

Investigating South African grade 12 Physical science learners' meanings of everyday words
when used in the science context.

Nasimu Semeon

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ABSTRACT

The general poor performance in physical science in South Africa is a cause for concern. The reasons for this situation includes lack of basic content knowledge by science teachers, unprofessional attitudes, ineffective teaching approaches, lack of resources and failure to understand the language of science by the learners. This study investigated South African grade 12 learners' meanings of everyday words when used in science context. The study focused on grade 12 physical science learners from four different government secondary schools in Johannesburg. These learners had different home languages and socio-economic background. Data was obtained through a questionnaire given to learners followed by group interviews with the learners. A face-to-face interview with each physical science teacher from each school was also conducted.

This study reveals that learners face difficulties with meanings of everyday words when used in science context as was reflected by their response in the questionnaire. The physical science teachers from the four secondary schools were not aware that everyday words (non-technical words) are misunderstood by the learners when they are teaching them. As such teachers were not explaining the meanings of these words to learners in their context of use. Also the teachers did not know the difference between technical words and non-technical words. The study seeks to make the science teachers aware of this problem so that they can take time to explain the meanings of these words when teaching and this might improve understanding of science concepts. It is hoped that if there is shared meaning of words used in the instructional language between the teacher and learners it would improve the general performance in physical science.

DECLARATION

I declare that this research report, titled

INVESTIGATING THE CHALLENGES FACED BY GRADE 12 PHYSICAL SCIENCE
LESARNERS WITH MEANINGS OF EVERYDAY WORDS WHEN USED IN A
SCIENCE CONTEXT IN JOHANNESBURG.

is my own work and that all sources that I have used or quoted have been indicated and
acknowledged by means of complete references.

It is being submitted for the degree of Master of Science at the University of the
Witwatersrand, Johannesburg, South Africa. It has not been submitted before for any degree
or examination at any other university.



N. Semeon (509434)

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CHAPTER 1

1.0 INTRODUCTION

1.1 Problem statement

South Africa is in need of suitably qualified teachers, doctors, scientists and many other scientifically oriented professionals and yet very few learners are enrolling for physical science in grade 10 due to the perceived difficulty of physical science (Mji & Makgato, 2006). Of those few learners who enrol for physical science in grade 10, most of them fail the subject at the end of grade 12 as is reflected by the following results adapted from the Gauteng Department of Education (GDE), 2003.

Table 1 Physical science candidates in Higher grade (HG) and Standard grade (SG) with percentage passes in Gauteng Province – 2003

Subject / Grade	Entered	Wrote	Passed	% Pass
Physical Science HG	10 804	10 639	7 070	66.4
Physical Science SG	17 382	17 078	11 492	67.3

Adapted from Mji & Makgato, 2006) p. 257

The content for physical science higher grade (HG) is more than that of standard grade (SG). Considering the fact that Gauteng province is one with the highest enrolment of learners in South Africa, it seems from the statistics shown in the table that in general, few learners opt to study physical science. It is also apparent that some of them do not even write the examination after enrolling for physical science e.g. 304 learners who had enrolled for physical science standard grade didn't write the examination and out of 17 078 who wrote, 5 586 learners failed to score at least 30% in the examination and hence they failed. The above results paint a gloomy picture about the state of the learning of physical science in South Africa hence my concern. Table 2 shows that there has been a steady increase in the number of passes in grade 12 physical science results from 53.4% in 2011 to 67.4% in 2013.

Table 2: Percentage pass rate in Physical science in 2011, 2012 and 2013 in South Africa

Year	2011	2012	2013
Total No. of learners who wrote physical science	180 601	179 311	184 281
No. of learners who passed physical science	96 441	109 918	124 206
Percentage pass (%)	53.4%	61.3%	67.4%

Adapted from Department of Education [DoE], 2014) p.6

The percentage pass in physical science of 2003 (see Table 1) even though it was only for Gauteng province alone is comparable with the national pass rate in physical science in 2011, 2012 and 2013 (see Table 2). These results seem to reveal that, there are issues in learning

and teaching of physical science and more research needs to be done in this area so as to identify and address some of these challenges hence this study.

There are quite a number of factors which attribute to these poor results in physical science in South Africa which have been highlighted in literature. These factors includes poverty, learning cultures, infrastructure of schools, outdated teaching practices and lack of basic content knowledge by teachers resulting in poor teaching standards (Kriek & Grayson, 2009). The unqualified and under-qualified teachers, large science classes and non-equipped classrooms have also added to poor standards in the teaching and learning of physical sciences (Mji and Makgato, 2006). Lack of resources has made some schools stop offering physical sciences and it has also been noted that very few university students graduating with physical science and mathematics choose teaching as a career (Mji & Makgato, 2006).

In South African schooling, low teacher effort has been considered one of the most serious problem leading to poor science results and this is exacerbated by lack of teacher content knowledge and pedagogical skills required for teaching the curriculum effectively (Armstrong, Gustafsson, Van der Berg, Spaull & Taylor, 2011). This might be the reason why most learners are not keen and therefore do not opt for physical science in grade 10. I am also involved with the Secondary School Intervention Programme (SSIP) where I teach grade 12 physical science learners from different schools on Saturdays and some of them confess that some teachers do not teach them certain topic(s). Other teachers either, ignore the topics they find challenging to them or just photocopy notes and give the learners without explaining to them what those notes mean. To me, such approach shows an element of lack of understanding of the topic by those teachers in question. Thus, I concur with Mji & Makgato (2006) and Munby (1976) that we might have incompetent teachers in some schools who struggle with the subject content of physical science.

Whilst the government have come up with policies and programmes, very little has happened at a systematic level to address the challenges faced by science learners and providing quality science teachers. The government set up the Dinaledi focus schools Project which is part of the National Strategy for Science, Mathematics and Technology as a way of encouraging more learners to study mathematics and physical science (Mji & Makgato, 2006). The government together with other stakeholders set up Secondary School Intervention Programme (SSIP) where grade 12 learners from any secondary school are free to attend classes and receive tuition on Saturdays free of charge. The major aim of this project was to

assist learners studying mathematics and science and now other subjects such as Geography, English, Life Science and Accounting have been added. The learners are provided with free transport in the form of buses and also provided with learning materials and food for free. Non-governmental organisations (NGOs) and private companies such as SASOL also assist learners who are studying science and those who want to pursue science related programmes at university level by providing them with bursaries (Cameron, 2009).

One of the reasons why South African learners do not want to enrol for physical science in grade 10 or why they generally perceive science as a difficult subject could be their failure to understand the language used in the science classroom by teachers or used in the science text books. This study seeks to raise science teachers' awareness of this problem so that corrective measures can be taken so as to enhance learners' understanding of science concepts. It is my hope that when this happens learners might develop a more positive perception about science, and the enrolment at grade 10 might increase and learning outcome in physical science might also improve both at school level and national level. I would like to believe that to some extent this might help in addressing skills shortage in science related professions in South Africa.

1.2 Background and context of the study

The language of instruction in most secondary schools in South Africa is either Afrikaans or English. This means that physical science is taught either in Afrikaans or in English. During apartheid era there were more schools using Afrikaans as the medium of instructions than we have now (Department of Basic Education [DBE], 2010). However, the number of schools using English as a medium of instruction has increased remarkably from 3000 in 1998 to 4000 in 2007 whilst that of schools using Afrikaans has decreased from 1227 in 1998 to 1174 in 2007 (DBE, 2010). The dominance of English as the language of learning and teaching (LOLT), in the school system is due to a number of factors including tradition, parental preference and capacity. Moreover, *“English is viewed as a language associated with economic growth, global (international) language and as useful for future studies at tertiary institutions and as a language widely spoken at work places”* - italics my emphasis (DBE, 2010 p. 24).

According to the Department of Education in schools, learners can be taught English as home language, English as first additional language and English as second additional language (Department of Education [DoE], 2010). However, in this study learners whose mother

tongue is not English are regarded as English first additional language learners and those whose mother tongue is English, as English first language (EFL) learners. It is the English second language learners who might need additional support to develop their English language skills especially at the initial schooling stages (DoE, 2010). Research studies on difficulties encountered by science learners with meanings of everyday words when used in science context have been conducted in other countries such as Australia (Gardner, 1972), United Kingdom (Cassels & Johnstone, 1975 – 1979) and Kenya and United Kingdom (Oyoo, 2007). The findings from all these cross-national studies reveal that students encounter challenges with all categories of everyday (non-technical) words common in science teachers' classroom language irrespective of their linguistic or cultural backgrounds or gender (Oyoo, 2011). The sample used in this study comprised of learners from different cultural background as well as different home languages which included: isiZulu, isiXhosa, isiNdebele, Setswana, Sesotho, English, Tshivenda, Sipeedi and Xitsonga.

1.3 Language in Learning and Teaching science

In science education, language can be perceived as a tool that facilitates communication between the teacher and the learners in a science classroom (Muralidhar, 1991). Language can be perceived as having a dual character in that it is a carrier of culture as well as a means of communication (Msimang, 1992). One of the major functions of language relevant to science educators is its use in learning: for trying to put new ideas into words, for testing the learners' thinking, for fitting together new ideas with old ones and all this is done for the purpose of bringing about new understanding in the learner's mind (Torbe, 1977). It is vital to note that such functions suggest active uses of language by the learner as opposed to passive reception. According to Tam (2000), the theory of constructivism views leaning as an active process. For instance, science teachers use science language when teaching and might impose science knowledge on their learners but cannot impose understanding in them because it has to come from within the learners' minds. Language is also viewed as the sum total of talking, listening, reading and writing and all the four modes are equally important (Torbe, 1977).

Language plays a pivotal role in all activities which have to do with effective teaching and learning of science (Oyoo, 2012). Other researchers (e.g. Muralidhar, 1991; Oyoo, 2007, 2009, 2010) have argued that, it's not only the learner's proficiency in the medium of instruction which enable the learners to grasp scientific concepts but also their understanding

of meanings of everyday words when used in science context. It is apparent from the literature that research so far conducted has not really focused on the way science teachers use the instructional language during teaching as a factor in quality of learning of school science (Oyoo, 2012). According to Oyoo (2007), the learners' proficiency in any instructional language is the primary step for all learning processes. However, the general difficulty of the instructional language as used by science teachers in the classroom as is evidenced by the challenges faced by learners with meanings of everyday words when used in science context cannot be ignored (Oyoo, 2007).

Classroom talk in science lessons mainly involves the teacher addressing the learners where the language is usually pre-planned. The classroom talk encompasses the talk amongst learners and teachers when they solve problems; explore new ideas on scientific issues, and debate on scientific matters (Torbe, 1977). According to Yore, Hand, Goldman, Hildebrand, Osborne, Treagust & Wallace (2004), language is a means of doing science and of constructing science understandings: language is also vital for scientific literacy since it is used to communicate about procedures as well as science understanding to other people so that they can make informed decisions.

In a science classroom all learners can be regarded as members of a science culture and are accustomed to the general educational system, values and procedures as those within which the studies of science were crafted. Thus, the teacher and the learners have a common classroom language or classroom discourse which is the language in which science is being taught in the classroom (Stevens, 1976). This entails that the communication between learners and their teacher is a vital factor or ingredient in enhancing the understanding of science particularly when the main sources of information for most if not all learners are teachers and textbooks as is the case in South Africa.

From my 20 years of teaching science and several years of attending road shows where matric national physical science results are discussed each year the results are generally poor. This worries me as a physical science teacher and I am concerned and keen to find out the possible reasons for this high failure rate. I have been marking grade 12 physical science national examinations for some years now and most candidates fail to understand meanings of everyday words like *deduce*, *analyse*, *suggest*, *infer* when these words are used in questions, causing them to lose marks. In my experience as a science teacher, I have witnessed poor understanding of science concepts by learners resulting in poor learning

outcomes both at school and national level. These experiences have motivated me to want to carry out a research on the challenges faced by our grade 12 physical science learners on the meanings of everyday words when used in science context.

1.4 The components and nature of science classroom language

The language of the science classroom or science text books is divided into two parts namely: the *technical* component and the *non-technical* component. According to Oyoo (2009), the technical component comprises of technical words which are specific to a science subject for example: *photosynthesis*, *respiration* and *genes* are words associated with Biology; *capacitance*, and *voltage* are associated with Physics; while *atoms*, *elements* and *reaction* are associated with Chemistry (Oyoo, 2012).

On the other hand, non-technical component is made up of non-technical words and this makes up the science classroom language or language of science text book(s). There are three categories of non-technical terms or words: The first category is *logical connectives* – these are words or phrases which serve as links between sentences or between a concept and a proposition e.g. ‘since’, ‘because’, ‘conversely’ and ‘therefore’ (Gardner in Oyoo, 2012, p. 853). The second category is *metarepresentational terms* – these are words or terms which signify thinking and includes: metalinguistic verbs - words which take the place of the verb to say such as, ‘define’, ‘suggest’, ‘explain’, ‘describe’ etc. (Oyoo, 2012, p. 853) and metacognitive verbs – these are words which take the place of the verb to think such as ‘calculate’, ‘observe’, ‘analyse’, ‘deduce’, ‘predict’, ‘hypothesize’ etc. (Oyoo, 2012, p. 853). The third category is *non-technical words used in the science context* – are those words which have become part of language typical of science subject. Examples includes, ‘reaction’, ‘diversity’ and ‘disintegrate’.

According to the Macmillan dictionary (2002 p. 1172), however, the everyday meaning of the word ‘*reaction*’ is the way one feels or behaves as a result of something that happens. *Diversity* refers to the fact that very different people or things exist within a group or place while the everyday meaning of *disintegrate* is to be completely destroyed by breaking into lots of very small pieces (Macmillan dictionary, 2002 p.395). The challenge comes when words like *reaction*, *diversity* and *disintegrate* are now used in a science context where their meanings change from everyday meaning to that when used in the science context. The word ‘diversity’ is commonly used in biology in talking about the various types of species such as plants and animals (Oyoo, 2012). The word ‘reaction’ is commonly used in Chemistry more

than in Physics. In Chemistry the word ‘reaction’ is used to describe what happens when two or more substances are mixed. On the other hand ‘disintegrate’ would be used more in Physics to mean the decay of an unstable nucleus (Oyoo, 2012). While, such words as *disintegrate*, *diversity* and *reaction* are recognizable as words commonly used in everyday language, but become “specialist language” (Barnes et al in Oyoo 2012) only when used in science to constitute the register of the science subject. This study looks at school physical science learners’ difficulties with meanings of non-technical words when used in science context.

1.5 Rationale of study

What prompted me to undertake this study is the declining numbers of learners opting to study physical science at the end of grade 9 and also the general poor performance in physical science as earlier said in section 1.1. When you ask the learners including those who were doing very well in Natural science in grade 8 and 9 why they are not choosing physical science, they always say it’s a difficult subject. For instance at the school where I am currently teaching we have $\pm 30\%$ of grade 9 opting to do physical science in grade 10. However, some of these learners drop out in grade 10 and 11 such that when we get to grade 12 we have even fewer learners writing the final examination and it’s not all the learners who pass the examination some of them fail. On average we have been having 85% pass rate in physical science and on average 50% of them qualify for Bachelor’s degree. This is so because in South Africa the pass mark is 30% but most universities only enrol learners who will have scored above 50% in their physical science if they want to pursue science related programmes.

Some researchers (Ali & Ismail 2006; Ferreira, 2011; Muralidhar, 1991; Probyn, 2006), contend that learners have to be proficient in the language of instruction (English) in this case, for them to understand science concepts and perform better. Most of the learners in South Africa are second language English speakers and as such science teachers are faced with the challenge of teaching science in English while the learners have not yet mastered the English language at high school level (Ferreira, 2011).

This study also probed the minds of physical science teachers by conducting face-to-face interviews with each teacher so as to find out if they are aware of this problem, what they are doing about it or what they think can be done about it. The study sought to make the teachers more aware of the difficulties learners encounter with the language of the classroom so that

corrective measures can be taken in alleviating these challenges. This study values the communication between the science teacher and the learners as important. It has been suggested that difficulties which learners encounter with meanings of everyday words in the science classroom might be attributed to the teacher's speed of talking; teacher's pronunciation of words; audibility of the teacher and the teacher's language level (Oyoo, 2011). The study recognises that the teacher intervention is paramount in promoting learners' understanding of the non-technical words and hence the need for effective communication between the teacher and his learners.

Some of the research studies I have read did not interview teachers (Ali & Ismail, 2006; Farrell & Ventura, 1998) except a few researchers like Oyoo (2007) when he conducted his studies in Kenya and United Kingdom. In this study, the participant science teachers were interviewed because they are the main resource in learners' effective learning of science (Oyoo, 2007). Therefore, the interviews with science teachers would reveal whether they are aware of the difficulties learners encounter with meanings of everyday words when used in science context. I believe that, once the teachers are made aware they will see the importance of explaining these non-technical words when teaching science to their learners to enhance their understanding of science. Therefore, the beneficiaries of this study will be the science learners at large

1.6 Aims and Objectives of the study

The goal of the study was to get an insight into the meanings of everyday words when used in science context by grade 12 physical science learners in Johannesburg, South Africa. The objectives of the study were:

- To investigate whether South African grade 12 physical science learners face difficulties with the meanings of everyday words when used in science context.
- To find out the possible sources of any difficulties grade 12 learners encounter with the meanings of these words presented in the science context.
- To establish physical science teachers awareness of the difficulties faced by learners in understanding meanings of everyday words when used in science context.

1.7 Research questions

1. Are there difficulties encountered with everyday words when used in science context by South African grade 12 physical science learners?
2. What are the sources of difficulty of the words?

3. Are the teachers aware of the difficulties learners encounter with the language of teaching and learning when they are teaching them?

In this study, I decided to use grade 12 instead of grade 10 or 11 because these learners have had the most experience in learning high school physical science and they are about to graduate from high school and probably go into tertiary institutions. I am hoping that it would be interesting to see how they understand the meanings of everyday words when used in science context.

1.8 Chapter Summary and Outline of Research Report

In this chapter, an introduction and overview of the study has been provided. The role of language in teaching and learning science is provided as well as the components and nature of science classroom language. The need for effective communication between the teacher and learners is emphasised and rationale for study is also highlighted. Chapter I also highlight some of the steps taken by government and other stakeholders in trying to address challenges faced in Mathematics and Science education in South Africa. The rest of this report is structured as follows:

In Chapter 2, an explanation of the theoretical framework which forms the basis of analysis and arguments, the review or related literature on technical words and non-technical words or terms used in science language and the difficulties encountered by physical science learners with meanings of everyday words when used in science context in other countries is highlighted. Policy on language of instruction in South African schools as well as the general performance in physical science in secondary schools is discussed. In Chapter 3, a detailed account is provided on the research design and methodology adopted for the research. Data collection methods used in the study are given and the everyday words whose meanings were sought when used in science context in the questionnaire are provided. The sampling methods used in the study as well as the sample details of the participant physical science learners and their teachers is provided. The ethical procedures which were followed in the study are also highlighted in this chapter.

