NAT0308/NAT0307: *Yes!*

R: Who can say: due to not understanding what the abdomen is, I guessed the answer?

NAT0305/NAT0306/NAT0308: *I guessed the answer.*

NAT0307: *I was sure of the answer I chose.*

R: What will you do to understand this question, what processes do you have to go through in understanding this question and choosing the correct answer?

SBT0312: *To understand this question, you will need to understand the word abdomen first, understand what it means before you can choose the answer.*

R: Do you understand or do you know the word abdomen and do you know where it is?

SBT0312: *No!*

SBT0310: *No!*

SBT0311/SBT0309: *No!*

R: Will you agree with me then that to answer this question you will have to understand this word or all the words in the question, if there is a word that you do not understand in a question, it might affect the way that you are going to choose your answer, is that correct?

SBT0312/SBT0310: *Sure!*

SBT0309/SBT0311: *Yes!*

R: How then did you choose the answer?

SBT0312: *I just guessed the answer.*

SBT0311: *Ja, I guessed because I could not understand this word 'abdomen'.*

SBT0310/SBT0309: *We guessed it.*

SBT0307: *I don't know the word 'abdomen'.*

R: If you did not know that word, which strategy did you use to answer this question?

SBT0307: *I just guessed the answer.*

R: How did you go about guessing your answer?

SBT0307: *I looked at all these words given here in the answers and I knew that some of these words will not fit in with this question, so I did not look at those words any further but I considered these other three possible ones, then I guessed from them.*

R: How did you go about choosing the one word among those three possible ones for you?

SBT0307: *I left out the words 'stomach' and 'heart' because I knew they will not fit in with this question and I also know them, then I looked at these other three words: 'liver',*

'kidney' and 'bladder', but I also did not know the words 'liver' and 'bladder' and so I did not select them but selected 'kidney' because it sounded familiar.

R: Once again, you are in a test situation and you want to answer this question, what do you do to understand and answer it?

MCT0309: *I did not understand this question and it was not easy to answer.*

R: Did you experience any difficulties on this question?

MCT0309: *Ja, I did not understand this word: abdomen and I then guessed the answer to be B.*

MCT0303: *I chose the answer D because I did not understand the word abdomen, and I don't know what it means in isiZulu.*

MCT0311: *I chose the answer E because I also did not understand this word.*

MCT0301: *I guessed the answer to be D.*

R: So, are you saying that in this question you did not understand the word 'abdomen' and then you guessed the answer?

MCT0301: *Yes, I guessed it because of this word.*

R: Does it normally happen that if you meet a question which has some words that you do not understand, you resort into the strategy of guessing?

MCT0301/MCT0311: *Yes!*

R: Is this common to all of us?

MCT0303: *Yes, I guess when I do not understand the question.*

MCT0309: *Ja, when I do not understand the question or some words, I just guess the answer.*

12038

R: Who can say: I understand this question, I know what it requires and this is how I understood it?

NAT0302: *As I was reading it, I saw that they talk about the red blood cells, and I think the answer is A since they said **ukulwa nezifo emzimbeni** (to fight diseases in the body).*

NAT0304: *I read it first and then I looked for the possible answer, I got it to be A.*

R: As you were reading the question, how did you understand it, was it in isiZulu or in English?

NAT0304: *I understood it as it is in English, I did not translate it into isiZulu, and it is only the answer that I thought in isiZulu.*

NAT0303: *I think it's D. I first read the question and then the answers.*

R: Did you understand this question in English or in isiZulu?

NAT0303: *I understood it in English; I did not translate it into isiZulu.*

R: In this question, which words tell you that this is what the question requires?

NAT0303: *It has been 'the function of the red blood cells' which enabled me to choose this answer.*

NAT0301: *Ja, it was the red blood cells that fight diseases in the body.*

R: Do you know what the red blood cells are?

NAT0302: *I heard some people talking about them but I don't know what they are.*

R: People from where: from school or from your community...?

NAT0302: *People at the clinic.*

NAT0303: *I have also seen it in the books from the clinics.*

R: So, you never had had an explanation of the red blood cells, you only know the word?

NAT0303: *Ja, but I think **amasosha omzimba** (Soldiers of the body).*

NAT0304: *I don't know this word but I also think **amasosha omzimba**.*

NAT0301: *I also think **amasosha omzimba** but I never had an explanation of what they are.*

R: If you were to translate this question into isiZulu, what will it be?

NAT0301: ***Yini umsebenzi wamasosha omzimba?***

SBT0305: *My answer is A because I have learnt about the red blood cells in Grade 8, last year, and so I know that these cells fight diseases in the body.*

SBT0306: *I think the answer is C.*

SBT0307: *I think the answer is C but I am guessing because I cannot remember learning about these red blood cells, I don't know them!*

R: So, can I then conclude that if there is a word you do not understand in the question, the understanding of the question and the way you will select your answer will be affected?