Chapter 4 focuses on the data presentation and analysis. The marking of the questionnaire and the words whose meanings were difficult to participant learners are provided. Interview results with learners to find out why they chose certain meanings of words are given as well as interview results with the participant physical science teachers to establish if they are aware of the difficulties encountered by learners with meanings of everyday words when

used in science context. This chapter also provides suggestions on the way forward from the participant teachers. Chapter 5, the key aspects of the research are discussed and critiqued, results are summarised. The limitations of the study, recommendations are highlighted and reflections on the study are provided.

CHAPTER 2

2.0 THEORETICAL FRAMEWORK AND LITERATURE REVIEW

2.1 Introduction

This chapter places the research into perspective by highlighting the theoretical framework which guided this study. The review of related literature to establish important links between existing knowledge on meanings of words is also provided. This review is critical in establishing central and pertinent questions that guided the study. The historical background on language in South Africa is provided as well as the language policy in education. A brief summary on status of language in schools and trends in language provisions in the past decade is also examined. This chapter also looks at the relevance of this study to the South African context; teachers' awareness of the effect of their classroom language on the understanding of science concepts by the learners is also discussed. I first present the theoretical framework.

2.2 Theoretical framework

According to Constructivism learning theory, learners are not blank slates because whenever they come for the lesson they always have some ideas of the meanings of everyday words used by the science teachers or written in the science text. The knowledge of science is embedded in the language of science which is made up of words. Constructivist perspective views learning as a change in meaning constructed from experience of the learners (Tam, 2000). This means that as the teacher is teaching, each learner will be actively constructing his/her own new knowledge using what the teacher is saying and his/her own experience in his/her mind. For the learners to construct the new knowledge, they require to understand the meanings of the words in which this new knowledge is codified. This is in line with the role of language use in concept formation and development (Vygotsky in Oyoo, 2012).

Science is a subject which is rich in words and terms which can either be technical or non-technical and one cannot separate science from words (Wellington & Osborne, 2001). According to Postman and Weingartner in Oyoo (2012), what is called knowledge of say science is actually the language of science which means that the key to understand science is to understand the meanings of the words used in science. Therefore, without words used in science language, there is no science to talk about. Thus, my focus in this study on words has been argued in the following words,

All of what we customary call “knowledge” is language. Which means that the key to understanding a “subject” is to understand its language ... what we call a subject is its language? A “discipline” is a way of knowing, and whatever is known is inseparable from the symbols (mostly words) in which the knowing is codified. [Postman & Weingartner (1971, p. 102) in (Oyoo, 2012, p. 854)].

The fact that knowledge of science is its language which implies that the key to understand science is to understand its language. The knowledge of science is codified in the words used in the learning of science and this forms the theoretical framework of this study. This means that whatever science content is known today, it cannot be separated from the words in which knowing it is codified (Hodson in Oyoo, 2012). The fact that the meaning of each word is its use and function in the context in which it is used, during teachers’ classroom talk there is need for shared thinking towards a common understanding of the meanings of everyday words in science context with the learners Oyoo (2012, p. 854). I next present the related literature review of this study.

2.3 Literature Review on meanings of words used in science classrooms.

Learning science can be viewed as learning a new language because in some ways it presents more difficulty in that many of the hard conceptual words of science such as *power*, *work*, and *energy* have precise or exact meanings or definitions when used in science. This means that science education involves the use of familiar words like ‘power’ but which have new meanings in science (Wellington & Osborne, 2001). However, words such as ‘power’, ‘work’ are technical words or science words and have specific meanings in science. This study seeks to establish if non-technical words like *consecutive*; *prepare*; *conserve* and *sensitive* are misunderstood by grade 12 Physical science learners when used in science context. Thus, this language shift whereby the same words are used but their context has changed and hence their meaning is what challenges the learners. In most cases learners are not aware of this change in context of ordinary language to scientific context hence their interpretation of the meaning will be wrong (Munby, 1976; Oyoo, 2011). The intent of the study is to establish whether South African learners studying physical science at grade 12 levels encounter difficulties with the meanings of such words when used in science context and also to find out if their teachers are aware of these difficulties.

As so far mentioned, the non-technical component of the science classroom language consists of three categories of non-technical words namely, *non-technical words in science context*, *metarepresentational terms* and *logical connectives*. This review focuses on the category

referred to in literature as non-technical words in science context. Despite the fact that there is no empirical study in the literature which has specifically focused on learners' difficulties with metarepresentational terms such as, 'describe', 'explain' and 'comment', learners in Kenya learners have scored low marks in science examinations due to poor understanding of these words (Oyoo, 2011). Again there is no major studies conducted so far on the difficulties learners' encounter with logical connectives (the third category of non-technical words) except the one conducted by Gardner in 1977 using English first language junior secondary learners (Oyoo, 2011). The results suggested that learners encounter difficulties with meanings of logical connectives such as , 'consequently', 'therefore', occasionally' and 'nevertheless' when used in both science teachers' classroom language and science texts (Oyoo, 2011).

There are quite a number of studies which have been conducted on student difficulties with meanings of words as used in science classrooms after the pioneer study by Gardner in 1972. Gardner tested the understanding of 599 words on a sample of about 7000 learners from 39 different schools across Australia (Farrell & Ventura, 1998). In Gardner's pioneering study which he conducted in Papua New Guinea where he used a sample drawn from secondary school learners all of whom were English second-language speakers. The results of this study indicated that some of the most common words used by teachers of science in the classroom were simply misunderstood by the learners (Oyoo, 2011). Three words – 'disintegrate', 'random', and 'spontaneous' were found to be the most difficult. The summary results indicated that 26%, 25% and 31% of the entire sample scored correctly on the words, 'disintegrate', 'random', and 'spontaneous' respectively (Oyoo, 2011). In 1972, Gardner replicated the study in Australia using English first-language learners and in Philippines in 1976 using English second-language learners. The separate studies revealed similar trends in the difficulties learners encounter with meanings of everyday words. However, on comparison on the levels of performance, it was found that English first-language learners in Australia encountered fewer difficulties with meanings than English second-language learners in the Philippines. These findings by Gardner saw the birth of numerous similar investigations in other parts of the world in the years that followed.

One study consequent to the Gardner's pioneering study was conducted using more than 25 000 learners by Cassels and Johnstone in Britain between 1975 and 1979. They found out that, what could be presented as a test to learners might turn out to be an assessment of

language skills. They also discovered that learners did not only struggle with vocabulary but also with the meanings of everyday words in science context.

In 1990, Gilmour and Marshall conducted a study in Papua New Guinea in which they tested the understanding of 45 non-technical words such as *exert* and *random* which they had selected from the words commonly used by teachers when teaching. Their sample consisted of grade 7 up to university students. The results indicated that indeed learners have problems with the meanings of everyday words when used in science context. However, university students understood these words better than students at lower levels. Pickersgill and Lock carried out another study in 1991 in Britain which was similar to the one conducted in 1990 by Gilmour and Marshall in Papua New Guinea (Oyoo, 2011). Even though the study by Pickersgill and Lock (1991) detected no difference in the understanding of non-technical words in science by females and males, they found a positive correlation between a learner's score on a test of understanding of non-technical words in science context and on a verbal reasoning test (Oyoo, 2011). These results may be taken to suggest that learner's proficiency in the language of instruction might promote better understanding of meanings of non-technical terms in science. However, further studies will need to be conducted to ascertain that notion (Oyoo, 2011). Once again these studies drew the same conclusion (everyday words were misunderstood by science learners when used in science contexts) as the other researchers before them (Farrell & Ventura, 1998).

There were several subsequent studies which were conducted whose samples consisted of mainly English second – language learners (Farrell & Ventura, 1998; Oyoo, 2000 & 2004; and Prophet & Towse, 1999). All these studies focused on different categories of learners who were at different levels of schooling. For instance Farrell and Ventura (1998), concentrated on non-technical words as used in a particular science subject such as Physics while on the other hand Prophet and Towse (1999) used learners drawn from developing country (Botswana) and a developed country (United Kingdom) and made comparisons in performance on these non-technical words in different countries by first – and second-language learners simultaneously (Oyoo, 2011). Also the study by Oyoo in 2000 drew samples from both first- and second-language learners but from Kenya and United Kingdom (Oyoo, 2011). However, the trends in the difficulties encountered by learners were independent of whether the learner learns science in English as first or second language. The

types and trends in all the studies regarding learners' difficulties with meanings of everyday words were quite similar irrespective of gender and research design (Oyoo, 2011).

In the recent review of these studies conducted by Oyoo in 2007, it was revealed that even first language speakers had problems with non-technical words used in science context. Thus, the difficulty encountered by learners in understanding of non-technical terms when used in science context was irrespective of the gender, linguistic or cultural background. This implies that, 'the difficulties faced by students learning science should not only be judged on the basis of their perceived levels of proficiency in the language of instruction (English) only since other factors such as understanding word meanings come into play' (Oyoo 2012, p. 854).

According to Ryan (1983), it's not only the scientific words that cause problems with science learners but also the short common words that have crept into the language of science bearing technical meaning. In her research she found that regardless of learner's proficiency in the language of instruction all the learners encountered difficulties with meanings of everyday words used in science context. In fact she found out that, the non-science major that were proficient or had superior vocabulary also had problems when such common words were used in different context. This means that when a learner is familiar with a certain non-technical word, it's very possible for such a learner to give that word its usual everyday meaning without considering the context in which the word was used. For example in chemistry, not all pleasant –smelling chemicals are "aromatic". However, when students learning organic chemistry see the word aromatic they are likely to think of arenes (organic compounds which contain a benzene ring). This is so because the students will assume that they already know the meaning of the word. Naturally such learners will miss the whole concept being represented without realising it (Ryan, 1983).

The types of difficulties encountered by the learners with this category of words include:

- Lack of the required comprehension – most participant learners failed to understand the meaning of the words and often confused words in the same semantic field such as, 'detect' with 'project', 'insulate' with 'isolate', 'referred' with 'reference' (Oyoo, 2011).
- Learners selected words of which meanings were opposite to those anticipated in the study. For instance, 'a lot' for 'negligible', 'initial' for 'final'.

- Words which were ‘graphologically’ similar according to Gardner in Oyoo (2011) or ‘look-alike’ and ‘sound like’ according to Cassels and Johnstone in Oyoo (2011) or ‘phonetically’ similar Gardner in Oyoo (2011). Examples of such words includes: ‘compound’ with ‘consistent’, ‘protect’ with ‘detect’, ‘accumulate’ with ‘accommodate’, ‘portion’ with ‘proportion’ (Oyoo, 2011).

Research studies in many countries across the globe have established that even learners who learn science in their home language or have attained native speaker levels of proficiency in the language of teaching and learning are not spared from these difficulties (Oyoo, 2012). Many a time, this occurs when both the teacher and the learner know the meaning of the everyday word used in a science context and each assumes that the other shares the same meaning (Oyoo, 2007). The results of such communication breakdown have compromised the understanding of scientific concepts and have led to poor learning outcomes.

2.3.1 Science teachers’ awareness of the effect of their classroom language

This also sought to establish teacher awareness of learners’ difficulties with meanings of everyday words when used in science context. Research has shown that the greater percentage of talk in most classrooms involves the teacher and science classrooms are not an exception. It is believed that two thirds of the time in a classroom talk, the teacher will be talking implying that the remainder of the time learners will either be writing or discussing amongst themselves (Edward & Mercer in Oyoo, 2004). In perhaps the only study so far in this area, conducted in Kenya by Oyoo (2004), it is revealed that science teachers are not aware that the language which they use when they are teaching the learners can be a source of difficulty for the learners in understanding science. According to Oyoo (2004), teachers were not aware of the functional value of non-technical words when used in science context. As such they did not bother to explain the meanings of the non-technical words when teaching their learners.

It is believed that science learners can easily understand and internalise science concepts as long as they are able to understand the meanings of everyday words when used in science context or as science words (Oyoo, 2004). The nine teachers who took part in the research conducted by Oyoo in Kenya thought that physics content was the only source of learners’ difficulties in learning the subject. As such they never bothered to explain the meanings of words like *characteristic* and *convention* in the context of use. However, most of the participant teachers had noticed that their learners could not comprehend word problems let

alone interpret the word questions (Oyoo, 2004). Unfortunately most of the research which has been conducted in this area dealt with misunderstanding of technical terms or science words hence the limited literature in this area of misunderstanding of non-technical words.

This study specifically sought to establish whether the meanings of everyday words when used in science context present difficulties to grade 12 physical science learners in South Africa, and teacher awareness of this problem. A review of studies on language in science education in South Africa have revealed that no similar studies have been reported on learners' difficulties with meanings of everyday words when used in science context (Oyoo, 2012). It is a fact that most research done to date in South Africa focused on English language as a barrier in learning science. For instance, Probyn (2006), investigated classroom language practices by some grade 8 natural science teachers in Eastern Cape. Probyn found that all the teachers used Xhosa when teaching or emphasising certain science concepts. However, she discovered the extent of using Xhosa varied from one teacher to the other. Most recently Ferreira (2011) conducted a study on teaching Life science to English second language learners. According to Ferreira (2011), South African learners in the Life science classroom have to cope with understanding the English language and at the same time they have to learn the subject matter which is also in English. As such, English second language learners struggle to comprehend the Life science concepts and this has negative effects in their performance in the subject. The background of the mix in language of teaching and learning in South Africa is now presented.

2.3.2 Historical Background on Language in South Africa

The Dutch Boer settlers arrived in South Africa in 1652 and they made a great impact on the development of languages in the country. Credit should be given to early European missionaries who worked hard to codify some African languages so that the entire texts in those indigenous languages were accessible in 1823 even though the intention was never to promote these languages to the level of English or Dutch (Thobeka, 1997). However, African languages were virtually ignored as languages of instruction to teach subjects in all South African schools until the present times. Afrikaans became an official language in addition to English in 1925 and they are still the languages of instruction in schools (Thobeka, 1997).

The infamous policy of apartheid (which is an Afrikaans word for separatism) was introduced in 1948 and South Africans were separated from each other based on language or the mother tongue principle (De Wet, 2002). Thus, the home language has a bad image amongst most

indigenous African language speakers because it is associated with the inferior Bantu education (De Wet, 2002). It is based on most parents' memories of Bantu Education that they prefer English as the language of learning and teaching because they see it as a gateway to better education and empowerment (De Wet, 2002).

2.3.3 Language Policy and Legislation in South Africa

Language policy is not just a document but rather a series of strategies in the classroom and consequently the whole school (Torbe, 1977). The language policy can be seen as a process of discussion or debating, of asking questions and finding answers to those questions and once the process takes off, the process does not stop (Torbe, 1977).

The language policy in all learning institutions in South Africa including schools is guided by principles enshrined in the Constitution of the Republic of South Africa (CRSA) (RSA, 1996) and South African Schools Act (SASA) (RSA, 1996). The constitution of the Republic of South Africa recognises 11 official languages and the right of all South Africans or citizens to receive education in the official language(s) of their choice in public schools. It stresses the fact that all official languages should be treated equally in other words, there is no language which is special to any other language (DBE, 2010). Thus, the constitution affords all learners the right to be taught in the languages of their choice. However, this right is tempered by the state's or government's ability to practically provide for its implementation. At the present moment I have never seen a scientific register or science text books for example written in any one of the African languages which can enable the learners to exercise that right, if such registers or science text books exist, it would seem to me that they are not yet being implemented in schools.

On the other hand South African Schools Act (SASA) prescribes several preconditions regarding language policies in public schools. These include: subject to the constitution and this Act, the minister may, by notice in the government gazette, after consultation with the Council of Education Ministers, determine norms and standards for language policy in public schools (DBE, 2010, p. 6) The governing body of a public school may determine the language policy of the school subject to the constitution, this act and any applicable provincial law (DBE, 2010, p. 6). However, these powers entrusted to (School governing bodies) SGBs might be subject to abuse by some members who might choose their preferred language at the expense of the learners. It is important to note that SASA now recognises Sign language as an official language for the purposes of learning at a public school. This

means that in the context of education in South Africa we now have 12 official languages as opposed to the 11 documented in the constitution (DBE, 2010).

The Language in Education Policy (LiEP) prescribes the use of home language as the language of learning and teaching (LOLT) in the early years of learning, while providing access to an additional language(s) which is usually Afrikaans or English for future learning. The Language in Education Policy includes the following stipulations:

- ❖ All learners shall be offered at least one approved language as a subject in Grades 1 & 2.
- ❖ From Grade 3 onwards, all learners shall be offered their LOLT and at least one additional approved language as a subject.
- ❖ All language subjects shall receive equitable time allocation.
- ❖ Learners must choose their LOLT upon application to a particular school. Where a school uses the LOLT chosen by the learner, and where there is a place available in the relevant grade, the school must admit the learner.

Department of Basic Education [DBE] (2010, p. 6)

Thus, the South African Language Educational policy encourages the use of both the learners' home languages in schools as well as acquisition of an additional language of communication to cater for learners from different cultures, race and regional divides at the same juncture promoting respect of other languages (DBE, 2010). From my experience as a science teacher, the use of home language is a thorn in the flesh for urban schools like in Johannesburg, where learners are generally from varied language backgrounds in any one class and the teacher in most cases is an expatriate who does not know any of the local languages.

The National Curriculum Statement (NCS) advocates for the teaching of African languages in schools and recognises the importance of additive multilingualism and this is clearly demonstrated in the following statements:

- ❖ All learners should study their home language and at least one additional language as language subjects from Grade 1.
- ❖ All learners should have studied an African language for a minimum of three years by the end of the General Education and Training (GET) band (DBE, 2010 pp.7).

I would like to believe that the policy makers do come with good language policies sometimes and is well documented for all stakeholders to read as highlighted above but, there

is no enforcement or follow up made to check if schools are adhering to these policies. From the study conducted by the Department of Basic Education (DBE) in 2010 it was noted that in 2008 and 2009, less than 5% of learners in South Africa studied a language subject at the additional language level in the Foundation Phase. This clearly demonstrates that schools did not implement the curriculum policy as prescribed (Romaine, 2000, p. 12).

2.3.4 Status of language in schools and trends in language provisions in the last ten years.

I have highlighted above, the language policy in schools as prescribed by the Constitution of the Republic of South Africa and the South African School Act. Despite the fact that schools are free to use any of the local official languages such as Xhosa, Venda and so on, it has been noted that, the majority of schools in South Africa use English as the language of instruction and assessment as compared to Afrikaans (DBE, 2010). For instance, you can find a teacher using isiZulu to explain scientific concepts to learners while the official medium of instruction English, is used for assessing learners and this is described as dual medium of instruction (DBE, 2010).

Table 3 illustrates that in 2007, 7% of the learners in the school system in South Africa learnt via the medium of isiZulu, while 12% learnt via the medium of Afrikaans and the majority 65% learnt via the medium of English.

Table 3: Percentage of learners by language of learning and teaching and grade: 2007

LOLT	Percentage of learners by LOLT: 2007												
	Gr 1	Gr 2	Gr 3	Gr 4	Gr 5	Gr 6	Gr 7	Gr 8	Gr 9	Gr 10	Gr 11	Gr 12	SA
Afrikaans	9.5	9.6	9.9	12.3	12.2	12.2	13.2	13.1	14.0	12.7	12.1	12.8	11.9
English	21.8	23.8	27.7	79.1	81.1	81.6	80.6	80.9	80.0	81.2	82.0	81.8	65.3
isiNdebele	0.7	0.8	0.8	0.3	0.3	0.3	0.3	0.1	0.1	0.1	0.1	0.1	0.4
isiXhosa	16.5	15.0	14.0	3.1	2.5	2.0	1.9	1.6	1.4	1.3	1.2	1.5	5.5
isiZulu	23.4	21.7	20.1	1.5	1.0	1.0	1.0	1.1	1.1	1.1	1.1	1.1	6.8
Sepedi	8.3	9.1	9.2	1.1	0.9	0.9	0.9	0.9	0.9	1.0	1.0	1.0	3.1
Sesotho	4.7	4.8	4.4	0.5	0.4	0.3	0.4	0.4	0.5	0.5	0.4	0.3	1.6
Seswana	7.5	7.4	6.8	0.6	0.5	0.5	0.6	0.6	0.7	0.6	0.5	0.3	2.4
Siswati	2.1	2.1	1.7	0.4	0.3	0.3	0.3	0.1	0.1	0.1	0.1	0.1	0.7
Tshivenda	2.2	2.4	2.4	0.3	0.2	0.2	0.2	0.4	0.5	0.5	0.6	0.5	0.9
Xitsonga	3.1	3.3	3.1	0.7	0.6	0.6	0.6	0.7	0.7	0.8	0.8	0.8	1.4
Total	100	100	100	100	100	100	100	100	100	100	100	100	100

Source: DBE, LOLT Report, 2010d p. 20

Based on the results highlighted in the Table 3, one can note that approximately 75% of the learners in the school system learnt via the media of Afrikaans and English in 2007 whilst the

remaining 25% learnt in other languages. This confirms the fact that Afrikaans and English are still the dominant languages of learning and teaching in South African schools.

2.3.5 Significance of the study for the South African Context

The classroom talk involves the teacher and the learners and just like in any other relationship, both parties can have a deep impact on the other, for better or for worse. Most of the time teachers are more concerned about their own language competence in the classroom than being concerned about the quality of pupils' language (Henderson & Wellington, 1998). When teachers use everyday words in science context, they might assume that they are sharing the same meanings with the learners yet this might not be the case. This is so because such words have more than one meaning depending on the context in which they are used (Oyoo, 2012). The language of science itself is unfamiliar enough to most of our secondary school learners to be considered a second language or a foreign language to the science learners (Ali & Ismail, 2006; Becker, 1993)

From the foregoing in this review, immediate beneficiaries of this study are teachers and the learners at large. For the learners, it should be manifested in their learning outcomes in physical science either at school level or nationally and for teachers, they will be able to help learners understand science hence improved understanding. I believe that in the long run the Republic of South Africa would benefit because there will more local skilled manpower such as doctors, science teachers and engineers is currently lacking.

2.4 Chapter Summary

This chapter has highlighted the theoretical framework guiding this study and the review of literature of relevant foundation for this study. The impact of teachers' unawareness of classroom language on learners has been examined. The historical background on language in South Africa as well as the current language policy in education has been examined. The level of difficulties encountered by learners with each category of non-technical words from literature was highlighted. This chapter has included the relevance of the study to South African context as well as examining the impact of teachers' awareness of difficulty of classroom language on learners. In chapter 3, the research design and research methodology that was used in conducting the study are discussed.

CHAPTER 3

3.0 RESEARCH DESIGN AND METHODOLOGY

3.1 Introduction

The main focus of this study was to investigate whether South African grade 12 physical science learners have challenges in understanding the meanings of everyday words when used in science context as well as teacher awareness. This chapter focuses on methodological matters dealt with in the study such as the overall research approach used in the study, the methods of data collection used, the context of the study and the manner in which the participants in the study were selected, the details of the actual data collection and data analysis strategy more of this in chapter four.

3.2 Research Design

Research methods are the means of collecting and analysing data (McMillan & Schumacher, 2010). According to Cohen and Manion (1994), research methods can be viewed as approaches used in educational research to gather data which are to be used as a basis for inference and interpretation, for explanation and prediction. Thus, there are many types of research methods which are employed in research and these include: *experimental, survey, action research, evaluation research* and *document analysis research*.

There are basically three common research paradigms namely: qualitative, quantitative and mixed methods pragmatic research paradigm (Reeves & Hedburg, 2003). The two terms quantitative and qualitative can be viewed in two ways: one can view them as referring to distinctions about the nature of knowledge that is the ultimate purpose of research and how one understands the world. On the other hand the terms qualitative and quantitative can refer to research methods – for example data collection and how it's analysed (McMillan & Schumacher, 2010). Researchers working within the qualitative research paradigm investigate the quality of the relationships. On the other hand, researchers working within the quantitative research paradigm tend to present statistical results represented by numbers (McMillan & Schumacher, 2010). In such cases data collection is usually done by means of quantitative methods and data analysis is done by descriptive and inferential statistical techniques.

A mixed method study combines characteristics of both qualitative and quantitative approaches to research and is becoming very popular with researchers because it provides the best approach to answering the research questions (McMillan & Schumacher, 2010). Mixed method research is one in which the investigator collects and analyses data, integrates the findings, and draws inferences using both qualitative and quantitative approaches or methods in a single study or programme of enquiry (Tashakkori & Creswell in McMillan & Schumacher, 2010). According to McMillan and Schumacher (2010), mixed method designs are useful in identifying factors, issues and attitudes which can become the focus of a quantitative study and they are also suitable for individuals or small group whose thinking is different from the majority. However, a mixed method approach has both advantages and disadvantages for instance; it requires an extensive data collection and more resources than other methods. It is difficult for one person to use mixed method because of the amount of time required and would be better if it's done by team effort. It is not a matter of collecting data alone but involves integrating, merging, linking and embedding two distinct strands of research – quantitative and qualitative (Creswell, 2008).

The overall approach for this study was survey method. There are two basic types of survey research namely: Longitudinal design - which is used to study individuals over a period of time, and cross-sectional designs - which is used to collect data about the current opinions, feelings or beliefs of individuals in a sample about a certain issue (Creswell, 2008). According to Creswell (2008), there are key characteristics of survey research regardless of whether the survey design is cross-sectional or longitudinal and these include, sampling from a population and collecting data through questionnaires or interviews. A survey is a method employed in quantitative research in which the researchers administer a survey to a sample or to the entire population of people to describe the characteristics (for example opinions, attitude, feelings etc.) of the population (McMillan & Schumacher, 2010; Creswell, 2008).

The aim of survey research is to describe relevant characteristics of individuals or groups (Berends, 2006). Surveys are used to gather data at a particular point in time with the intention of describing the nature of existing conditions or determining the relationships which exist between specific events (Cohen & Manion, 1994). In this method the survey researchers gather quantitative, numbered data using questionnaires or interviews and statistically analyse the data to describe trends about responses to questions made by participants and also to test research questions. The researchers also interpret the meaning of

the data collected and compare it with literature from similar studies (Creswell, 2008). It is vital to note that, survey researchers cannot explain the cause and effect because they do not experimentally manipulate conditions during the study. In the experimental method, the variation between the attributes of people is created by intervention from the experimenter wanting to see if the intervention creates a difference (de Vaus, 2002). A survey can also be contrasted with case study method which focuses on cases without necessarily comparing them but puts emphasis on fully understanding the wholeness of a particular case (de Vaus, 2002).

However, survey research resembles correlational designs in that survey researchers usually correlate variables even though their focus is inclined on learning about a population and less on relating variables as is the focus in correlational research (Creswell, 2012). Surveys sample populations so as to find out the incidence and distribution of, as well as the interrelationships among educational variables. The information collected in a survey is derived from responses to predetermined questions that are asked of a sample of respondents or participants. The researcher's intent would be to generalise these findings to the entire population from which the sample came (Aryl, Jacobs & Razavieh, 1990). In this study grade 12 physical science learners from four public secondary schools in Johannesburg had to respond to a 30 multiple choice questionnaire (word test) on meanings of non-technical words when used in science context. As revisited in section 3.4.2, since a non-probability - convenience sampling was used in this study and this involved choosing the nearest secondary schools to where the researcher was teaching, the results of the study could not be generalised due to the non-representativeness of the sample to South African schools as a whole. The convenience sampling was used in the study because of limited time to conduct the research as well as to cut transport costs.

3.3 Data Collection Methods

There are many different ways of collecting data which can be employed in educational research and these include: questionnaire, interview, observation, documents and audio-visual materials (Creswell, 2008). However, in this study data was collected using questionnaires and semi structured interviews. Questionnaires and interviews are used extensively in educational research to collect data about phenomena that are not directly observable: the inner experience, opinions, values and interests. They can also be used to collect data about observable phenomena more conveniently than by direct observation.

3.3.1 Questionnaires

Through a questionnaire, information is obtained from the participants' written responses to a list of questions and the items in it can be open-ended or closed-questions. Open-ended questions are those questions to which the participants respond freely without being restricted to a choice from given alternatives. Open-ended questions allow testing the limits of the participant's knowledge as well as clearing up any misunderstandings (Cohen & Manion, 1994). According to Creswell (2008), open-ended questions allow the researcher to explore reasons for the closed-ended responses and identify any comments people might have that are beyond the responses to the closed-ended questions. However, open-ended questions might present problems in that the responses of the participants might be too long or too short making it difficult to analyse (Creswell, 2008). On the other hand, closed questions are those to which participants are provided with various alternative responses to choose from. The advantage of this closed-ended questioning is its ability to bring to bring about information from participants who support concepts and theories in the literature. The main drawback of closed-ended questions is that it does not give participants room for any elaboration (Creswell, 2008). This study adopted with permission a questionnaire with closed-questions which was used in Oyoo (2004) – see appendix 8a. According to McMillan and Schumacher (2010), if a researcher adopts an existing instrument (questionnaire) with established validity and reliability it means that time and money can be saved. It was possible to adopt the questionnaire because it was earlier used on learners who were at similar level as the sample. Also the context of the sample was also African and the learners were predominantly English second language speakers.

Questionnaires are printed forms that ask the same questions of all individuals in the sample and for which participants record their answers in verbal form or written or typed response to each questionnaire item. The questionnaire is the most widely used technique for obtaining information from participants in a survey, it is economical and has the same questions for all the participants and ensures anonymity (McMillan & Schumacher, 2010). Also the participants have control on the data collection process, for instance they can fill out the questionnaire at their convenience and can answer the items in any order (Borg, Gall, D.M & Gall, P, 2007). However, once the questionnaire has been distributed, it's impossible to modify the items and also questionnaires cannot probe deeply into the participants' inner

experience, attitudes and beliefs. The adopted questionnaire had provisions for each participant to fill in their gender as well as the home language and this information was important in this study. Such information was to be used to address the question on whether gender or language background of the learner had an effect in understanding the meanings of everyday words when used in science context.

The adopted questionnaire (word test) comprised of 30 multiple choice questions each with an underlined word and four options to choose from (A, B, C or D). The questionnaire had questions which were to find learners' ideas about some words used in school science. Each participant learner was required to write his / her name or allocated code, indicate gender by ticking the appropriate box and write down the language spoken at school and at home. It was indicated to the learners on the questionnaire that it was not a test and there was no need for them to worry about their answers being wrong or right and that their answers would be kept confidential and anonymous. Learners were encouraged to read each question carefully and think about the meaning the word that was underlined to answer all the questions. The participant learners were to put a circle round the letter (A, B, C or D) next to the sentence or phrase that they thought represented the nearest meaning of the underlined word.

Examples of the everyday words in science context used in the questionnaire are:

7. The beam balance is a very sensitive instrument. This means that it
 - A. can be used to weigh very small things
 - B. can be used only by sensible people
 - C. is hard to understand how it works
 - D. gets spoilt very easily
14. The two chemicals seemed to combine in a spontaneous reaction. This means the reaction
 - A. was very quick
 - B. happened by itself
 - C. once started increased vigorously
 - D. was explosive
19. The pupil was trying to find a chemical that would retard the reaction. This means the chemical would
 - A. speed up the reaction
 - B. make the reaction go the other way
 - C. slow down the reaction
 - D. gives maximum yield from the reaction.

The grade 12 physical science learners were asked to choose the correct meaning of the underlined word.

At the end of the questionnaire, the participant learners were thanked in writing for giving their time to complete the questionnaire and were also asked to indicate by ticking the appropriate box if they were willing to participate in small group discussions of the meanings of the underlined words in the questionnaire (see appendix 8a). This was so that the participant learners could reconfirm their consent to be interviewed. The questionnaire was not piloted because it was used in several cross-national studies including the pioneering studies by Gardner in 1972 as earlier said.

3.3.2 Interviews

An interview occurs when a researcher asks one or more participants general, open-ended questions and records their answers and later the researcher transcribes and types the data into a computer file for analysis (Creswell, 2008). According to Borg et al (2007), interviews consist of oral questions asked by the interviewer and oral responses by the research participants. Interviews typically involve just one participant at a time, but there is increasing interest in conducting group interviews.

A group interview creates an atmosphere for discussions to develop thereby yielding a wide range of responses and also enables participants to challenge each other and extend each other's ideas. However, group interviews do not allow personal matters to emerge and sometimes you have only a few individual participants dominating the discussions at the expense of others (Watts & Ebbutt in Cohen & Manion, 1994). The participants typically speak in their own words, and their responses are recorded by the interviewer, either through handwritten or computer generated notes or verbatim on audiotape or videotape.

Usually the interviewer is in control and can schedule with the participant a mutually agreeable time and place to carry out the interview and then controlling. The interviewer also has control over the sequence and question pace to suit the circumstances (Borg et al, 2007). The main advantage of using interviews in data collection is their adaptability. It's important for the interviewer to establish a good rapport and trust with participants making it possible to obtain information that the individual would not divulge by any other data-collection method (McMillan & Schumacher, 2010).

According to Borg et al (2007), there are three basic types of interviews in quantitative research and they vary in structure and these includes: structured interviews – which involves a series of closed-form questions that can be answered by choosing from among a set of

short-answer questions or have yes or no answers; semi-structured interviews – this involves asking a series of structured questions and then probing more deeply with open-form questions to further information and finally unstructured interview – this involves the interviewer asking questions which gradually leads to the participants giving out the desired information. Normally the type of information sought is psychologically sensitive. However, in this study a semi-structured interview was for both learners and teachers.

Interview approach was chosen in the study as a way of finding out why certain participants (learners) chose certain responses or meanings in the questionnaire. Survey interviews are used to supplement data that have been collected by other methods such as observations and questionnaires (Cohen & Manion, 1994). The main reason for conducting face-to-face interviews with each teacher was to find out if the participant teachers were aware of the difficulties learners encounter with the language of teaching and learning. Such information would help in understanding issues relevant to the objectives of the study but specific to the circumstances of each teacher and in the context of each school. Teacher interview provided the researcher with an opportunity to find out if the participant teachers were aware of the differences between technical words and non-technical words. Finally teacher interview sought suggestions from individual teachers on ways or strategies which can be employed in schools by science teachers to alleviate this problem in science classrooms.

After marking the participant learners' response to the questionnaire (word test), interviews were conducted with learners and the science teacher from each of the participant schools. Two interview schedules were prepared: one for the learners and one for the teachers (see appendix 7a and 7b). The interview schedules were prepared on the bases of the responses which were perceived to be more challenging to the grade 12 learners in the questionnaire. Learners' interview questions were generally structured but, participant learners were afforded the opportunity to explain why they chose certain meanings of non-technical words in the questionnaire. Structured interviews were used with participant learners in the study because they were found to be suitable in probing the minds of the learners more details in section 3.6.4. A leeway was granted for open-form questions (Borg et al, 2007) so as to illicit reasons for choosing certain meanings of non-technical words when used in science context. Audiotaping and field notes for both teachers' and learners' interviews were also used as a strategy for data collection in the study.

3.4 Context of study and sampling

3.4.1 Historical background of schools in South Africa

I will provide first some historical background of the South African schools because of the uniqueness of these schools due to Apartheid system which was operating until the attainment of independence in 1994. The Bantu education system was tailored to suit black people; it was poor in content and was under resourced (Rose & Tunmer, 1985). However, after independence there was a complete overhaul of the education system in South Africa.

During the Apartheid era different race groups were kept apart from one another and received school education at a level which was deemed appropriate for them by the government of the time. As such there was unfair levels of education with White South Africans being the most advantaged followed by Indians, Coloureds and finally Blacks. Very little funds were made available to Black schools resulting in overcrowding, poor facilities and lower standard of education yet more funds were allocated to White schools (Rose & Tunmer, 1985).

After independence in 1994, the African National Congress (ANC) government decided to rectify this inequality amongst the different race groups by introducing a different schooling system namely: Model-B and Model-C system. In a model-B school there is equal amount of state funding as in model-C school but in a model-B system this state funding is used partly for staff salaries and partly for operations and administration. Also in a model-B school, the staff appointments, enrolment policy for learners and the maintenance of the school is the responsibility of the government. The school fees in a model-B school are not compulsory, not enforceable and as such schools have very little extra funds for other things since most parents choose not to pay anything. On the other hand, in model-C school besides the government paying staff salaries, the School Governing Body (SGB) controls the actual running of the school. Such schools insist on payment of school fees and as long as school fees are paid such schools are able to maintain a high level of education as well as extra-curriculum activities such as tennis, rugby, hockey just to mention a few. The SGB can employ additional staff who it pays whenever need arise. A model-C school determines the learner admissions policy and school fees are legally enforceable but no learner can be turned away for non-payment of fees.

The secondary schools used in the study were model C secondary schools (fee paying schools) and all from the same district in Johannesburg not very far from where the

researcher was working and thus it was convenient both in terms of time and costs of travelling.

3.4.2 Population and Sampling

A population is a group of elements or cases, whether objects or individuals that conform to specific criteria and to which we intend to generalise the results of the research (McMillan & Schumacher, 2010). On the other hand a sample is a group of participants from whom the data are collected (McMillan & Schumacher, 2010). In this study a non-probability sampling (convenience sampling) was used in the selection of the participants. Although this type of sampling makes it easier to conduct the research, the results cannot be generalised to any other population since the results are dependent on the unique characteristics of the sample. This also means that the results from such a study are less representative of an identified population (McMillan & Schumacher, 2010).

According to McMillan and Schumacher (2010), the number of participants or sample size plays a pivotal role in conducting and evaluating any research. The general rule is to have as many participants as possible to enhance credibility of the results. In this study, a total of 115 grade 12 physical science learners from the four Johannesburg secondary schools were selected using convenience sampling and their respective science teachers took part in this study.

3.5 Sample Details

3.5.1 The four secondary schools used in the study

School A is a model-C school with good infra-structure which is slowly going down due to failure by the school to maintain it. The school has an enrolment of about 900 learners most of whom come from different areas particularly Soweto, Thokoza and Voslorus. Since the school is situated near a railway junction serving all the three townships, it means that learners from these areas can easily reach the school cheaply since train fares are cheaper than road. Also the main roads from the city centre to the school are well serviced by taxis and buses. This makes the school attractive to learners from distant places; however there are learners from the neighbourhood who attend the school. Learners in School A are expected to pay school fees although the majority of the learners do not pay and take advantage of the government policy that schools are not allowed to turn away learners who fail to pay school fees. This has resulted in the school failing to maintain sporting facilities and buildings. The

School Governing Body (SGB) cannot afford to employ extra teachers and as such there are large classes averaging 45 learners per class. The learners are of mixed abilities and most of them are from poor background and broken up families making discipline issues a challenge at the school. There is *one* principal with *two* deputies to assist in the running of the school and a teaching staff of 35.