SBT0305/SBT0306: *Yes!*

SBT0307: *Yes, and we end up guessing the answer.*

SBT0308: *I chose the answer A because the red blood cells fight diseases in the body; I have heard about this but cannot remember where.*

R: Once again, you are in a test situation, what will you do to understand and answer this question?

MCT0305: *I first read it until I understand what it requires and then choose the correct answer.*

MCT0310: *It is the same process as before, I read this question first in English and then I translated it into isiZulu so as to understand it well, then I looked for the correct answer.*

MCT0307: *I guessed the answer to this question because I could not see any of these answers that can fit in with this question.*

MCT0305: *Yes, I also had a problem in this question since I did not know what the red blood cells are, whether they are something in the body or something else, it has been really problematic in trying to understand it.*

R: Does anyone of you know what the red blood cells are?

MCT0305/MCT0307: *No!*

MCT0310: *No, I have never heard of them before.*

MCT0304: *I have also never met them anywhere before.*

R: Did anyone else of you guessed the answer?

MCT0304/MCT0305: *Yes!*

MCT0310: *I can say that I guessed because I was not sure of the answer I chose.*

Guessing: red blood cells giving a problem!

22235

R: What do you do to understand this question?

NAT0310: *I read the question first and then choose the answer.*

NAT0309: *I read the question and then think about it in isiZulu so that it can be clearer, trying to analyze it well in isiZulu, then I can choose the correct answer.*

NAT0311: *I read this question and I got the clearer meaning of it in isiZulu, it has been a bit difficult to understand it in English, it was easy to understand it in isiZulu.*

NAT0312: *I have tried to understand it in English but the understanding was much clearer in isiZulu.*

R: Now, how did you arrive at your answers?

NAT0310: *I thought the answer was E because a plant needs soil, sunlight and water to grow.*

NAT0309/NAT0312: *The answer is E.*

NAT0311: *I could not understand this question in both English and after translation into isiZulu, so I guessed the answer to be B.*

R: How did you answer this question?

SBT0306: *I think the answer is B because the girl uses sand, soil and water.*

SBT0305: *I did not understand the question but I guessed my answer to be D.*

SBT0307: *I chose the answer A but I was also guessing it.*

SBT0308: *I also guessed in this question and my answer was C.*

SBT0302: *I was guessing on this question because I never learnt anything like this at school.*

SBT0304: *I first read the question, it said that: (reading the first two sentences in the question). In this plant she used sand, soil and water. So, for the other plant that she wants to test, most of the plants come from the soil and water, so, I chose E which has soil and water.*

SBT0303: *I also chose E but I was guessing the answer.*

SBT0301: *I chose A because plants need water and sand for healthy growth.*

R: What will you do to understand this question?

MCT0312: *I read this question and I tried to translate it into isiZulu, and I looked at this picture here on the top and at these pictures here on the bottom, then I had a problem in that some of these pictures are similar; for example, picture A and picture D.*

MCT0306: *I first read the question and then looked at the pictures on the bottom, then I went back and read the question again in English and found that I still have the same problem of not understanding well what the question requires, after that I read the question again in isiZulu and I thought that maybe D is the answer because it can fit in with this answer but I was not sure of that.*

MCT0308: *I first read the question and I looked at the pictures on the bottom, then I thought that the answer is C.*

MCT0302: *I read this question and I looked at the pictures and I saw that option D had soil, so I selected it.*

R: Why did you specifically look at the pictures with the soil?

MCT0302: *Because here in the question it states the soil and I saw that the picture, with the soil, to choose was in the option D.*

Presence of sunlight = disruptor

Can't understand question = guessing

Better understanding in isiZulu

22160

R: For you to understand this question, so you can answer it, what do you do to it?

NAT0308: *We read it first and understand it.*

R: Did you understand it as it is in English or translated it into isiZulu?

NAT0305/NAT0306/NAT0307/NAT0308: *We understood it as it is in English.*

R: So, this is not one of the questions you will need to translate first so that you can understand it, you just understood it as it is in English?

NAT0305/NAT0306/NAT0307/NAT0308: *Yes!*

R: So, now to answer this question, what will you do? On thinking about your answer, do you think of it in English as you have understood the question or you think of it in isiZulu?

NAT0306: *You think of it in isiZulu so that you can be able to answer quickly.*

NAT0307: *The answer to this question comes quicker to the mind in isiZulu, but in English it can take some time to come.*

R: What causes it to come quicker into your mind in isiZulu but takes you some time in English, what problems do you encounter?

NAT0306: *The problem I experience is that I write it, but change things which were in English into isiZulu, and it is difficult to write what I want to say in English but I know what to say in isiZulu, so I will have to try and translate from isiZulu into English so that I can understand better.*

R: So, are you saying that for you to answer the question you first have to understand the language in which it is written?