School A had 25 grade 12 physical science learners who participated in the study (15 girls and 10 boys) and were taught by male teacher, Mr M. At school A, there were 13 learners whose home language was isiZulu, Sipeedi (1), Setswana (1), isiXhosa (2), Sesotho (2), isiNdebele (2), English (1) and other languages (2).

School B is situated in a medium density area with a reasonable number of learners coming from the surrounding areas. However, almost half the number of the learners commute from Soweto daily using public transport such as taxis and buses. It is a school for both boys and girls with a total enrolment of around 850 learners, a principal and *two* deputies to assist in the running of the school. There are quite a number of Indian and Coloured learners amounting to almost a third of the school. It has a staff complement of 43 teachers and the class sizes range between 35 to 46 learners per class. According to the physical science teacher, Mr K, discipline is a problem at the school especially with smoking dagga, fighting amongst learners and bunking of classes by learners. Expelling problem learners from the school is not an easy task according to Mr K because the Department of Education does not support it and it would ask the school to submit a lot of paper work and intervention programmes for the learner.

School B had 28 grade 12 physical science learners who took part in the study (15 girls and 13 boys) and were taught by male teacher, Mr K. At school B, there were 8 learners whose home language was isiZulu, Sipeedi (5), Setswana (1), isiXhosa (1), Sesotho (2), isiNdebele (1), English (6), other languages (4).

School C had 31 grade 12 physical science learners who participated in the study (22 girls and 9 boys) and were taught by male teacher, Mr N. At school C, there were 6 learners whose home language was isiZulu, Sipeedi (7), Setswana (9), isiXhosa (1), Sesotho (3), Tshivenda (1), English (3) and one learner did not indicate the home language.

School D had 31 grade 12 physical science learners, all boys and were taught by male teacher, Mr Y. At school D, there were 7-learners whose home language was isiZulu, Sipeedi

(1), Setswana (5), Xitsonga (2), isiXhosa (2), Sesotho (3), English (9) and 2 learners did not indicate their home languages.

However, schools C and D have a lot in common and are in the same neighbourhood within about 2km from each other and most of their learners come from the same areas. The main difference between the two schools is that school D is a school for boys only while school C is co-educational. The enrolment at both schools is about 1000 learners and the majority of the learners come from Alexander Township which is about 10 km away and these learners pay for transport to and from school every day. Interview results with Mr N revealed that some parents feel that there is better education offered at model C school than non-fee paying model-B schools in Alexander Township; most of them do not pay fees because they cannot afford them. According to Mr N the physical science teacher at school C, the school is failing to hire teachers due to financial constraints and hence the big classes going up to around 45 learners per class. Apparently both schools seem to be struggling in keeping and maintaining the infrastructure in good order as reflected by the state of the toilets, grounds, classrooms and furniture. The calibre and motivation of the majority of the learners towards their education is poor because according to their teacher, Mr N (from school C), most learners are not interested in learning at all.

The total sample used in the study was 115 (52 female and 63 male learners) as earlier indicated. The results indicates that, IsiZulu was the home language of most participant learners' (34 out of 115) in this study while none of the learners spoke Afrikaans or siSwati. Out of a total sample of 115 used in the study, only 19 learners had English as their home language whilst 3 learners forgot to indicate their home language.

3.5.2 The Four Participant Teachers

Mr M, physical science teacher at school A was a male teacher and was not married at the time the study was conducted. He was born and educated in Zimbabwe and graduated with a Bachelor's degree in Applied Mathematics from one of the universities there and has been teaching physical science in South Africa for five years. The qualifications of Mr M from school A suggested he was qualified to teach Mathematics and not Physical science. However, from the exam results by Mr M over the years, it appears he has adjusted and is coping very well with the teaching of physical science. For example, he said his 2012 pass rate was 77% against a 48% when he started. The researcher knew Mr M at personal level

and had also interacted together at various platforms such as science workshops and CAPS training seminars and come from the same home country.

Mr K, physical science teacher at from school B was a male teacher and was married at the time of study. Mr K was born and educated in Nigeria and possess Bachelor's degree in Physical science and had seven years teaching experience five of which were South African and the other two years in his home country. The researcher only met Mr K for the first time when he went to school B to seek permission from the principal to conduct study there. The principal of school B introduced the researcher to Mr K.

Mr N, physical science teacher from school C was a male teacher, married but his wife and children live in Zimbabwe. Mr N was born and educated in Zimbabwe and his highest qualification is M. Ed which he obtained in Zimbabwe. He has been teaching science for 21 years and five of them in South Africa the other 16 years he taught physics only in Zimbabwe. The researcher knew Mr K from teaching together at Secondary School Intervention Programme (SSIP) and also at various workshops on science organised by the district office. Mr N specialised more in physics than chemistry and has worked over the years to improve his weaker subject, chemistry since he is now teaching physical science which is a combination of physics and chemistry.

Mr Y, physical science teacher from school D was also a male teacher, married but living alone since his wife and children are living in Zimbabwe. Mr Y holds several qualifications and his highest qualification is M. Ed which he obtained from one of the universities in Zimbabwe. Mr Y has been teaching physical science in South Africa for six years but has a total of 20 years teaching experience, of which 14 he taught mainly chemistry in Zimbabwe where he was born and educated. Since Mr Y specialised more in chemistry than physics he had to work hard over the years to improve his weaker subject, physics since he is now teaching physical science which embraces chemistry and physics as one. The researcher first met Mr Y in Zimbabwe where they used to mark national examinations together and the two continue to meet at science workshops organised by the district.

All the four participant teachers were male, referred to as Mr M, Mr K, Mr N and Mr Y three of them are from Zimbabwe except Mr K who is from Nigeria. Mr N and Mr Y had several qualifications and had the most experience in teaching unlike Mr M and Mr K who had one qualification each and fewer years of teaching experience as shown in Table 4.

Table 4: Summary of details of the teacher participant

Teacher	School	Qualifications	Years of experience
Mr M	School A	BSc Hon in Applied Mathematics*	5
Mr K	School B	BSc in Physical Science	7
Mr N	School C	Cert. Ed, B.Ed. (Physics), M. Ed (EAPPS)	21
Mr Y	School D	Cert. Ed, B.Ed. (Chem), Post Grad Dip in Sci, M.ED	20

* means a qualification not in line with Physical science

3.6 Actual Data Collection

3.6.1 Gaining Access

It is worth mentioning that in educational research, the question of ethical considerations cannot be ignored because the data is sought from engaging human beings whose rights should be respected at all times as shown by the following extract.

Research comes into the lives of people who are the focus in various ways, taking up their time, involving them in activities they wouldn't otherwise have been involved in, providing researcher with privileged knowledge about them – and therefore, potentially, power over them (Opie, 2004, p. 25)

Permission to conduct this study was sought from the University of The Witwatersrand Ethics Committee and granted (see appendix 13) and permission to conduct the study in government secondary schools was also sought from the Gauteng Department of Education (GDE) by completing a request form and attaching a copy of the research proposal and it was granted – (see appendix 14). To have access to each of the four participating secondary schools, permission was sought from each of the four principals by giving them a letter (see appendix 6) and permission was granted verbally. Fortunately permission from the university ethics committee and GDE came at almost the same time while the principals of the four schools allowed the researcher to collect data anytime which was convenient to the physical science teachers in their respective schools.

Even though the teachers had agreed verbally to participate in the study, information letters were issued requesting each one of them to participate. Information letters were issued to all the participants (*see appendices 1a & 1b*) and these letters described briefly why the study was being carried out, why the person who received the letter was chosen and for them to know the personal and contact details of the person conducting the study. The information letter tends to establish the legitimacy of a survey thereby contributing to a participant's trust (Walonick, 2000). It also builds expectation and reduces the possibility that a potential participant might disregard the survey when it arrives. Thus, each teacher had to complete and sign the consent letter so that a written agreement was available. The learners who were

under the age of 18 years were issued with consent letters be completed by their parents or guardian to participate in the questionnaire (*see appendix 2a*) while those learners above 18 years were given consent letters to sign on their own (*see appendix 2b*). The guardian or parent had to sign the consent letter and return the reply slip to the school before the survey or study was conducted. Both letters highlighted that participants were free to withdraw at any stage of the study and would not be victimised in any way and that confidentiality and anonymity for all the participants. The letters also urged all the participants to complete the questionnaire and assured the participants that the data collected would be kept under lock and key and was to be used for the purposes of the study and conference presentations only.

The researcher was fortunate in that, three of the participant teachers (from schools A, C and D) were from his home country and had met each other several times at science workshops organised by the district office. Therefore coming to collect data at their respective schools was not a threat to any one of them at all. The situation was quite different with teacher from school B whom the researcher met for the first time and fortunately the researcher got his cooperation as far as data collection from the learners (response to the questionnaire and group learners' interview) was concerned. The researcher presented the research agenda which highlighted how the data was going to be collected for the study to each teacher so that the teachers were aware of what the researcher was looking for. However, it was not easy task to collect data since the study was done during the course of the term and at the same time, data collection was not supposed to interfere with teaching time of participant learners in their respective schools. The researcher was also having classes at his school to teach and that meant asking for permission from the principal to leave school, asking another teacher to attend to his classes in his absence.

3.6.2 Questionnaire implementation

At each participating school, the researcher was introduced to the learners by the physical science teacher. Despite the fact that learners were given the information sheet about the study, at each school the researcher gave a brief summary of the study and reasons why the learners were key to the success of the study. The researcher stressed that the questionnaire was not to be treated as a test but a way of establishing how the learners understand the meanings of everyday words when they are used in science context. The questionnaire was administered after lessons during their one hour lunch time, as learners were waiting to participate in their co-curriculum activities such as, soccer, volley ball and netball. This was

done to avoid interfering with the teaching time of the learners. The researcher reminded learners that their participation in the study was voluntary and they were free to withdraw their participation any time they deemed necessary. Only the learners who had indicated willingness to participate in the questionnaire (word test) by completing and returning the consent letters were given the questionnaire to respond to.

Each participant was given a copy of the questionnaire (see appendix 8a) and asked to fill in the code allocated to each one of them by the researcher, language spoken at school and at home as well as gender. The researcher assured all participant learners of confidentiality and anonymity of their identities and that the data collected was solely for the study. The participant learners were urged to read each item carefully and think about the meaning of the underlined word before choosing their answers. They were to indicate their choice by putting a circle on the letter of their choice (A, B, C or D) which they felt represented the nearest meaning of the underlined word on the questionnaire. Once again the participant learners were thanked verbally by the researcher for their willingness to take part in the study.

In all the schools, the physical science laboratory was used as the venue for administering the questionnaire and learners were asked to leave their bags outside the laboratory to ensure that no learner consulted dictionaries. All the participant learners were to sit at least a metre from each other as a precautionary measure to prevent them from sharing ideas and they were to remain silent until the end of the exercise. At school A, C and D the physical science teachers were present and assisted the researcher with handing out of the questionnaire, invigilation and the collection of the questionnaires. However, at school B, the researcher had to do everything alone since the physical science teacher sat at the back of the laboratory and was busy marking books. At the end of the questionnaire, participants were reminded to check if they had responded to all the questions and were thanked for taking their time to complete the questionnaire.

3.6.3 Preparation for the interviews

The time allocated to the researcher was just enough for the learners to respond to the questionnaire and as such the researcher had to mark the questionnaire responses (word test) later. Thus, it was not possible to conduct the group interview on the same day because the time allocated for data collection was just below one hour. Therefore group interviews were only conducted a few days later and this also enabled the researcher to complete the marking and identify the words whose meanings were misunderstood by the learners per school. The

marking was done manually using a red pen and a memo (see appendix 8b). If the meaning of a word was not known by at least 30% of the participant learners, it was considered a problem word. This criterion was arrived at because in South Africa, the pass mark is 30% and most of the words if not all the words are elementary words expected to be known by any grade 12 learner studying physical science. It was these problem words whose meanings were misunderstood by learners which were discussed during the learners' interview.

All the learners from *school A*, *school B*, *school C* and *school D* were coded to avoid using their real names as a way of ensuring confidentiality and anonymity. After the marking exercise the researcher identified words whose meanings were found to be difficult to the learners in each school. This was done by using a grid which had the words used in the questionnaire and highlighting words whose meanings were known by a tick and those which were not known by a cross and this was done for each participant learner. The words which were found to be problematic in all the four schools were: *sensitive*; *trace*; *contract*; *spontaneous*; *retard* and *convention*.

3.6.4 Learner Interviews

After marking the participants' questionnaire responses learners were interviewed as a group to find out why they chose those meanings. The researcher used group interview instead of individual interviews as a way of saving time and he also hoped that learners would feel more comfortable to participate. The interviews were audio recorded with consent from the learners or their parents for learners who were below 18 years of age, the researchers also took some field notes. An interview schedule (*see appendix 7a*) was made and used as a guide with each group of learners and it was subject to change depending on everyday words whose meanings were found to be a challenge to the learners at a particular school. The interview with the learners was meant to establish reasons why they chose certain meanings of words and this information would provide sources of difficulty with meaning of non-technical words are used in science context.

The interview questions were semi-structured and this allowed the researcher to ask a series of structured questions and probe the learners with open-ended questions to obtain additional information from the learners (Borg et al, 2007). For instance one of the questions was,

'In question number ... some of you gave ... as the meaning of this word. How do you think they arrived at this meaning of the word?'

The meaning of a word was regarded as difficult if at least 30% of the learner failed to get the meaning correct as already highlighted in section 3.6.2. In some cases it was not possible to discuss all such words due to time constraints (*see appendix 9a, b, c and d*). The group interviews with learners were meant to help establish whether the choice of the answer was made due to failure in grasping scientific concepts or maybe it was a misunderstanding of the meaning of the words used in science context.

Each group interview was conducted in one of the classes because in the laboratory the tables were fixed and could not allow us to seat in a circle. The learners were asked to sit on chairs in a circle and the two audio recorders were put on a table at the centre to capture whatever was being said during the interview. The researcher asked the learners to raise their hands if they wanted to contribute something as a way of ensuring order and discouraged them from making noise as this would affect the quality of the recordings. The reason for using two audio recorders was to ensure that at least one of them would record in the event that some unforeseen technical fault developed with any one recorder during the recording process.

3.6.5 Teacher Interviews

Another interview schedule (*see appendix 7b*) was prepared for the teachers for their one-on-one interview with the researcher to establish if the teachers are aware of the challenges faced by their learners with the meanings of everyday words when used in science context and this was also audiotaped and again field notes were written down. The major reason for conducting teacher interviews was to seek teacher awareness. The study needed to establish whether science teachers know that science learners encounter difficulties with meanings of everyday words when used in science context and if they do explain meanings of such words when they are teaching. The physical science teachers from each school were asked to complete an interview consent form before they were interviewed separately and audio taped despite the fact that they had agreed to it verbally. An interview schedule was prepared for the teachers (*see appendix 7b*). Questions in the interview schedule included:

‘Some of your learners gave ... as the meaning of this word. How do you think they arrived at this meaning of the word?’

The interview with the teacher was done to get some information on the qualifications of the teacher and years of experience in teaching. The teacher interview also sought to find out if the teachers were aware of the difficulties learners encounter with the meanings of everyday

words in the science classroom and if they took time to explain meanings of words as they are teaching their learners. The participant teachers' view on whether proficiency in the language of instruction (English) lead to better understanding of these meanings was also sought as well as their opinion on how this problem can be overcome.

For Mr M from school A, Mr N from school C and Mr Y from school D, the teacher interviews were conducted in their respective offices just next to their under equipped laboratories. The participant teachers from school A, C and D appeared relaxed and at ease because to them it was just like any other conversation we had had in the past since we interacted with each other on a number of occasions during science workshops. Their accent and pronunciation of words were not a problem to me since we all went through the same educational system in our home country. However, with Mr K from school B who comes from West Africa it was not at ease when the interview started but became relaxed after a while. It was sometimes difficult to hear everything he said because of his accent and he addressed learners as children. I had to rewind the audiotape several times when I was transcribing the interview I had with him and it took me a longer time.

Generally the noise levels did not interfere with the interviews except for Mr Y from school D which is a boys' school who had to go out during the interview to silence some boys who were making noise. The interviews were conducted behind closed doors and both researcher sat on chairs facing each other across the table with the audio recorder at the centre. However, the situation was quite different with Mr K from school B who moved to another school (soon after I administered) where he was offered a permanent post. I was able to track him to his house but had to conduct the interview in the researcher's car. Mr K sat on the passenger's seat whilst the researcher sat on the driver's seat with the audio recorder in between. Mr N from school C had to share his frustration with me when I asked him if he had anything more to share. Mr N said his school principal and his head of department who is a Life science teacher are the ones who select learners for physical science in grade 10 and he has no say in the selection process at all. Despite the fact that this was outside my area of study, I had to sympathise with him and encouraged him to make them see the need to consider his input towards the selection process since he is the only physical science teacher at the school. The teacher was encouraged to do his best with those learners put in his care and even offered them extra lessons, I felt it was my turn to give back to the teacher by offering some suggestions.

The researcher would start the interview by greeting the participant teacher and thanking the teacher for affording the researcher the opportunity to conduct his research using his learners. The participant teacher was asked if he was aware of learner difficulty with meanings of everyday words when used in science context and if they take time to explain meanings of such words. The teacher had to provide suggestions on what can be done to help learners understand the meanings of everyday words in science context better. The researcher-teacher interview was audio recorded and some field notes were also taken during the interview by the researcher.

3.6.6 Exiting the Research Site

The results from the questionnaire were to show whether meanings of non-technical words present difficulties to grade 12 physical science learners from the four participating secondary schools in Johannesburg. On the other hand the group learner interviews per school were meant to find out reasons for choosing certain meanings by the learners.

The challenge came when the researcher had to do the actual data collection. Some learners took a long time to return the consent letters which they took home for their parents to sign and this delayed the commencement of data collection process especially at school D where I had to wait for two weeks. Being a full time teacher, it was not easy to collect data during the school term because of my own classes which I was teaching. My principal allowed me to go and collect data provided I had someone to take care of my classes in my absence. I believe that my principal allowed me to collect data for my study each time I asked because I am always at work most of the time. I also learnt that it's very important to socialise and have respect for other teachers because you never know when you might need their assistance. Each teacher I approached who was free during the time I needed to leave my classes for data collection agreed to take care of my classes. Even teachers from the participating schools were quite helpful in reminding their learners to bring back the signed consent letters and helping me to invigilate the questionnaire during the data collection process.

I also learnt that technology cannot be trusted completely. At school B, I used my two audio recorders during the group interview with the learners but to my surprise some of the information mysteriously went missing. I had to refer to my field notes to cater for that and the responses which I got from school B which were very similar to what I got from the other schools. If I was to repeat the same study next time I would use three or four recorders. I feel

the data collected meet the objectives of the study but, when I reflect on it I always feel that I could have done some of the things differently.

3.7 Data Analysis Procedure Adopted

Data analysis is used in order to consolidate and interpret data generated from the questionnaire and interview. Data from interviews which were audio recorded was transcribed into a format which facilitates analysis. The field notes or hand written notes taken during the interviews were typed for entry into a database or for a manual view and this required a lot of time and resources.

The data was coded according to participant perspectives, relationships, ideas, and context and this depended on the data collected. Therefore, the data management and analysis for this study was carried out using the SPSS statistical package in calculating the mean score values. The Excel spread sheet was used to collate, manage and descriptively analyse the data (Maree & Pietersen, 2010). Descriptive analysis included describing the data, for instance, the percentage of pupils who knew the meaning of a non-technical word in each participant school. Inferential statistics which allowed comparison of the scores (e.g. words whose meanings were found to be problematic in all the four participating schools) was also employed. The presentation of data from the questionnaire and interviews included the use of tables, graphs and frequency counts charts.

The findings from each data source were discussed and analysed using the literature review and theoretical framework. A criterion on word difficulty was applied using the South African policy of 30% as a pass mark in the analysis of the questionnaire. In the learners' and physical science teachers' interviews there were some recurring references which emerged which were mostly due to the questions in the interview schedule which were asked during the interviews. These references enabled the identification of the categories which were used to discuss and analyse the learners' and teachers' interviews.

3.8 Chapter Summary

This chapter highlighted the research design adopted in the study and the data collection methods employed. It gave a brief history of South African schools in general and four participant secondary schools in particular. The sample size used in the study was also indicated and the type of sampling used (convenience sampling) as well as the ethical procedures followed in accessing the research sites were discussed. The actual data collection

has been discussed including challenges faced during the process. The next chapter deals with analysis of data collected by using the two instruments in the study (questionnaire and interviews).

CHAPTER 4

4.0 DATA ANALYSIS AND FINDINGS

4.1 Introduction

In this chapter, findings from each data source are discussed and linked to literature reviewed and the theoretical framework. To begin this chapter I present the words whose meanings were difficult to the grade 12 physical science learners per school based on the criteria for difficulty used in the study. This was done to provide a picture and tell a story on whether South African grade 12 physical science learners also encounter difficulties with meanings of non-technical words when used in science context. Results of the interviews conducted with learners from each school on why they chose certain meanings of the words used in the questionnaire are also presented. Face-to-face interview results with each of the four participant teachers to find out if they were aware of the difficulties learners' encounter with meanings of everyday words when used in science context are also presented. The teachers' opinions on how to overcome these challenges are also discussed.

Tables and graphs have been drawn to represent the questionnaire results and some interpretation is given. To conclude the chapter, I look across the separate analysis of all data sources per participant school and note the overlaps and contradictions presented across them, and comment on how looking across a range of sources can inform both further research and teacher development work on everyday word meanings when used in science context.

This study sought to answer the following research questions as already highlighted in section 1.7:

1. Are there difficulties encountered with everyday words when used in science context by South African grade 12 physical science learners?
2. What are the sources of difficulty of the words?
3. Are the teachers aware of the difficulties learners encounter with the language of teaching and learning when they are teaching them?

First, I revisit and discuss the data analysis strategy used in the study.

4.2 Data Analysis Strategy

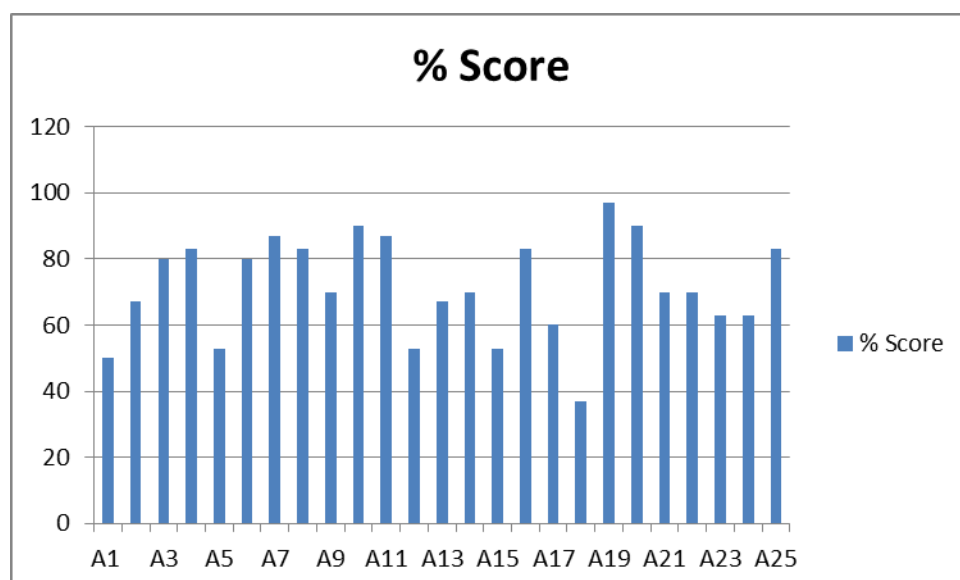
4.2.1 Marking of the questionnaire

In this study, if 30% of the participants (grade 12 learners) at any one participant school didn't know the contextual meaning of the everyday word used in science context, the word was considered to be difficult. In South Africa, 30% is the pass mark in any subject in all grades including matric. Since all the four participating schools were South African schools, I decided to use the same criterion. The other reason why I decided to use this criterion was because all the words used in the questionnaire are everyday words whose meanings any grade 12 is expected to know based on the physical science content covered in grades 10, 11 and 12. Any participant who scored at least 70% was regarded as not having problems with meanings of the everyday words when used in the science context and anything below 70% meant the learner had problems.

4.2.1.1 School A (Sample – 25)

The overall performance by learners from school A is illustrated in Figure 1 (see also appendix 11a) and none of the participant learners scored 100% or knew all the meanings of the non-technical words when used in science context since no bar touched the 100.

Figure 1: School A learners' performance in the questionnaire

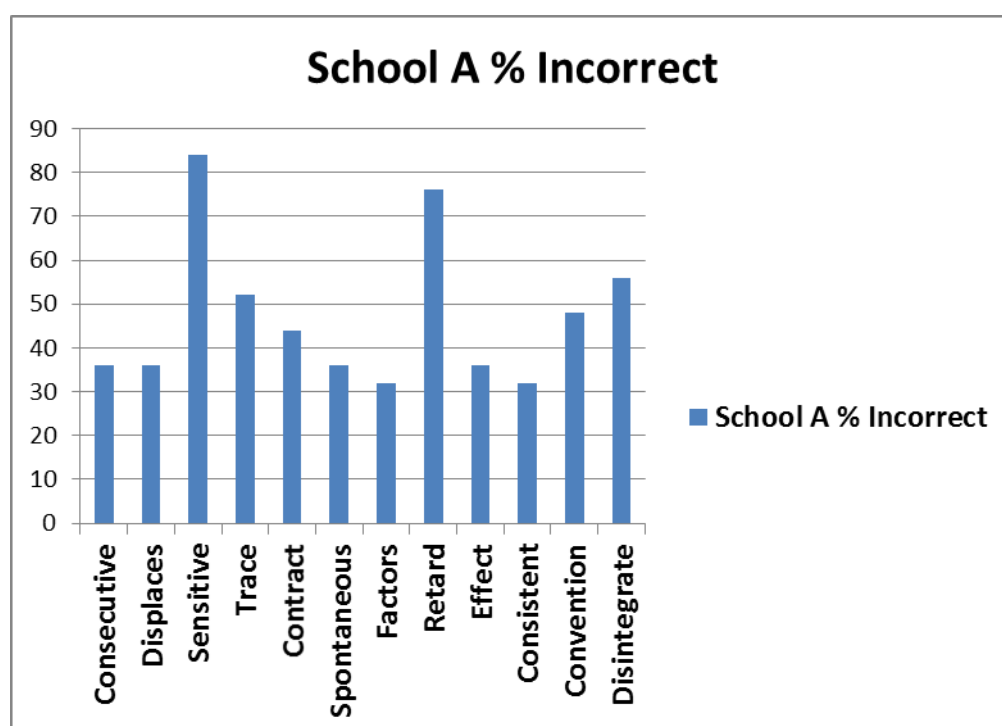


School A mean score was 63.9% (see appendix 11a)

According to the pass mark of at least 70% in the questionnaire used in this study, 56% of the learners got below 70% while 44% scored at least 70% (see figure 1 and appendix 11a). This means that the majority of the learners in school A struggle with understanding meanings of everyday words when used in science context.

In school A there are 12 everyday words that were difficult to the learners according to the criteria used in this study, these words are: *Sensitive* (88%); *Factors* (76%); *Disintegrate* (56%); *Trace* (52%); *Convention* (48%); *Retard* (48%); *Contract* (44%); *Consecutive* (36%); *Displaces* (32%) and *Spontaneous* (36%) - see Figure 2).

Figure 2: Difficult words for Grade 12 learners in School A



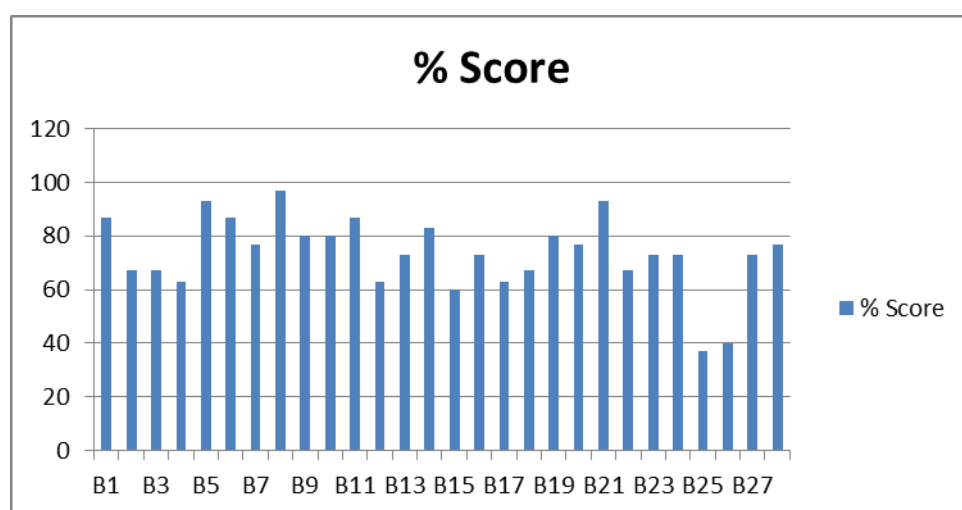
The majority of the learners (88%) didn't know the meaning of the word, 'sensitive' and chose option D, 'gets spoiled easily' as the meaning of sensitive instead of option A, 'can be used to weigh very small things'(see appendices 8a & 9a). The other (8%) chose option B, 'can only be used by sensible people'. The source of difficult encountered by these learners was the look alike of the words, 'sensible' and 'sensitive' as earlier reported (Oyoo, 2011). The meaning of the word 'disintegrate' (see appendix 8a) was misunderstood by 56% of the participant learners from school A with 36% of the choosing option D 'collapse on itself' as the meaning instead of 'break up into small pieces', whilst 12% chose option B 'change colour' as the answer and 8% chose option C 'be seen to glow' as the answer. From the

interview results (see appendix 9a), the reason for choosing the other options like B, C and D was just guess work, the learners did not the meaning.

4.2.1.2 School B (Sample – 28)

Just like in school A, Figure 3 (see also appendix 11b) shows that no participant learner scored 100% or knew the meanings of all the non-technical words when used in science context despite the fact that six of the learners were first language English speakers. This seems to suggest that being first English language speaker is not an advantage in understanding the meanings of everyday words when used in science context as earlier highlighted in literature (Oyoo, 2007).

Figure 3: School B learners’ performance in the questionnaire



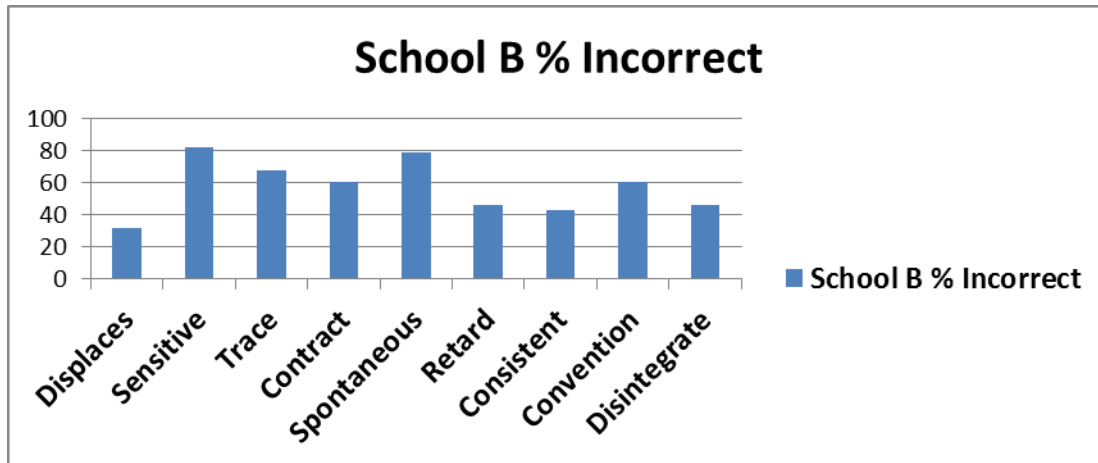
School B mean score was 73.5% (see appendix 11b)

Out of the four schools used in this study, school B had the highest number of learners (64%) who got less than (70%) or who had difficulties with the meanings of everyday words when used in science context in the questionnaire (see Figure 3 and appendix 11b). As earlier reported in section 3.5.1 learners from school B, bunk lessons and engage in drinking alcohol and smoking dagga at school and this could have manifested in their failure to understand meanings of everyday words when used in science context more than participants at other schools.

In school B there were 9 everyday words that proved to be difficult to the participant learners according to the criteria for difficulty used in this study, these words are: *Sensitive* (82%);

Spontaneous (79%); Contract (71%); Trace (68%); Convention (61%); Retard (46%); Disintegrate (46%) Consistent (43%) and Displaces (32%) -see Figure 4.

Figure 4: Difficult words for Grade 12 learners from School B

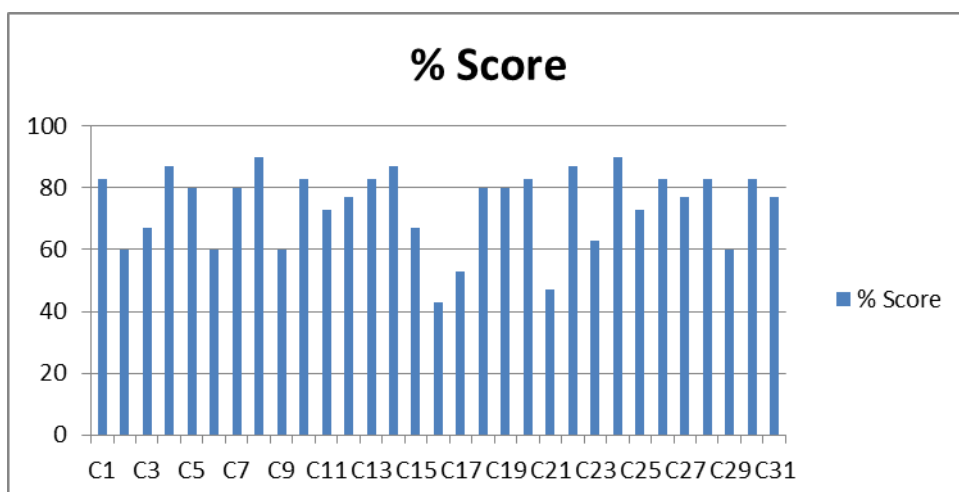


The meaning of the word ‘sensitive’ was not known by 82% learners from school B possibly for the same reasons as highlighted for learners from school A due to lack of exposure to practical work.

4.2.1.3 School C (Sample – 31)

Just like in schools A and B, none of the learners in School C knew the meanings of all the everyday words when used in the science context as reflected in Figure 5 (see also appendix 11c).

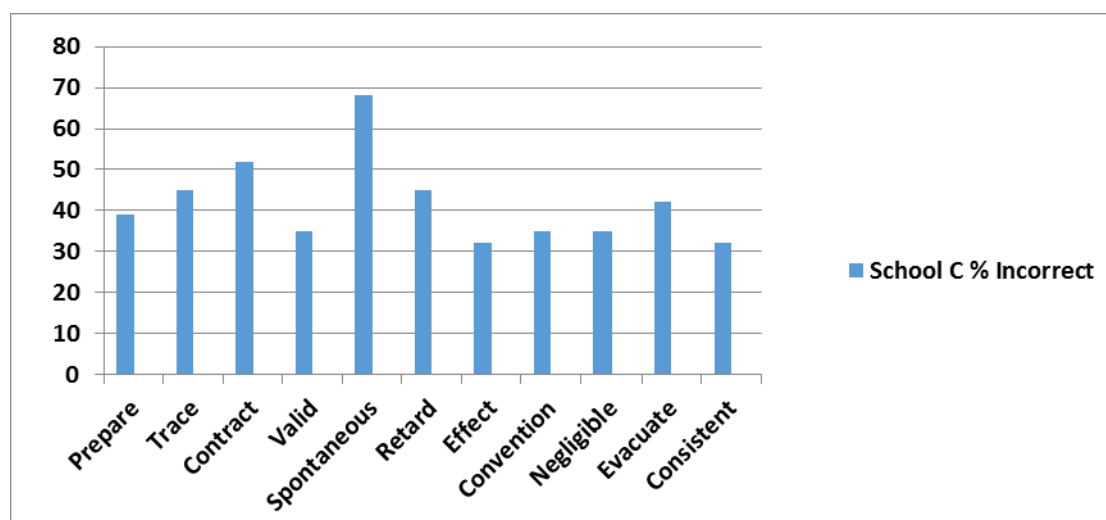
Figure 5: School C learners’ performance in the questionnaire



School C mean score was 74.2%

Unlike in school A and B, school C had more learners – 55% who scored at least 80% in the questionnaire indicating that more learners knew the meanings of these everyday words when used in science context (see Figure 5 and appendix 11c)). Although, the reasons for this difference cannot be verified but, could be due to the calibre of the learners from school C or simply the fact that these learners had met the words used in the questionnaire before in their schooling and knew their meanings in the context of use.