NAT0305/NAT0307: *Yes!*

NAT0308: *Sure.*

NAT0306: *You will need to understand the two languages.*

R: What came into your mind when you had read the question and you thought that this is the answer?

NAT0306: *When you have one ear, let's say you have an ear infection, some of the sound would not get in that infected ear, so if you have one ear you will not hear at all.*

NAT0307: *Ja, if you have one ear you would not have good reception of sound when I talk to you, so I will have to speak louder, but when you have two ears they help each other.*

R: You are in a test situation, you want to answer this question, how will you answer it?

SBT0304: *I manage myself without two ears and I can manage myself with two ears, then I compared and wrote what are the advantages of having two ears.*

SBT0301: *I thought of a person, I have never saw a person with only one ear, so I thought that maybe someone with one ear only cannot hear very well and will be abnormal.*

R: So, are you saying that for you to answer this question you used picture memory, you pictured someone with one ear or someone with two ears?

SBT0301: *Yes!*

SBT0303: *Having two ears will enable you to hear well.*

R: Has anyone of you translated this question into isiZulu to understand it better?

SBT0302/SBT0304: *No!*

R: You want to answer this question in a test, what will you do to understand it?

MCT0309: *I read it in isiZulu: Yibuphi ubuhle bokuba nezindlebe ezimbili kunokuba neyodwa ukuze uzwe kahle, when you have one ear you won't hear very well but when you have two ears you will hear very well, one ear cannot give you a good reception of sound.*

R: So, are you saying that you have translated this question into isiZulu so that you will understand it well?

MCT0309: *Yes!*

R: When you were reading it in isiZulu, did your answer come to your mind in English or isiZulu?

MCT0309: *It came in isiZulu.*

R: How did you write it?

MCT0309: *I wrote it in English.*

R: How did you do that because it was in isiZulu?

MCT0309: *No, I first translated it back into English so that I could write it.*

R: Did you write your answer in the same way that you thought about it?

MCT0309: *No, my answer came into my mind in isiZulu and I translated it back into English, but it was not that easy to write it in English, it could have been easier if I had to write it in isiZulu. There are some words that are easy to write down if it is in isiZulu but they are difficult to write in English.*

MCT0301: *Ja, it is easy to write the answer in isiZulu than in English. English has some difficult words!*

R: The answer that you wrote, was it based on what you learnt at school or based on what you heard about or on what you have seen around your communities?

MCT0309: *It was based on the things that I learnt at school.*

MCT0301: *I wrote what I heard from around my community.*

R: Has anyone of you used the picture memory, that is, had a thought of somebody who has one ear or both ears?

MCT0301: *Ja, I pictured a person with one ear and I thought it could be abnormal and that person cannot hear very well.*

22152

NAT0309: *I have read the question as it is in English but I understand it better when I translate it into isiZulu.*

R: How did your answer came up to your mind, was it in English or in isiZulu?

NAT0310: *I thought of a person doing some exercises, she loses weight and gaining more energy.*

NAT0311: *I thought about this question in isiZulu, I pictured an exercising person how he looks like.*

NAT0309: *I though of my answer in isiZulu. I had a picture in my mind of a person exercising, what happens when the person exercises: he loses weight, gains more energy and sweats a lot.*

NAT0312: *I analyzed this question in isiZulu and I know that when a person exercises he sweats and lose weight.*

R: What do you do to understand this question? Has anyone of you encountered a problem in understanding this question?

SBT0304: *I did not understand it in the isiZulu test but I understood it well in the English test.*

SBT0301: *I did not understand it in both the English and the isiZulu tests.*

R: What is it that you did not understand about this question?

SBT0301: *I did not understand how you can prevent overheating in the body when exercising.*

R: You did not understand which processes prevent overheating during exercise.

SBT0301: *Yes, because I never met this thing at school before.*

SBT0302: *I understood this question but my answer was based more on what I learnt from school rather than the general knowledge.*

R: How would you answer this question?

MCT0306: *I first read this question and I looked to see what can I do in this question to answer it, I just then translated it into isiZulu and I had a better understanding, then I wrote my answer.*

MCT0302: *This is the last question I wrote, I went past through it and I came back to answer it when I was finished with all the other questions, I still could not understand what this question was about.*

MCT0308: *Ja, I also did not understand this question, and so I just wrote what I thought could be the answer, I really did not understand it, even after trying to translate it into isiZulu.*

MCT0312: *I read this question and I saw the phrase: 'human body that prevent it from overheating during exercise', I thought of a person who is exercising and I wrote what I thought could help that person not to overheat when he exercises.*

22154

R: What will you do to answer this question?