Figure 6: Difficult words for Grade 12 learners from School C



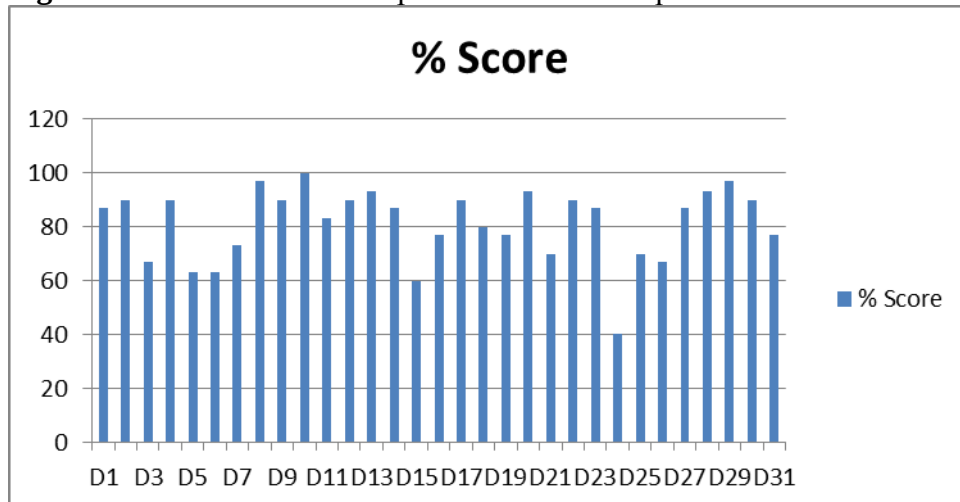
In school C, there were 11 everyday words that presented difficulties to participant learners according to the criteria used in this study, these words are: *Sensitive* (90%); *Spontaneous* (61%); *Contract* (52%); *Retard* (48%); *Evacuate* (42%); *Valid* (39%); *Convention* (35%); *Negligible* (35%); *Prepare* (35%); *Trace* (35%) and *Consistent* (32%) - see Figure 6).

School C had the highest percentage of learners (90%) who did not know the meaning of the word ‘sensitive’ and this can be attributed to lack of practical work in school C where words like ‘sensitive’ are discussed. The majority of these learners chose option D ‘gets spoilt very easily’ as the answer for the same reasons as learners from school A (see appendix 9c). 61% of the learners from school C didn’t know the meaning of word ‘spontaneous’ as used in the questionnaire (see appendix 8a). About 22.6% of the learners chose option A ‘was very quick’ as the answer instead of option B ‘happened by itself’ as the answer. Some learners (19.4%) chose option C ‘once started increased vigorously’ because they thought the word ‘spontaneous’ and ‘vigorously’ go hand in hand.

4.2.1.4. School D (Sample – 31)

School D had the highest number of learners (61%) who knew the meanings of the everyday words when used in science context as reflected by the results (see Figure 7 and appendix 11d).

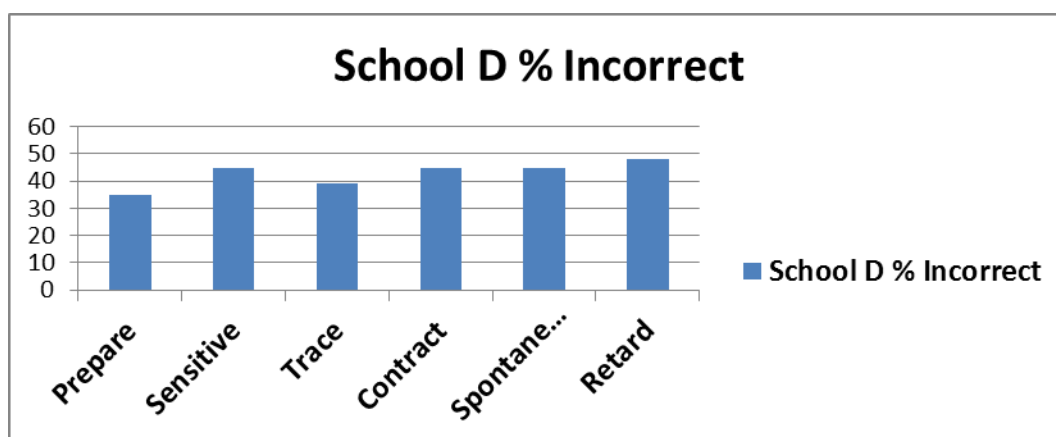
Figure 7: School D learners' performance in the questionnaire



School D mean score was 81.2%

However, unlike the rest of the participant schools, there was one learner from school D who knew the meanings of all the non-technical words when used in science context hence scored 100% in the questionnaire (see Figure 7)

Figure 8: Difficult words for Grade 12 learners from School



School D had 7 everyday words, lowest number in the school sample that fit the criterion of difficulty; these words are: *Retard* (48%); *Contract* (45%); *Sensitive* (45%); *Spontaneous* (45%); *Trace* (42%) and *Prepare* (35%) - see Figure 9.

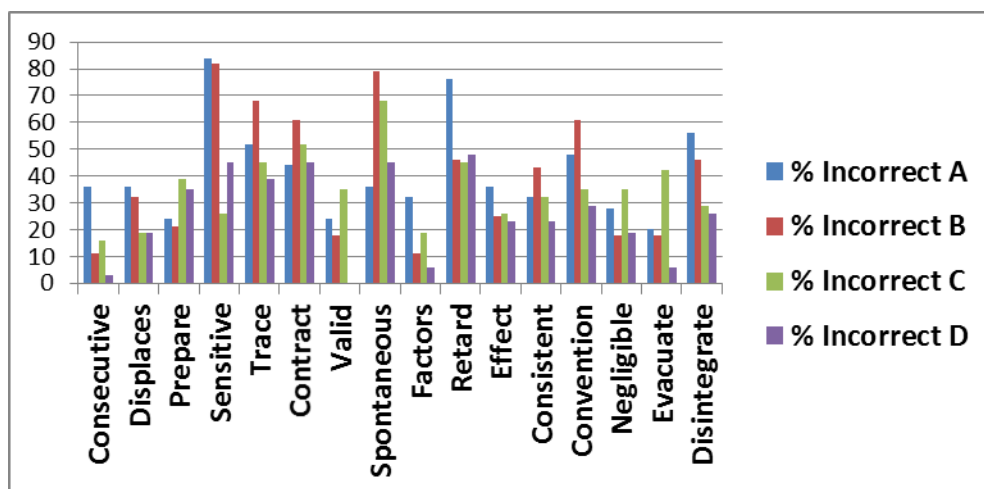
Overall, school D knew the meanings of most of the words and had fewer learners who didn't know the meaning of the everyday words used in science context; all the percentages for incorrect meanings indicated in brackets are all below 50%. However, the percentages of incorrect although lower than other participant schools A, B and C, are still a cause of concern. For instance, the meaning of the word 'retard' was not known by 48% of the learners from school D with 29% of the learners choosing option B 'make the reaction go the other way' as the answer instead of option C 'slow down the reaction'. Despite the fact that these learners use this word on daily basis to refer to someone who is behaving or acting out of the norm (see appendix 9d), the source of difficulty in the meaning of the word 'retard' was the context in which it was used in item 19 (see appendix 8a).

However, the profile of learners from school D could enable an attempt at an explanation to suggest that boys perform better than girls. However, this is contrary to the study conducted in the nine provinces of South Africa by Chetty and Moloi between 2000 and 2007 who found that girls perform better than boys in South Africa (Chetty & Moloi, 2011). Apparently school D, which is a school for boys only had a better understanding of the meanings of the everyday words than all other schools put together that had mixed gender. Maybe these results are a sign that things are changing and hence a separate study would be needed to verify gender based performance in South Africa.

4.2.1.5. Difficult words in the four schools

Out of the 30 everyday words used in the questionnaire, the following seven words emerged the most difficult based on the criteria used in the study: *Sensitive; Spontaneous; Retard; Trace; Contract; Convention and Disintegrate*. However, the meaning of the word 'sensitive' was not understood by most learners from the participant Schools particularly learners from school A – 88% and school B – 82% as shown in Figure 9. The words 'consistent' and 'convention' were more difficult to the learners from school A, B and C only. It is interesting to note that school B had the highest number of learners who did not know the meanings of the words 'trace', 'contract' and 'spontaneous' when used in science context (see figure 9). These results are the symptoms which suggest that learners from School B were different from the rest of the participant schools in the study in that most learners from the school are not well-behaved and some engage in bunking lessons, smoking dagga and drinking alcohol at school according to their teacher, Mr K as alluded to in the sample details in chapter 3.

Figure 9: Difficult words for Grade 12 learners in all the four Schools (A, B, C & D)



These results indicate that learners from school D understood the meanings of the everyday words used in science context better than learners from Schools A, B and C. Since this study was not conducted to compare learners' performance in the questionnaire, the reason for this difference would require a further investigation at another time. The meaning of, 'sensitive' when used in science context was not known by most learners across all the four participating schools. This could have been attributed to the fact that learners in South African schools don't or rarely do experiments so words like, 'sensitive' are not familiar to learners (Makgato & Mji, 2006; Muwanga-Zake, 2001). From my own experience as a science teacher the word sensitive is used in practical work when saying measuring small amounts of current using a galvanometer and masses of small objects.

In this study, grade 12 physical science learners from the four participant schools also encountered difficulties with meanings of the words such as spontaneous just like students from other studies (Gardner in Australia-1972; Farrell & Ventura in United Kingdom -1998; Prophet & Towse in Botswana- 1999 and Oyoo in Kenya and United Kingdom – 2000) as earlier reported in chapter 2. Despite the fact that this study only focused on four secondary schools in Johannesburg with almost all participant learners being second language English speakers, the results from other studies and this study suggest that generally South African learners are also likely to encounter difficulties with meanings of everyday words when used in science context.

4.2.2. Interview results with learners (see appendices – 9a, 9b, 9c and 9d)

In this study, learners from each school who participated in the questionnaire were interviewed and audiotaped as a group and not individually. Group interviews were conducted as opposed to individual interviews due to limited time available and encourage participation was alluded to in chapter 3. Only learners who took part in the questionnaire and had completed and returned the consent forms for the interviews were allowed to participate in the interviews. The main reason for these interviews was to find out the reasons why some learners chose certain meanings of the everyday words used in the questionnaire. These interviews were to provide the researcher with an opportunity to seek clarification and elaboration on the choices of meanings of words made when they responded to the questionnaire. Interview results of common everyday words that presented difficulties to grade 12 physical science learners in the four schools will now be presented and discussed according to the level of difficulty. Also discussed were the meanings of ‘evacuate’ and ‘disintegrate’ were not amongst the difficult words but are also discussed (see figure 9) because of request made by some participant learners from school B as earlier reported in chapter 3 under actual data collection.

Sensitive (item 7)

The word appeared as follows in the questionnaire:

The beam balance is a very sensitive instrument. This means that it

- A. can be used to weigh very small things
- B. can be used only by sensible people
- C. is hard to understand how it works
- D. gets spoilt very easily

Only 24% of all the participant learners knew the meaning of the word *sensitive* (item 7) as presented in the questionnaire. The rest of the learners (76%) did not know its meaning and associated the word *sensitive* with something which is very fragile and hence gets spoilt very easily. When I asked the learners to explain why they associated fragile with *sensitive*, learners from school C responded as highlighted in the following excerpt:

Learner 2: When you think of *sensitive* ... you think of that is to spoil.

Learner 3: Something that is fragile sir ...

R: You think of something that is fragile?

Learners: Y-e-s

R: Okay ... can you elaborate more, if something is fragile what happens?

Learner 2: Breaks easily ...

R: You think of breaking? Laughter

Learner 2: Y-e-s ... yes

Learner 3: Spoilt easily

The learners further argued that if you are a *sensitive* person it means you can easily get angry; you are very fragile so other people should handle you with care because you can easily be spoilt. Incidentally this response was quite similar across the four schools which took part in this study. From the discussions I had with participant teachers as earlier reported, there isn't much practical work going on in participant schools unless if it's prescribed by the department as portfolio work whose marks will contribute to the learner's school based assessment marks (SBA). This means that the participant science learners are not exposed to conducting experiments and words like, 'sensitive' are not familiar to them when used in science context. For instance, if learners were doing practical work they could have met this word when using beam balances in measuring masses or galvanometers when detecting or measuring small currents.

Trace (item 12)

The item appeared in the questionnaire as follows:

The soil contained a trace of potassium. This means it

- A. used to have some potassium
- B. had plants which use potassium
- C. had a very small amount of potassium
- D. had a large amount of potassium

49% of all the grade 12 physical science learners from the four participating schools didn't know the meaning of 'trace' (item 9) when used in science context (see figure 9). The learners gave varied reasons for not knowing the contextual meaning of the word.

Learners from school A said they were confused by the tense of the word, 'contained'. This confusion made them to think that the soil used to have potassium and it's no longer there because it has been used up by the plants hence they chose option A (used to have some potassium).

The excerpt below clearly indicates the learners' line of thinking from school D, but which was common in all the other participating schools A, B and C.

R: ... I want to discuss why someone might choose option A or B there as the answer.

Learner 3: It was once there now it's not there.

R: Okay ... you mean potassium was once there?

Learner 3: Umm ... yes

R: So it disappeared now?

So learners from school A, B and C thought that the word, 'trace' in the question meant that potassium was once there but now it's no longer there because it was taken out and yet the context meaning as used in the questionnaire was that very little potassium was available or present in the soil.

Retard (item 19)

The item appeared in the questionnaire as follows:

The pupil was trying to find a chemical that would retard the reaction. This means the chemical would

- C. speed up the reaction
- D. make the reaction go the other way
- C. slow down the reaction
- D. gives maximum yield from the reaction

The word *retard* was not known to all the participant learners according to the interview results with the learners and yet 54% of the learners didn't know its meaning when used in science context (see figure 9). According to these learners they use the word *retard* almost on a daily basis to refer to people who do not think or act in a normal way. It was against this background that they chose the meaning of retard as to make the reaction go the other way and not slowing down the reaction as was expected.

Spontaneous (item 14)

The item appeared in the questionnaire as follows:

The two chemicals seemed to combine in a spontaneous reaction. This means the reaction

- C. was very quick
- D. happened by itself
- C. once started increased vigorously
- D. was explosive

The meaning of *spontaneous* (item 14) proved to be one of most difficult words to learners across all the four schools used in the study (see figure 9). The learners confessed that she met the word *spontaneous* in physical science when they were being taught redox reactions. However, no follow-up on the context in which the word, 'spontaneous' was used when learners were taught about redox reactions. Another learner said he heard the word in a song

and upon asking him the meaning of spontaneous in the question he said it meant happened differently. Apparently there was no such an answer in all the four options in the questionnaire under that question.

However, according to the grade 11 and 12 physical science work schedule for National Senior Certificate (NCS) which all physical science educators get from the Department of Education, all the learners should have encountered this word either in grade 11 when they did redox reactions or electrochemical cells in grade 12. Unfortunately, I did not ask their teachers whether they had mentioned this word to their learners or it was the learners who missed it.

Contract (item 12)

The item appeared in the questionnaire as follows:

The experiment was designed to prove that the brass rod would contract as the temperature fell. This means the rod would

- A. change colour
- B. become harder
- C. become shorter
- D. become longer

53% of all the participant learners did not know the meaning of, ‘contract’ when used in science context (see figure 9) and they chose option B (becomes harder) instead. Upon asking whether the learners had met this word before I got an interesting response from learners from school C as highlighted by the excerpt below:

Learner 7: Yes sir, I said so ... I watched Fantastic 4 ... so what happened is that they heated the metal to a very high temperature and they quickly cooled it and it became very hard so you don’t expect the metal piece to become smaller but to become harder.

R: Okay ... come again

Learner 7: Sir, when you heat metal sir, to a high temperature and then you quickly cool it, it becomes harder, you can’t expect the metal piece to become smaller.

R: Ok-a-y ... so that was the reasoning behind that.

Learner 7 & others: Ja ... we expected it to become harder.

This confirms that our learners do not come to class as empty slates, they always have something in their minds; always have some ideas of things teachers say to them in the lesson. The experiment was to prove that the brass rod would contract when cooled. Most

learners chose, 'become harder' not 'shorter' as the answer and they based their answer on the movie called Fantastic 4 as illustrated in the excerpt above. The choices made by these learners suggest the context of use of a word does present some difficulties in word meaning. In the movie which these learners watched (Fantastic 4) they saw the hot metal becoming very hard but the learners failed to consider the context of use of the same word as was presented in the question in the questionnaire.

Convention (item 24)

The item appeared in the questionnaire as follows:

By convention, when writing a chemical formula. The symbol of the metal is usually written first. This means that this way of writing

- A. has been accepted as an agreed practice
- B. is a result of chemical formula
- C. was developed as metals were discovered first
- D. has been arrived at but is still not accepted by everybody

The meaning of the word, 'convention' in science context was not known by 43% of the learners (see figure 9). However, the reasons given for choosing other meanings like option B and C instead of the expected meaning-option A, were varied. Some learners from school A chose C (was developed as metals were discovered first) because they thought metals were discovered first. Other learners from school B had this to say when asked why learners chose B (is a result of chemical formula).

Learner 2: I think they just saw chemical formula that's why they chose B.

R: Okay ... they linked that chemical formula in the question.

Learner 2: Ja ... (Laughter)

This means learners have unique ways they use to figure out meanings of everyday words used in science context. It means in one science classroom you have different learners understanding the meaning of the everyday word in many different ways which in most cases would be contrary to the teacher.

The reason for the difficulty was attributed to the context of use of the everyday word which makes the same word to have different meanings. This misunderstanding will obviously result in poor understanding of science concepts and poor learning outcomes.

Evacuate (item 26)

The item appeared in the questionnaire as follows:

Your science teacher said that she was going to evacuate the flask. This means the teacher will

- A. cool it in a vacuum
- B. close the flask
- C. clean the flask
- D. empty the flask

The meaning of the word, 'evacuate' when used in the science context was known by the majority of the learners from all the participant schools particularly school D which had the highest percentage – 90% (see figure 9). However, the following excerpt illustrates that the meaning of the word, 'evacuate' in science context was a challenge to learners:

R: Do you know the meaning of the word evacuate? What is meant by the word evacuate? The understandings of the word evacuate? Yes (pointing at a learner).

Learner 3: Clearing of something?

R: To clear something? Okay, thank you. Any other?

Learner 4: Sir you know? There is a thing, it's always in companies.

R: Ja ...

Learner 4: ... even here at our school when there is fire they say evacuation plan.

R: Ja ... okay

Learner 4: Ja ... I thought of it when it's like getting out so ...

R: What were they doing there?

Learner 4: In the situation like ... where there is fire the way you get out of the building.

R: So you learners will know how to move out?

Learner 4: Ja ... it's called evacuation plan.

R: Okay that's good. So to evacuate is to do what? So what was the answer there?

Learner 4: I chose D (empty the flask).

R: Umm ... D that's good, that was the expected answer, that's correct.

Learner 2: What about C (clean the flask)?

R: What do you mean? Maybe can you justify why you chose C – to clean.

Learner 2: When you clear something, it's like you are cleaning something.

R: Remember there are no wrong answers, we want to see how you understand these words, so that's fine that is his opinion there....

The meaning of the word evacuate posed some debate amongst the learners some saying it means clearing something or to clean something hence they chose C (clean the flask as the answer) instead of the expected answer D (empty the flask).

Disintegrate (item 29)

The item appeared in the questionnaire as follows:

The tube may disintegrate when the reacting gases are released into it. This means the tube may

- A. break up into small pieces
- B. change colour
- C. be seen to glow
- D. collapse on itself

The word *disintegrate* (item 29) presented difficulty to 24% of the participant learners of school D and some of these learners chose D (collapse in on itself) instead of A (break up into small pieces). The meaning of this word did not warrant discussion according to the criteria employed in this study, however I only found myself discussing it with the learners from school B (see appendix 9b). What made me discuss the meaning of the word, ‘disintegrate’ with the participant learners was the fact that I had seen this word being used in other studies, so I wanted to find out the learners’ views on the meaning of the word in my study. According to the learners, the reason behind their choice was that the prefix (*dis-*) on the word *disintegrate* gave them an idea to think about destruction and collapsing. However, on looking on the two words *disintegrate* and *destruction* one can actually see the comparison which these learners had because we have *dis-* (in *disintegrate*) and *des-* (in *destruction*) which are different but rhyming words (sound like) as earlier discussed. This shows that our learners have their own way of interpreting word meaning from how words sound and is a complex process and as such, science teachers should not assume that they always share the same meaning with their learners.