NAT0303: *I have answered this question by thinking about that maybe when Siphos was at school talking to his friends, he did not cover his mouth when coughing, and then his friends got the flu while others were telling him to cover his mouth when talking for he has a flu, so that is why the others did not get the flu.*

R: So for you to answer this question, it is easier when you translate it into isiZulu?

NAT0303: *Yes, it is easier to understand it in isiZulu than in English, and the answer becomes easy to think about because everything is in isiZulu.*

NAT0304: *Those who did not get the flu were not staying with him for longer times and those who got it were staying with him for longer times.*

R: Am I right if I say you understood this question better in isiZulu?

NAT0304: *Yes, better than when it is in English, and I can answer it better in isiZulu than in English.*

NAT0301: *Ja, I think those who were seating close to him got it and those who were seating away from him did not get it, and maybe they were telling him to cover his mouth when coughing.*

NAT0302: *I think Sipho was not supposed to go to school because he will infect the other learners with his flu.*

R: Tell me, what problems do you encounter when facing the Science questions written in English?

NAT0302: *There are some English words which I would not understand and these words surely affect the way I understand and answer the question.*

R: Is it more of the scientific terms or just the everyday English words?

NAT0302: *It's more of the English words which I have difficulty with.*

NAT0304: *Ja, it's the English words which I normally don't understand.*

R: What do you think will be best for you to understand those words?

NAT0303: *I think you just have to read wildly, everything, even the news papers and try to understand because it can happen that you will meet these words at school and they can be easier for you to understand.*

NAT0302: *I think it is better to have dictionaries when we write exams because we cannot understand some words.*

R: So what is the strategy that you use to understand the questions which you have problems with their words?

NAT0302: *I think it is better to ask someone who can help me or maybe when I write the examination, ask the teacher to explain those words to me.*

R: Would you expect that teacher to give the explanation in English or in isiZulu?

NAT0302: *If I don't understand it, I will ask the teacher to explain it in isiZulu because I really don't understand it in English.*

R: So, one of the strategies you are using is to ask someone to give you the explanation in isiZulu so that you can understand it better?

NAT0302/NAT0303: *Yes!*

R: How much is the possibility that if there is a word which you cannot understand, you end up guessing the answer, or when is it that you resolve into guessing the answer?

NAT0302: *When I have to guess, I first read the question for a couple of times and then when I realize that I cannot understand it, I then read the answers, if I also don't understand the answers, I look at a word, for example red blood cells, so where I see the word blood or red blood cells, I will choose that answer.*

R: What will you do to answer this question, what processes do you have to go through in understanding and answering this question?

SBT0312: *Here, you were supposed to read this question in English, after that translate it into isiZulu so that you can understand better, and then read it again in English so as to answer.*

R: How do you think about your answer, do you think about it in English or in isiZulu?

SBT0312: *I think about it in isiZulu.*

SBT0310: *I think about the answer in isiZulu and then I translate it back into English so that I can write it.*

R: Now, to answer as you are thinking in isiZulu, for you to answer, which one is better or easier: do you answer better when you use English or do you answer better when you use isiZulu?

SBT0309: *It is better when you use isiZulu...*

SBT0312: *...Because it's your home language.*

R: Once again, you want to answer this question in a test, what will you do to understand it?

MCT0303: *I thought that those who had flu were sitting with him in the same desk and those that did not have it were not sitting with him.*

MCT0309: *I translated it into isiZulu to understand it better and I thought that when Siphon was coughing his germs were transferred to the other learners in his class and they also suffered from the flu.*

R: Now tell me, what are the problems that you experience when you meet the science questions written in English?

MCT0309: *I find the problem with the words used: some of them are difficult and I cannot understand them but there are some other words that I can understand. It is not easy to answer a question when there are words which you do not understand.*

R: Is it the English words or maybe the scientific terms that you do not understand?

MCT0303: *It is the English words which are more difficult...*

MCT0309: *The science also has some very difficult words, like that word: abdomen.*

R: What strategy do you then use to answer the questions in such situations?

MCT0303: *I guess the answer...*

MCT0309: *Ja, I first translate it into isiZulu and if I still do not understand it, I just guess it.*

MCT0311: *If I have a problem, I call the teacher or the invigilator to come and explain what that question requires and then I can answer.*

R: Would you expect that teacher or invigilator to explain in English or in isiZulu?

MCT0311: *It does not matter how he explain it, so long as I will understand what is required in the question.*

MCT0303: *Sometimes I leave that question until I finish with the other questions and then come back to that question again and try to answer it.*

R: Why do you have to leave it and come back to it later?

MCT0309: *Sometimes it happens that you have some answers for other questions in your mind and when you see that a certain question is not easy to answer, you leave it because you can forget the answers you already have for the other questions and then when you are finished, you can go back to that difficult question and try to answer it.*

22161

NAT0308: *I have read this question two times: I read it first as it is in English and I read it for the second time trying to analyze it in isiZulu and the answer come in isiZulu.*

NAT0306: *I have also translated this question into isiZulu so that I can understand it better since there were some words which I did not understand clearly in English, and after translating them into isiZulu the answer was easy because I understand all the words now.*

R: What would you say this question requires?