I could have gone on and on to show how learners interpreted the meanings of the everyday words used in the science context as revealed by the results of the questionnaire. However, the bottom line is that the meanings of these words when used in science context are misunderstood by grade 12 physical science learners who participated in the study and hence it is a cause for concern. Further studies would need to be conducted to see if grade 12 learners from other schools in South Africa also encounter the same problems. However, literature has shown that the meanings of non-technical terms when used in science context

present difficulties to learners (Ali & Ismail, 2006; Gardner, 1972; Cassels & Johnstone, 1975-1979; Johnstone & Selepeng, 2001; Oyoo, 2004).

4.3. Teacher Interviews

As already discussed in section 3.6.5, the reason for conducting face-to-face interviews with each teacher was to find out if these participant teachers were aware of the difficulties learners encounter with the language of teaching and learning in terms of understanding the meanings of everyday words when used in science context. Such information would help in understanding issues relevant to the objectives of the study which are specific to the circumstances of each teacher and the context of each school involved in the study. Participant teachers were also asked to share their personal views on learners' understandings of the meanings of these words. Since the participant teachers, by taking part in this study, were made aware of the difficulties learners encounter with meanings of everyday words when used in science context. These teachers were also asked to offer suggestions on ways or strategies which can be employed in schools by science teachers to alleviate this problem in science classrooms. Details of how interviews with participant teachers were conducted have been presented in section 3.5.4. The interview results with participant teachers are now presented in view of their schools A, B, C and D.

4.3.1. Interview with School A physical science teacher - Mr M

Mr M, the physical science teacher at school A had the least number of years of teaching Physical science (5 years see also Table 6) but felt that each year has its own challenges because he meets a new group of learners. As already indicated in section 3.5.2, Mr M seemed better prepared to teach Mathematics not Physical science from his qualification. This was because he wasn't trained to be a Physical science teacher. He found himself teaching physical science after the one who had been at the school left and he was asked to assist; at the time of this study he had done that for five years. Mr M had however done pure physics and pure chemistry at high school up to 'A' Level.

From the interview, Mr M said he was not aware of the challenges physical science learners encounter with the meanings of everyday words when used in science context. As such he does not explain their meanings when teaching his learners; however, he does explain meanings of some technical words or science words such 'work' and 'power' when he introduces such concepts by first building them up from the everyday English meanings and then into meanings in science as shown in the following excerpt.

“... when I am introducing a concept ... such as work, which is used in science I first build it from the English context”

As such this study was actually an eye opener to him especially with regard to how badly some of his learners responded to the questionnaire items. The following excerpt was also from Mr M, the physical science teacher from school A,

“...I got a glimpse of how bad the problem is when I saw the questionnaire ...when I saw a few answers from the learners ... I realised that there is a lot of misconceptions with these words ... you don't know really understand how deep the problem is ... can take it for granted as an educator...”

While Mr M has been disappointed by the way most of his learners performed in his assessment tasks such as tests, it never clicked in his mind that the poor performance by his learners could have been attributed to failure by them to comprehend the meanings of these everyday words. In his entire teaching career, Mr M had been taking it for granted that learners know and understand the meanings of these words and he promised to stop making such assumptions.

Mr M feels that to a certain extent, learners' level of proficiency in the language of instruction might help in understanding the meanings of these everyday words when used in science context. However, he wouldn't blame poor pass marks in science on lack of proficiency in English by the learner because he feels that it's only certain words such as, 'work', 'power' and 'force' as according to the syllabus which could be problematic. On further probing Mr M to give examples of words whose meanings he explains to the learners, I discovered that the words were actually technical words or science words such as, 'work', 'power' and 'force' and not non-technical terms. The excerpt revealed to me that this teacher lacked knowledge of the difference between non-technical terms and technical. This was reflected in the failure by Mr M to differentiate between the words used in the questionnaire such as, 'prepare', 'sensitive' and 'negligible' from words like, 'work' and 'power' as used in the science classroom. It was clear that Mr M's knowledge of distinction between technical and non-technical words was limited. This also revealed to me that Mr M was not aware of the difficulties his grade 12 physical science learners encounter with meanings of everyday words. Therefore, he only explained the meaning of technical words or science words like, 'work' and 'power' and did not explain the meanings of everyday words such as, 'prepare', 'sensitive' when teaching learners.

4.3.2 Interview with School B physical science teacher – Mr K

As already laid out in section 3.4.3 (Table 6), Mr K from school B had taught Physical science for about 7 years in South Africa at the time of this study. On being asked whether he explains the meanings of everyday words to his learners when teaching, the teacher acknowledged that learners get confused with meanings of everyday words especially when they are used in questions and gave the word, ‘*magnitude*’ as one of the problematic word. Mr K said:

“...if the question is requiring the learner to calculate the magnitude and direction of an object, learners get confused looking for the correct formula that they can use for magnitude”

As such Mr K said he advises his learners to find the magnitude of a distance and of the speed. On whether learner’s proficiency in the language of instruction is key to the learner’s understanding of the meanings of everyday words when used in science context, Mr K responded by saying that he believes that when a learner is proficient or fluent in English, it becomes easier for such a learner to understand the meanings of these words because they are using this language in their everyday lives. This view supports that by Johnstone and Selepeng (2001), who found that learners whose home language is English understood the meanings of the words better than learners who are second language English speakers. However, the learners who use vernacular language most of the time are easily confused with words which mean one thing in English context but different thing in science context.

4.3.3 Interview with School C physical science teacher – Mr N

As laid in **Table 7**, Mr N taught Physical science in South Africa for 5 years but had 21 years of teaching experience altogether, the other years were in teaching science in Zimbabwe. Mr N claimed that he explains the meanings of everyday words to his learners when teaching them and gave examples of words like, ‘power’ and ‘work’ as shown in the excerpt below:

R: ... I want to find out if you take time to explain meanings of aah ... everyday words as you are teaching them?

Mr N: Ja ... yes we do and even come up with synonyms, what other words can be used in place of this one.

R: Okay ...

Mr N: Ja ...

R: Ummh ... okay ... ummh ... do you mean you explain everyday words or the scientific terms because there is a difference. What we call technical terms and non-technical terms.

Mr N: We start from everyday meanings when you are looking at 'power', what 'power' would mean eeh ... in the streets and then we get into the scientific or technical meaning of the word.

The teacher seemed not to know the difference between technical and non-technical words. Mr N didn't know the difference between technical words or science words such as, 'work' and 'power' and non-technical words like, 'prepare', 'retard' and 'random'. Mr N's statement that he would discuss with his learners the meaning of the word, 'power' in the streets and 'power' in the science classroom, revealed that he didn't know the difference between technical and non-technical words.

Mr N said, he usually notices this lack of understanding or the meanings of everyday words when he gives his learners questions which require explanations where they fail to do so. From his experience, Mr N has seen learners go in circles when asked to explain certain concepts and they end up losing marks. He also blamed some science teachers who oversimplify some of the scientific terms to an extent that such terms lose the expected thrust which the word should have. To a certain extent Mr N is against explaining word meaning to learners judging from the statement he made above. From the results of the interview and comments made by Mr N, it is clear that he was unaware of the difficulties learners encounter with meanings of everyday words when used in science context and he didn't take time to explain their meanings in the context of use when teaching.

4.3.4 Interview with School D physical science teacher – Mr Y

At the time of this study, Mr Y had taught Physical science for 5 years in South Africa but 20 years teaching experience in total, the other years he was teaching science in Zimbabwe. Mr Y confessed that in his normal teaching, he doesn't explain the meanings of everyday words as reflected by the following excerpt:

R: ... Do you explain the meaning of everyday words when used in science context to your learners?

Mr Y: Jah ... There are certain words which we just take for granted... we assume umm... that learners understand and we are communicating....

According to Mr Y, when he gets an odd answer or he doesn't get a response at all from his learners, he realises he is not being understood or he is not being clear to the learners or they have different meaning altogether of what he is trying to explain. Mr Y said he only explains

meanings of words if the learners ask him for clarification or when he is teaching a topic on ‘work’ or doing calculations involving ‘work’. Only in such situations does Mr Y explain what work means in everyday life or at home and what it means in the science classroom. This demonstrates that Mr Y also does not know the difference between everyday words or non-technical terms and technical terms like work.

Mr Y was not aware that learners face challenges when it comes to the understanding of the meanings of everyday words when used in science context because he never explained the meanings of these words teaching. Mr Y only became aware of it after seeing the questionnaire results of his learners, only then did he realise that science teachers should not take it for granted or assume that learners understand them when they are teaching. This means that this area or topic may not have been discussed during his training, and the same maybe argued for Mr M, N and K.

On whether learner’s proficiency is an advantage in understanding the meanings of everyday words, Mr Y had this to say,

‘... I don’t think it’s about proficiency ... umm ... even if someone is from England, I think it has to do with the culture, language ... eeh ...the learner’s language ... umm ... it being a second language to them ...eeh ... usually it has a different meaning even if the teacher is from England, ... the learners may still understand... in their own way ...’

Mr Y was of the opinion that since learners are always communicating with their peers or their parents at home in their mother tongue obviously is not English, since most of the participant learners were second language English speakers, this had a negative impact on how they understood the meanings of everyday words in science context. As such he suggested that, the learners’ culture and community which they come from this a pivotal role in the way learners interpret meanings of these everyday words when used in science context. This opinion by Mr Y has been supported in this study in the report that most learners interpreted the meaning of the word ‘retard’ based on how they use it on each other and in their community. In this regard, if someone behaved different from the norm they would call such a person a ‘retard’ because he / she thinks in a different way from the norm.

Emerging commonly from the interviews with participant teachers were the following issues: explanation of the meanings of everyday words in science context; teacher awareness of the difficulties learners encounter with meanings of everyday words when used in science context and suggestions in alleviating the problem. A summary of the participant teachers’

responses to the above themes which basically originate from the research questions is now presented:

4.4. Chapter Summary

In this chapter the questionnaire results from the learners and interview results of both the learners and their respective physical science teachers were analysed and discussed. The questionnaire responses by learners showed that South African grade 12 physical science learners also encounter difficulties with meanings of everyday words when used in science context. The face-to-face interviews with participant physical science teachers revealed lack of teacher awareness that learners have problems understanding meanings of everyday words when used in science context; and this is one of the reasons why they don't explain the meanings of these words to their learners when teaching. The other possible reason is because the participant physical science teachers did not know the difference between technical and non-technical words. Chapter 5 will give an overview of the findings in the study based on the objectives of the study and the research questions. Recommendations, limitations of the study and personal reflections of the study by the researcher are provided as well as areas for further study.

CHAPTER 5

5.0 CONCLUSIONS AND WAY FORWARD

5.1 Introduction

This chapter discusses the overview of the findings in the study in line with the objectives and research questions of the study. I present some discussions based on the results from all the participants (four teachers and 115 grade 12 physical science learners) on the difficulties learners encounter with meanings of everyday words when used in science context. I also provide, recommendations, limitations of the study as well as my reflections on this study and the impact it has made on me as a physical science teacher. Also in this chapter, I indicate areas for further study.

This study sought to investigate South African grade 12 learners' meanings of everyday words when used in science context and teachers' awareness. The specific questions whose answers this study aimed to answer were:

1. Are there difficulties encountered with meanings of everyday words when used in science context by South African grade 12 physical science learners?
2. What are the sources of difficulty of the words?
3. Are the teachers aware of the difficulties learners encounter with the language of teaching and learning when they are teaching them?

The results from the questionnaire have shown that South African grade 12 learners' from the four participant secondary schools in this study encounter difficulties in understanding the meanings of the everyday words when used in science context. These difficulties with the meanings of everyday words were found to be independent of gender or the linguistic background of the learner. Sources of difficulty in word meaning included poor vocabulary of the participant learners and confusion between sounds alike and look alike words as earlier reported in section 2.3.1.

All the four participant physical science teachers from the four sample schools were not aware of the fact that their learners encounter problems with the meanings of everyday words when used in science context when they are teaching them. Since these teachers were not aware they never bothered to explain the meanings of these words in their context of use. The interview results also indicated that the four physical science teachers who participated in this

study didn't know the difference between technical words (science words) and non-technical words.

Data were collected via a questionnaire and interviews and were analysed as so far detailed in chapter four. In this chapter, I now present a summary of the findings in the study in the order of the research questions.

5.2 Summary of the Findings in this Study

5.2.1 Are there difficulties encountered with meanings of everyday words when used in science context by South African grade 12 physical science learners?

The questionnaire results have shown that South African grade 12 Physical science learners who participated in this study encountered difficulties in understanding the meanings of some non-technical words such especially, 'spontaneous', 'sensitive' and 'retard' (see appendix 8a). These findings are similar to those found by Cassels and Johnstone, (1975-1979); Gardner (1972); Gilmour and Marshall (1990) in Oyoo, 2004. Linguistic background was therefore not a factor in the level of difficulty these participant learners encountered with the words' meanings.

5.2.2 Types of Difficulties of the Words

The main reason for conducting group interviews with learners and teachers from participant schools was to get more information. From these discussions it was possible to identify three sources of difficulty in the meanings of everyday words when used in science context, as presented in the subsections to follow. In the past studies however, the sources of difficulties with words have been speculations or interpretations of the researchers except in Oyoo (2004).

5.2.2.1 Context

The results from the questionnaire revealed that grade 12 physical science learners from the four participating schools encountered difficulties in understanding the meanings of everyday words when used in science context as earlier reported (see Figure 9). Interview results showed that the word, 'retard' for example was known to most if not all the participant learners since they used this word on daily bases; this however was in a different context to which it was used in the questionnaire (science context) hence learners missed the meaning in the context of use. This means a common context may drive the learners not to suspect a variation in the meaning of that word from the one with which they are not familiar with like

in science context. According to Farrell and Ventura (1998), the context in which the word is used affects its comprehension or understanding.

5.2.2.2 Confusion between sound alike and look alike

A learner from school D associated the prefix (dis-) on the word disintegrate with (des-) in the word destruction and this gave him the idea that disintegrate should have something to do with destruction. Therefore words which look alike or have similar sounds on pronouncing them can create confusion in the minds of the learners resulting in the learners failing to understand meanings of everyday words when used in science context. As earlier reported in section 2.3.1 words which sound alike such as, ‘sensitive’ and ‘sensible’ and ‘spontaneous’ and ‘simultaneous’ (Oyoo, 2004) can be a source of difficulty as reflected by the learner from school D. Such findings where learners get confused with words which sound the same or look alike were also found by Farrell and Ventura in 1998; Oyoo 2004 and Cassels and Johnstone in Oyoo 2011.

5.2.2.3 Vocabulary

One of the participant teachers, Mr M from school A pointed out the issue of poor vocabulary amongst learners as a contributing factor in the learners’ difficulties with the meanings of everyday words when used in science context. Mr M revealed that most learners hardly read novels hence they have limited vocabulary and this might also contribute to their poor understanding of the meanings of everyday words when used in science context. According to Ali and Ismail (2006), learners need to build up their vocabulary and familiarise with the use of the words in different contexts.

5.2.2.3 Teacher non-explanation of word meanings

All the participant teachers in this study were aware of difficulties learners encounter with the meanings of science words (technical words) such as ‘work’ and ‘power’. The teachers in this study do explain the meanings of science words like ‘work’ and ‘power’ to their learners but not non-technical words like ‘consecutive’, ‘prepare’ and ‘retard’. None of these teachers was therefore aware of difficulties learners encounter with meanings of non-technical words when used in science context. It is evident from the interview results of the participant teachers that they did not know the difference between non-technical words and technical words or science words. This is illustrated in the following excerpt:

R: I want to find out if you were aware that sometimes learners have got problems in understanding science because of these everyday words, they fail to understand the meanings of these words and literally end up failing to understand the science we are teaching them. I want to find out if you were aware of that.

Mr M: Umm... to a certain extent I am aware but how bad the problem is, that's where you cannot really measure or say. I got a glimpse of how bad the problem is when I saw your questionnaire.

R: Okay

Mr M: When I saw a few answers that's when I realised that probably there are a lot of misconceptions with these words.

R: Okay...

Mr M: ... you don't know really understand how deep the problem is and how much they understand with some words you can take it for granted as an educator but you realise that these students are not keen on reading or improving their English per say.

R: Okay

Mr M: Some words you expect that they know but you realise that actually they do not know what the word means totally.

Although the results of this study cannot be generalised to South Africa as a whole because only four teachers who also happened to be foreigners participated, these results suggest that there is a possibility that more science teachers are unable to differentiate between technical words and non-technical words as revealed in this study. This finding supports the findings of earlier studies hence the need to educate science teachers in this area.

5.3 Recommendations / Suggestions

The findings of this study 'such as teacher unawareness' suggest that science teachers should be made aware of the difficulties learners encounter with the meanings of everyday words when used in science context. The science teachers should be informed that, it's not only the technical words which need explanation but also non-technical words as the results from this study have shown. Once teachers are made aware of this, and they take time to explain the meanings of these words to the learners it would enhance understanding of scientific concepts and improve learning outcomes.

The district facilitators have to be well informed about the grade 12 physical science learners' difficulties with meanings of everyday words when used in science context so that when they go to schools for monitoring they can make other physical science teachers aware of this. The

district facilitators can also organise information sharing forums or workshops where physical science teachers from schools in the district can meet and made aware of this problem. At such forums teachers should be given opportunity to suggest ways of helping science learners better understand meanings of everyday words in science context.

Since all participant teachers became aware of the difficulties encountered by grade 12 learners with meanings of everyday words when used in science context along the study, they were asked to suggest ways of alleviating the problem.

Mr M suggested that at the beginning of each topic, science teachers should identify everyday words whose meanings they think would be problematic and ask the learners to go and find their general meanings and meanings in science context as homework. This would put the learners in a better position when they come for the lesson; they will have a better understanding of what those words mean. The teacher can also explain the meanings of some of the words when teaching. Since the matric (grade 12) Physical science syllabus is quite long and requires a lot of time to complete, Mr M suggested that it would be better to implement such a strategy in grade 10 and encourage learners to read widely and improve their vocabulary. He was advocating for learner centred approach and encouraged learners to do more on their own before coming to the lesson. Mr M also suggested the need to compile a list of all problematic words whose meanings are a challenge to learners topic by topic and then circulate the list amongst science teachers during science workshops.

On being asked to give suggestions on how the challenge of misunderstanding of everyday words can be overcome or minimised, Mr K stressed the need for scientists to simplify words like ‘magnitude’. He suggested that instead of asking learners to calculate ‘magnitude’ and ‘direction’, learners should just be asked to find distance without using the words like ‘magnitude’ and the ‘direction’ would be easy to tell whether it’s North; South; East or West.