NAT0306: *It asks that: uma umuntu egqoka izibuko, ku-contacteka kanjani nokuthi abone kangcono emehlweni?*

NAT0307: *Uma umuntu egqoke izibuko ubona kanjani emehlweni? Ukuthi into ekude uyibona kahle iseduze.*

NAT0308: *Uma umuntu egqoke izibuko zimusiza kanjani ukuthi abone kakhulu kunomuntu ongazigqokile.*

R: How would you answer this question? Have you find any difficulties with this question? Which strategy have you used to answer it?

SBT0304: *I found it hard to get the answer to this question, I understood the question but it has been hard to get the answer.*

R: Why, what could have been the problem?

SBT0304: *I did not know how to put down my answer.*

SBT0301: *I could not answer this question, I understood the question but just couldn't answer it, and I did not know what and how to write.*

R: What could have been the reason for that?

SBT0301: *I don't know!*

SBT0304: *I think the spectacles and contact lenses help some learners to see more clearly on the chalkboard when they sit maybe at the back, the writing on the chalkboard becomes bigger for them to see.*

SBT0303: *I did not understand the whole question because I had not met this thing before.*

SBT0302: *Ja, I also had a problem in answering this question because I had never worn spectacles and contact lenses, but I think spectacles help some people to see smaller things bigger and they can see things which are a distance away to be closer to them.*

R: What will you do to understand this question?

MCT0307: *I had a problem when I had to answer this question because there were some words that I thought about in isiZulu but I could not write them in English, I could not*

translate them from isiZulu into English and then my answer was not put in the same way that I thought in isiZulu.

MCT0304: *I also could not answer this question.*

R: So, what could you say was the problem in this question?

MCT0305: *I had a problem in answering this question because I have never worn the spectacles or suffer from the eyes and so I answered the question according to what I think happens to someone who wears spectacles.*

MCT0304: *Ja, I used more of my general knowledge to answer this question; I answered it according to what I heard people saying about the spectacles and the contact lenses.*

APPENDIX 6

Ethical Clearance Approval



RESEARCH OFFICE (GOVAN MBEKI CENTRE)
WESTVILLE CAMPUS
TELEPHONE NO.: 031 – 2603587
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22 NOVEMBR 2005

MR. SC ZUMA (962098366)
EDUCATION

Dear Mr. Zuma

ETHICAL CLEARANCE APPROVAL NUMBER: HSS/05146A

I wish to confirm that ethical clearance has been granted for the following project:

“Problems experienced by isiZulu-Speaking learners in interpreting science questions”

Yours faithfully


.....
MS. PHUMELELE XIMBA
RESEARCH OFFICE

PS: The following general condition is applicable to all projects that have been granted ethical clearance:

THE RELEVANT AUTHORITIES SHOULD BE CONTACTED IN ORDER TO OBTAIN THE NECESSARY APPROVAL SHOULD THE RESEARCH INVOLVE UTILIZATION OF SPACE AND/OR FACILITIES AT OTHER INSTITUTIONS/ORGANISATIONS. WHERE QUESTIONNAIRES ARE USED IN THE PROJECT, THE RESEARCHER SHOULD ENSURE THAT THE QUESTIONNAIRE INCLUDES A SECTION AT THE END WHICH SHOULD BE COMPLETED BY THE PARTICIPANT (PRIOR TO THE COMPLETION OF THE QUESTIONNAIRE) INDICATING THAT HE/SHE WAS INFORMED OF THE NATURE AND PURPOSE OF THE PROJECT AND THAT THE INFORMATION GIVEN WILL BE KEPT CONFIDENTIAL.

cc. Faculty Research Office (Derek Buchler)
cc. Supervisor (Dr. ER Dempster)

APPENDIX 7

Consent Forms

Informed consent

Dear parent

My name is Sandile Zuma and I am studying towards a Masters' degree in Education at the University of KwaZulu-Natal in Pietermaritzburg. My telephone number is 072-1359174.

The title of my research project is:

Problems Experienced by isiZulu-speaking learners in Interpreting Science Questions

The aims of my project are to understand how Grade 8 isiZulu-speaking learners make sense of questions in science tests. If the test is set in English, the children may try to translate the question into isiZulu to help them understand the question. I am investigating whether the translation process helps the child to answer the question correctly. I hope that my project will help teachers to understand how children answer questions in science tests, so that the teachers can set better tests in the future.

My research project is being supervised by Dr Edith Dempster from the School of Education and Development at the University of KwaZulu-Natal in Pietermaritzburg. Her contact telephone number is 033-2605723. If you need further information about the project, please contact Dr Dempster.

I became interested in this project because we are aware that many African children perform poorly in science at school. I wondered whether the language of the tests and exams (English) is a barrier to learning for these children. I decided to study Zulu-speaking children because my own home language is isiZulu, and I experienced many of the difficulties these children experience in my own studies.

I would like your consent to include your child in my research project. I would like the children in my study to answer a short test on basic science knowledge and concepts. The test will be conducted in English and in isiZulu on the same day, but with a break between. The test consists of some multiple choice questions, and a few free response questions. It should take about one hour to complete.

The next day, I would like to go through the test with the children, in groups of four children. I will ask the children to tell me how they made sense of the questions, and how they selected the answers. I will talk to the children in isiZulu, but switching to English for special terms, as their teacher does in class. The interviews will take about 45 minutes for each group.

The tests and interviews will take place during school time, and I have asked the school principal and the teacher for permission to take the children out of class. There will be no additional cost to you or the school.

I will record the interviews with a tape recorder, and will analyse the children's responses later. At the end of the project, the tapes will be destroyed.

I assure you that your child's name and the name of the school will not appear in my thesis, or in any papers or presentations that I make after the study. If you decide not to allow your child to participate, she/he will not be disadvantaged in any way. Your child may withdraw from the study at any stage and for any reason.

If you agree to your child participating in my research, please complete the attached consent form and return it to the school. I thank you for taking the time to read this letter.

Yours sincerely

(Mr.) Sandile C. Zuma

(Please complete the declaration below, and send it back to school).

I (full names of parent) hereby confirm that I understand the contents of this document and the nature of the research project, and I consent to my child participating in the research project.

I understand that my child is at liberty to withdraw from the project at any time.

Signature of parent

Date

.....

.....

Mzali

Igama lami ngingu-Sandile Zuma, ngifunda e-University of KwaZulu-Natal ngifundela iziqu ze-Masters in Education. Inombolo yami yocingo ithi: 072 135 9174.

Isihloko socwaningo lwami sithi:

Izindlela ezisetshenziswa abafundi abakhuluma isiZulu ekuphenduleni imibuzo ye-sanyensi.

Izinhloso zaloluhlelo locwaningo lwami ukuba ngiqondisise kahle ukuthi abafundi abakhuluma isiZulu abafunda ibanga lika-Grade 8 bayiphendula kanjani imibuzo ezivivinyweni zesanyensi. Uma isivivinyo sibhalwe ngesiNgisi, abantwana banokuzama ukuba baguqule lemibuzo bayiyise olwimini lwesiZulu ukuze bayiqondisise kahle. Ngizama ukuthola ukuthi lokhu kuguqulwa kwalemibuzo kuyamusiza yini umntwana ekubeni aphenndule ngendlela efanelekile. Nginethemba lokuthi lolucwaningo lwami luzosiza othisha balabantwana ukuba baqondisise kahle ngezindlela ezisetshenziswa abantwana ekuphenduleni imibuzo yesanyensi, ukuze nabo othisha benze izivivinyo ezikulungele ukuphendulwa yilabantwana esikhathini esizayo.

Loluhlelo locwaningo lwenganyelwe u-Dokotela Edith Dempster wase-School of Education and Development, e-University of KwaZulu-Natal ese-Mgungundlovu. Inombolo yakhe yocingo ithi: 033-260 5723. Uma udinga ulwazi olugcwele ngalolucwaningo, ngicela uxhumane naye u-Dokotela Dempster.

Ngahlabeka umxhwele ngalolucwaningo ngoba kugqama ukuthi abantwana abaningi base-Africa baphumelela ngokungagculisi ezifundweni zabo sesanyensi esikoleni. Ngamangazwa ukuthi ingabe ulwimi okubhalwa ngalo izivivinyo kanye nokuhlolwa (isiNgisi) luyakuvimbela yini ukufunda kwalabantwana. Ngingqume ukwenza ucwaningo ngabantwana abakhuluma isiZulu ngoba nami ulwimi lwami kuyiso isiZulu, futhi nami ngahlangabezana nobunzima obuningi labantwana abahlangabezana nabo ngesikhathi ngisafunda.

Ngingathanda ukuthola imvume yakho yokuba ngimbandakanye umntwana wakho kulolucwaningo lwami. Ngizothanda abantwana abamandekanyekile kulolucwaningo ukuba baphendule isivivinyo esifishane solwazi kanye namagama ayisiqalo sesayensi. Lesisivivinyo sizokwenziwa ngesiNgisi kanye nangesiZulu ngelanga elilodwa, kodwa kuzokubakhona ikhefu phakathi kwalesisivivinyo. Lesisivivinyo sizobe siqukethe imibuzo lapho bezokhetha khona impendulo kulezo ezinikeziwe kanye nemibuzo embalwa lapho bezobhala khona izimpendulo zabo. Lokhu kuzothatha isikhathi esingangehora ukuba kuphendulwe.

Ngelanga elilandelayo, ngizothanda ukubuyekeza lesisivivinyo nabantwana, ngizobahlukanisa ngamaqoqo nokuzokuthi iqoqo ngalinye libe nabantwana abane. Ngizobuza abantwana ukuthi ikuphi abakwenzile ukuze baqondisise lemibuzo kanye nokuthi bayikhethe kanjani impendulo yabo emubuzweni ngawodwa. Ngizokhuluma

nalabantwana ngesiZulu, kodwa ngibuye ngishintshele esiNgisini kwamanye amagama ikakhulukazi esanyensi, njengoba kuyeke kwenze othisha babo emakilasini. Lesisigaba sizothatha imizuzu engamashumi amane nanhlanu (45 minutes) ukuba siphothulwe kulelo nalelo qoqo labantwana.

Izivivinyo kanye nalezizigaba zizokwenziwa ngesikhathi sesikole, sengiyicelile imvume kathishanhloko kanye nothisha walabantwana yokuba ngikhiphe labantwana ekilasini ngesikhathi socwaningo. Angeke kube khona ukukhokha okwengenziwe kuwena noma esikoleni.

Ngizoqopha lokhukuxoxisana kwami nabantwana kwiziqophamazwi, ebese ngicubungula kahle izimpendulo zalabantwana ekuhambeni kwesikhathi. Kuzokuthi ekupheleni kwalolucwaningo, zonke iziqophamazwi zihlafazwe.

Ngiyakwethembisa ukuthi igama lomntwana wakho kanye negama lesikole angake livele emqulwini wami engizowubhala, noma kwelinye iphepha noma izinkulumo engizozenza emva kocwaningo. Uma unquma ukuba umntwana wakho angabi yingxenye yalolucwaningo, angeke aze alahlekelwe yilutho kulokhu. Umntwana wakho angakhetha ukuyeka ukuba yingxenye yalolucwaningo noma kunini nanoma yingasiphi isizathu.

Uma uvuma ukuba umntwana wakho abe yingxenye yalolucwaningo lwami, ngicela ugcwalise leli-form lemvume ebese ulibuyisela esikoleni afunda kuso umntwana wakho. Ngibonga kakhulu ngokuthatha isikhathi sakho ufunde lencwadi.

Ozithobayo

(Mr.) Sandile C. Zuma

(Uyacelwa ukuba ugcwalise lesisicelo semvume esingenzansi ebese usubuyisela emuva esikoleni esifunda umntwana wakho)

Mina..... (amagama aphelele omzali)
ngiyaqinisekisa ukuthi ngiyiqondisisile into equkethwe yilencwadi kanjalo nemvelaphi yalolucwaningo, ngiyayinikezela imvume yokuba umntwana wami abe yingxenye yabazombandakanywa kulolucwaningo.

Ngiyakuqondisisa ukuthi umntwana wami angayeka ukuzimbandakanya nalolucwaningo nanoma ingasiphi isikhathi.

Isayini yomzali

Usuku

.....

.....

I will record the interviews with a tape recorder, and will analyse your responses later. At the end of the project, the tapes will be destroyed.

I assure you that your name and the name of the school will not appear in my thesis, or in any papers or presentations that I make after the study. If you decide not to participate, you will not be disadvantaged in any way. You may withdraw from the study at any stage and for any reason.

If you agree to participate in my research, please complete the attached consent form and return it to me. I thank you for taking the time to read this letter.

Yours sincerely

(Mr.) Sandile C. Zuma

(Please complete the declaration below, and give it to me).

I (full names of learner) hereby confirm that I understand the contents of this document and the nature of the research project, and I consent to participating in the research project.

I understand that I may withdraw from the project at any time.

Signature of learner

Date

.....

.....

Mfundi

Igama lami ngingu-Sandile Zuma, ngifunda e-University of KwaZulu-Natal ngifundela iziqu ze-Masters in Education. Inombolo yami yocingo ithi: 072 135 9174.

Isihloko socwaningo lwami sithi:

Izindlela ezisetshenziswa abafundi abakhuluma isiZulu ekuphenduleni imibuzo ye-sanyensi.

Izinhloso zaloluhlelo locwaningo lwami ukuba ngiqondisise ukuthi abafundi abakhuluma isiZulu abafunda ibanga lika-Grade 8 bayiphendula kanjani imibuzo ezivivinyweni zesanyensi. Uma isivivinyo sibhalwe ngesiNgisi, kungenzeka ukuba uzame ukuguqula lemibuzo uyiyise olwimini lwesiZulu ukuze uyiqondisise kahle. Ngizama ukuthola ukuthi lokhu kuguqulwa kwalemibuzo kuyakusiza yini ekubeni uphendule ngendlela efanelekile. Nginethemba lokuthi lolucwaningo lwami luzosiza othisha ukuba baqondisise kahle ngezindlela ezisetshenziswa abantwana ekuphenduleni imibuzo yesanyensi, ukuze nabo othisha benze izivivinyo ezikulungele ukuphendulwa yilabantwana esikhathini esizayo.

Loluhlelo locwaningo lwenganyelwe u-Dokotela Edith Dempster wase-School of Education and Development, e-University of KwaZulu-Natal ese-Mgungundlovu. Inombolo yakhe yocingo ithi: 033-260 5723. Uma udinga ulwazi olugcwele ngalolucwaningo, ngicela uxhumane naye u-Dokotela Dempster.

Ngahlabeka umxhwele ngalolucwaningo ngoba kugqama ukuthi abantwana abaningi base-Africa baphumelela ngokungagculisi ezifundweni zabo sesanyensi esikoleni. Ngamangazwa ukuthi ingabe ulwimi okubhalwa ngalo izivivinyo kanye nokuhlolwa (isiNgisi) luyakuvimbela yini ukufunda kwalabantwana. Ngingqume ukwenza ucwaningo ngabantwana abakhuluma isiZulu ngoba nami ulwimi lwami kuyiso isiZulu, futhi nami ngahlangabezana nobunzima obuningi ngesikhathi ngisafunda nawe ohlangabezana nabo.

Ngingathanda ukuthola imvume yakho yokuba ngikumbandakanye kulolucwaningo lwami. Ngizothanda ukuba uphendule isivivinyo esifishane solwazi kanye namagama ayisiqalo sesanyensi. Lesisivivinyo sizokwenziwa ngesiNgisi kanye nangesiZulu, kodwa kuzokubakhona ikhefu phakathi kwalesivivinyo. Lesisivivinyo sizobe siqukethe imibuzo lapho uzokhetha khona impendulo kulezo ezinikeziwe kanye nemibuzo embalwa lapho uzobhala khona izimpendulo zakho. Lokhu kuzothatha isikhathi esingangehora ukuba ukuphendule.

Ngelanga elilandelayo, ngizothanda ukubuyekeza lesisivivinyo nawe kanye nabanye ningamaqoqo nokuzokuthi iqoqo ngalinye libe nabantwana abane. Ngizobuza ukuthi ikuphi enikwenzile ukuze niqondisise lemibuzo kanye nokuthi niyikhethe kanjani impendulo yenu emubuzweni ngamunye. Ngizokhuluma nani ngesiZulu, kodwa ngibuye ngishintshele esiNgisini kwamanye amagama ikakhulukazi esanyensi, njengoba kuyeke

kwenze othisha benu emakilasini. Lesisigaba sizothatha imizuzu engamashumi amane nanhlanu (45 minutes) ukuba siphothulwe kulelo nalelo qoqo labantwana.

Izivivinyo kanye nalezizigaba zizokwenziwa ngesikhathi sesikole, sengiyicelile imvume kathishanhloko kanye nothisha wenu yokuba nginikhiphe ekilasini ngesikhathi socwango. Angeke kube khona ukukhokha okwengenziwe kuwena noma esikoleni.

Ngizoqopha lokhukuxoxisana kwami kanye nani kwiziqophamazwi, ebese ngicubungula kahle izimpendulo zenu ekuhambeni kwesikhathi. Kuzokuthi ekupheleni kwalolucwango, zonke iziqophamazwi zihlafazwe.

Ngiyakwethembisa ukuthi igama lakho kanye negama lesikole angake livele emqulwini wami engizowubhala, noma kwelinye iphepha noma izinkulumo engizozenza emva kocwango. Uma unquma ukuba ungabi yingxenywe walolucwango, angeke uze ulahlekelwe yilutho kulokhu. Ungakhetha ukuyeka ukuba yingxenywe yalolucwango noma kunini nanoma yingasiphi isizathu

Uma uvuma ukuba yingxenywe yalolucwango lwami, ngicela ugcwalise leli-form lemivume ebese ulibuyisela kumina. Ngibonga kakhulu ngokuthatha isikhathi sakho ufunde lencwadi.

Ozithobayo

(Mr.) Sandile C. Zuma

(Uyacelwa ukuba ugcwalise lesisicelo semvume esingenzansi ebese usubuyisela kumina)

Mina..... (amagama aphelele omfundi)
ngiyaqinisekisa ukuthi ngiyiqondisisile yonke into equkethwe yilencwadi kanjalo nemvelaphi yalolucwango, nginikezela imvume yokuba ngibeyingxenywe yabazombandakanywa kulolucwango.

Ngiyakuqondisisa ukuthi ngingayeka ukuzimbandakanya nalolucwango nanoma ingasiphi isikhathi.

Isayini yomfundi

Usuku

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