As part of his suggestion to the way forward now that Mr N was aware of the challenges learners encounter with meanings of everyday words when used in science context. Mr N suggested that science teachers should be aware or should have a general view of how English language is taught in the English department and its usage in science related subjects such as Life science and Natural science at lower level and this calls for collaboration with all the teachers involved. This calls for teachers not to assume that learners understand what they are teaching them, hence the need for science teachers to test language usage and meanings of

terms during the science lesson. Mr N felt that at his school, other departments such as English and Mathematics are not complementing science teachers' efforts in this area.

Mr Y from school D did not think that the misunderstanding of the meanings of everyday words when used in science context can be eradicated (see appendix 10d). However, he believes that it can be minimised if science teachers can plan their work ahead of time and identify words of concern which are likely to be misunderstood by the learners before the lesson and deal with them. The suggestion offered by Mr Y was quite similar to the one provided by Mr M from school A. According to Mr Y, the challenge is always the lack of time since teachers are always rushing to complete the long grade 12 physical science syllabus and hence don't go that deep in their lesson preparation. However, Mr Y was adamant that with proper planning on the teachers' side it is possible to implement this strategy of covering the syllabus at the same time explaining the meanings of the everyday words when used in science context. Mr Y suggested that information from studies such as this one should be made available to science teachers to ensure that teachers are aware that learners have problems with meanings of everyday words when used in science context, it will help teachers to keep the situation under control as highlighted in the following excerpt:

Mr Y, I quote, ' ... such kind of research help us teachers to realise that when we are teaching sometimes we are not as effective as we intend to be ... there is a lot of assumptions which we don't research for ahead of time ... once such researches are done it will help us to keep things in order ... '

Mr Y, showed great appreciation of this study and believes that it will help science teachers to become more effective teachers and better communicators of science concepts.

Teachers' unawareness might be attributed to the fact that education of science teachers in Africa has been relying so much on research findings in first world countries like United Kingdom, Australia and United States of America where learners are English first language speakers (Oyoo, 2011). Thus, the focus of most of the research studies as argued by Oyoo (2011), has been mainly on the learners' proficiency in the language of teaching and learning (LoLT). As such physical science teachers are unaware of the difficulties learners encounter with meanings of everyday words when used in science context and they are not taught about this during their training.

I therefore suggest that science teachers during training or at workshops should be informed about the differences between science words and technical words. Teachers should be made

more aware that in addition to explaining the meanings of technical words, they need also to explain the meanings of non-technical words because such words are not well understood by the learners as was reflected by the results from the questionnaire. Physical science teachers are encouraged to ensure that the meaning of non-technical words is shared by both the learners and the teachers themselves. Learners should also be encouraged to explain science concepts in their own words as this would promote shared meaning between the teacher and the learners (Johnstone & Selepeng, 2001).

5.4 Limitations of the Study

The results of the study could not be generalised to because only grade 12 physical science learners and respective teachers from four secondary schools in Johannesburg took part in the study. However, their views are taken into account for the results of this study and generalization would require further research. Participant learners are bound to have their own unique personal qualities, socio-background and language background. There is also a possibility that some of the participant learners lack maturity and are less motivated towards learning. Such difference in the background of participant learners and their personal qualities and the fact that all the four participant teachers were foreigners makes the results of this study not to be generalised to South African teachers. However, it should be noted that similar results have been found with teachers and learners from other countries such as Kenya (Oyoo, 2004), Botswana (Prophet & Towse, 1999), Australia (Gardner, 1972) and United Kingdom (Cassels & Johnstone, 1975-1979) as earlier reported. Such results suggest that it might be the same case with South African teachers and this calls for further study in which a similar only South African science teachers participate.

5.5 Questions for Further Study

- a. Do South African physical science teachers take time to explain the meanings of non-technical words when teaching?
- b. Are the South African physical science teachers aware of the difficulties learners' encounter with meanings of everyday words when used in science context?
- c. Do male South African learners have a better understanding of the meanings of everyday words when used in science context than their female counterparts?

5.6 Reflections

As a result of my implementation of this study, my approach to teaching my learners has changed because I always start a topic by looking at words whose meanings I feel could be problematic to learners be it technical or non-technical and explain their meanings. Only after discussing the meanings of the words with learners will I start teaching the content and I am already seeing the positive results in the learners comprehend science concepts. I also share this knowledge with other physical science I come across and it is my hope that they also do the same since the ultimate goal is to help the science learners attain better results in physical science.

If time permitted, it might have been ideal to take this study to other grade 12 physical science learners in other secondary schools throughout the Republic of South Africa and see the extent to which the meanings of everyday words are misunderstood by these learners. However, due to time constraints and lack of resources it was not possible to do that. Despite these challenges, the results obtained from the four participating schools suggest that grade 12 participant learners from these schools do not understand the meanings of these everyday words when used in science context regardless of their gender and language background. These results agree with what other researchers who conducted similar studies in other countries found (Cassels & Johnstone, 1975-1979; Gardner, 1972; Gilmore & Marshall, 1990 in Oyoo, 2004).

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APPENDIX 1a

Information sheet for learners

Date: 10 July 2013

Dear Learner

My name is Nasimu Semeon and I am an MSc final year student in the School of Education at the University of the Witwatersrand.

I am doing research on :“ *Language of instruction and learning Physical Science in South African Schools: Investigating South African grade 12 physical science learners’ meanings of everyday words when used in the Science context*”

My investigation involves you responding to a questionnaire comprising of 25 multiple choice items and this might require about 30 minutes of your time. After going through your responses I would also want to conduct a group interview to discuss and find out why you chose certain meanings of everyday words and this will be audiotaped with your or your parents’ permission. It is my hope that the interview will not last more than 20 minutes. I would urge you to make the necessary arrangements in terms of your transport back home and food.

I was wondering whether you would mind if you can participate in my research because

I need your help with this study. Remember, this is not a test, it is not for marks and it is voluntary, which means that you don’t have to do it. Also, if you decide halfway through that you prefer to stop, this is completely your choice and will not affect you negatively in any way.

I will not be using your own name but I will make one up so no one can identify you. All information about you will be kept confidential in all my writing about the study. Also, all collected information will be stored safely and destroyed within 3-5 years after I have completed my study.

I look forward to working with you!

Please feel free to contact me if you have any questions.

Nasimu Semeon (Researcher)	072 956 5273	nasimu_semeon@wits.ac.za
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Dr. Samuel, O. Oyoo (Supervisor)	0117173 263	Samuel.Oyoo@wits.ac.za
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Thank you

SIGNATURE

APPENDIX 1 b

Information sheet for teachers

Date: 10 July 2013

Dear.....

My name is Nasimu Semeon and I am an MSc final year student in the School of Education at the University of the Witwatersrand. I am doing research on :“ *Language of instruction and learning Physical Science in South African Schools: Investigating w South African grade 12 physical science learners’ meanings of everyday words when used in the Science context*”

My research involves your learners responding to a questionnaire comprising of 25 multiple choice items and this might require about 30 minutes of their time. After going through questionnaire responses I would also want to conduct a group interview to discuss and find out why they chose certain meanings of everyday words and this will be audiotaped. It is my hope that the interview will not last more than 20 minutes. I would urge your learners to make the necessary arrangements in terms transport back home and food. With your permission, I would also want to have a one-on-one interview with you to find out if you are aware of the challenges faced by your learners with the meanings of everyday words when used in science context when you are teaching them.

The reason why I have chosen your school is because I believe that they can provide me with valuable information for my study, I was wondering whether you would mind if you can allow your learners and yourself to participate in my study. I will conduct the study after school, so that I do not interfere with your teaching time.

Your name and identity will be kept confidential at all times and in all academic writing about the study. Your individual privacy will be maintained in all published and written data resulting from the study. All research data will be destroyed within 3-5 years after completion of the project.

You will not be advantaged or disadvantaged in any way. Your participation is voluntary, so you can withdraw your permission at any time during this project without any penalty. There are no foreseeable risks in participating and you will not be paid for this study. Please let me know if you require any further information.

Nasimu Semeon (Researcher)	072 956 5273	nsemeon@yahoo.com
Dr. Samuel, O. Oyoo (Supervisor)	0117173 263	Samuel.Oyoo@wits.ac.za

Thank you very much for your help.

Yours sincerely,

SIGNATURE

APPENDIX 2 a

Consent letter for Parents / guardian: Questionnaire

Please fill in and return the reply slip below indicating your willingness to allow your child to fill in a questionnaire for my research project called: “ *Language of instruction and learning Physical science in South African schools: Investigating the challenges faced by grade 12 physical science learners with meanings of everyday words when used in science context*”.

Permission for the use of a questionnaire

I, _____ the parent of _____

Give/do not give my consent for my child to fill in a questionnaire.

- ☐ I know that my child may withdraw from the study at any time and that s/he will not be advantaged or disadvantaged in any way.
- ☐ I am aware that the researcher will keep all information confidential in all academic writing.
- ☐ I am aware that my child's questionnaire will be destroyed within 3—5 years after completion of the project and that it will be kept safe until then.
- ☐ I know that my child's identity will not be revealed.

Parent's Signature: _____ Date: _____

Contact persons:

Nasimu Semeon (Researcher)	072 956 5273
Dr. Samuel, O. Oyoo (Supervisor)	0117173 263

APPENDIX 2 b

Consent Letter for Learners: Questionnaire

Please fill in the reply slip below if you agree to fill in a question and answer sheet. I will use this sheet for my study called: : “ *Language of instruction and learning Physical science in South African schools: Investigating the challenges faced by grade 12 physical science learners with meanings of everyday words when used in science context*”.

Permission for questionnaire

My name is: _____

I agree to fill in a question and answer sheet for this study. YES/NO

I know that Mr. N. Semeon will keep my information confidential and safe. YES/NO

I know that I don't have to answer all the questions and can decide to stop the activity at any time. YES/NO

Sign _____ Date _____

Contact person:

Nasimu Semeon (Researcher)	072 956 5273	nasimu.semeon@wits.ac.za
Dr. Samuel, O. Oyoo (Supervisor)	011 7173 263	Samuel.Oyoo@wits.ac.za

APPENDIX 2 c

Letter to the parents / guardians

Marang Centre for Mathematics and Science Education
University of Witwatersrand
Private Bag 3
Wits 2050
Johannesburg
Republic of South Africa.

Dear Parents / Guardians

I am asking for permission to give your
son/daughter:.....

in Grade a short questionnaire in Physical Science for my research project. Your child will be interviewed together with other learners to discuss some of the items on the questionnaire and it will be audio taped. I am a final year MSc. student at the above mentioned university this current year (2013). The research is about “*Language of instruction and learning Physical science in South Africa: Investigating meanings of non-technical words used in the science context*”

The aim of this research is to investigate the language of teaching and learning physical science in the classroom of our country. I want to investigate why the learners find it difficult to understand some scientific terms and concepts used in the science classroom.

Your child has the right to confidentiality and anonymity according to the University’s ethical policy. The name of your child’s school will also not be used in this research. Please note that the study is being conducted for educational purposes and it will not harm your child in any way. I will be grateful if my request is successful.

Please indicate below if you grant me the permission or not by ticking the appropriate space as well as signing and then returning this letter to your child’s school.

Yes:	No:	Signature:
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Contact persons:

Nasimu Semeon (Researcher)	072 956 5273	nsemeon@yahoo.com
Dr. Samuel, O. Oyoo (Supervisor)	011 7173 263	Samuel.Oyoo@wits.ac.za

Yours faithfully

Nasimu Semeon

APPENDIX 3 a

Parent's Consent Letter: Interview

Please fill in and return the reply slips below indicating your willingness to allow your child to be interviewed in my research project called: “ *Language of instruction and learning Physical science in South African schools: Investigating the challenges faced by grade 12 physical science learners with meanings of everyday words when used in science context*”.

Permission to be interviewed

I, _____ the parent of _____

Give/do not give* my consent for my child to be interviewed.

- [] I know that my child may withdraw from the study at any time and that s/he will not be advantaged or disadvantaged in any way.
- [] I am aware that the researcher will keep all information safe and confidential in all academic writing.
- [] I am aware that my child's interview will be destroyed within 3—5 years after completion of the project.

Parent's Signature: _____ Date: _____

Contact persons:

Nasimu Semeon (Researcher)	072 956 5273	nasimu.semeon@wits.ac.za
Dr. Samuel, O. Oyoo (Supervisor)	011 7173 263	Samuel.Oyoo@wits.ac.za

APPENDIX 3 b

Consent Letter for Learner's Interview

Please fill in the reply slip below if you agree to be interviewed. I will use your answers to my questions for my study called: :“ *Language of instruction and learning Physical science in South African schools: Investigating the challenges faced by grade 12 physical science learners with meanings of everyday words when used in science context*”.

Permission for interview

My name is: _____

I would like to be interviewed for this study. YES/NO

I know that ...(YOUR NAME) will keep my information safe and confidential. YES/NO

I know that I can stop the interview at any time and don't have.

to answer all the questions asked. YES/NO

I know that my real name will not be used. YES/NO

I know that the interview notes will be destroyed within 3-5 years after completion of the project. YES/NO

Sign_____ Date_____

Contact persons:

Nasimu Semeon (Researcher)	072 956 5273	nasimu.semeon@wits.ac.za
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Dr. Samuel, O. Oyoo (Supervisor)	011 7173 263	Samuel.Oyoo@wits.ac.za
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Appendix 4a

Learner's consent letter for audiotaping

Please fill in the reply slip below if you agree to have the interview audiotaped. I will use these audiotapes for my study called: *Language of instruction and learning Physical Science in South African Schools: Investigating South African grade 12 physical science learners' meanings of everyday words when used in the Science context*"

Permission to be audiotaped

My name is:

I agree to be audiotaped during the interview. YES/NO

I know that I can stop the audiotaping of the interview at any time. YES/NO

I know that the audiotapes will be used for this project only. YES/NO

I know that the audiotapes will be destroyed within 3-5 years after completion of this study and will be kept safe until then. YES/NO

Sign _____ Date _____

Contact person:

Nasimu Semeon (Researcher)	072 956 5273	nsemeon@yahoo.com
Dr. Samuel, O. Oyoo (Supervisor)	011 7173 263	Samuel.Oyoo@wits.ac.za

APPENDIX 4b

Parent's Consent Letter for Audiotaping

Please complete and return the reply slip below and indicate your willingness to have your child's interview audiotaped for my research project called: *"Language of instruction and learning Physical Science in South African Schools: Investigating South African grade 12 physical science learners' meanings of everyday words when used in the Science context"*

Permission to have my child's interview audiotaped

I, the parent of

give/do not give* my consent to have the interview recorded.

☐ I know that my child may withdraw from the study at any time and that he/she will not be advantaged or disadvantaged in any way.

☐ I know that the tapes will be destroyed within 3-5 years after completion of the project and kept safe until then.

Parent's Signature: _____ Date: _____

Contact persons:

Nasimu Semeon (Researcher)	072 956 5273	nsemeon@yahoo.com
Dr. Samuel, O. Oyoo (Supervisor)	011 7173 263	Samuel.Oyoo@wits.ac.za

APPENDIX 5

Teacher's Consent letter for Audiotaping

Please fill and return the reply slip below and indicate your willingness to have your interview audiotaped for my research project, *“Language of instruction and learning Physical Science in South African Schools: Investigating South African grade 12 physical science learners’ meanings of everyday words when used in the Science context”*

Permission to be audiotaped

My name:

I give/do not give (please delete as appropriate) my consent to have the interview recorded.

- [] I know that I may withdraw from the study at any time and will not be advantaged or disadvantaged in any way.
- [] I know that I can stop the audiotaping of the interview at any time without repercussions.
- [] I know that the tapes will be destroyed within 3-5 years after completion of the project and will be kept safe until then.

Teacher's Signature: _____ Date: _____

Contact persons:

Nasimu Semeon (Researcher)	072 956 5273	nsemeon@yahoo.com
Dr. Samuel, O. Oyoo (Supervisor)	011 7173 263	Samuel.Oyoo@wits.ac.za

APPENDIX 6

Letter to the Principal

Marang Centre for Mathematics and Science Education
University of Witwatersrand
Private Bag 3
Wits 2050
Johannesburg
Republic of South Africa.

13 May 2013

The Principal
Johannesburg
South Africa

Dear Sir/Madam,

RE: PERMISSION TO CONDUCT A RESEARCH EXERCISE IN YOUR SCHOOL

I write this letter to ask for your permission that grade 12 learners at your school take part in the research exercise: “*Language of instruction and learning Physical Science in South African Schools: Investigating the challenges faced by grade 12 physical science learners with meanings of everyday words when used in the Science context*”. I am taking this research study as a project for my Masters of Science education (Physical science) Degree at the University of the Witwatersrand, Johannesburg. I hope to use the results of this study to make suggestions on what is probably a better approach to solving the language problem in various subjects, particularly physical science in South African Schools. I intend to conduct the research as soon as you grant me the permission.

The research instrument is a questionnaire (copy attached), which can be completed in a maximum of 30 minutes and thereafter the learners will be interviewed in small groups on their answers to the questionnaire. The teacher of the learners will also be interviewed to comment on his/her learners’ meanings of words used in the questionnaire. The participation is voluntary. The anonymity and confidentiality of their responses will be ensured. All participants will have the right to withdraw at any time during the study without any penalties. My contact details are as follow: Student No. **509434**; cell **072 9565 273**; e-mail: ***nasimu_semeon@wits.ac.za***)

I would be grateful especially should you allow me to carry out the research at your school.

Yours sincerely,

Nasimu Semeon

APPENDIX 7a

Interview schedule for grade 12 learners

This schedule is for the interview of the learners, after the marking of the items on the questionnaire (word test). However, the questions asked will be dependent on the general performance of the learners on a particular word or a uniquely performed word; the interview questions will be structured to access the learners' opinion on or explanations of these performances on the questionnaire items.

Examples of questions will include:

1. In question number... some of you gave..... as the meaning of this word. How do you think they arrived at this meaning of the word? This question shall be repeated for all the questions which were discussed in the interview. These are:

- ❖ Item ...

- ❖ Item ...

- ❖ Item ...

etc.

- 2 Do you have any other reason why you think certain participants selected
..... As the meaning of this word?

.....
.....
.....
.....

Thank you for your voluntary participation in the interview

APPENDIX 7b

Interview schedule for the teacher

This schedule is for the interview of the teachers after the marking of the items on the questionnaire (word test). The actual interview questions will be designed on the ground during data collection session and the content per teacher will not be necessarily be the same.

These however will be dependent on the general performance of the learners on a particular word or a uniquely performed word; the interview questions will be structured to access the teacher's opinion on or explanations of these performances on the questionnaire items. In addition, teachers' opinions will be sought on how learner knowledge of such words can be enhanced.

Examples of questions will include:

1. Do you remember using the word in your science lesson?
When was it? Which topic were you teaching? Do you think the learners' meaning of this word was the same as yours? Give reasons.

 - ❖ Item ...
 - ❖ Item ...
 - ❖ Item ...
2. Some of your learners gave As the meaning of this word. How do you think they arrived at this meaning of the word?
3. Now that you are aware of these challenges which our physical science learners have, what is do you think should be done to try and help the learners in our science classrooms?

Thank you for your voluntary participation in the interview

APPENDIX 8a: Questionnaire

University of the Witwatersrand, Johannesburg, SOUTH AFRICA

Investigation of Meanings of Everyday Words used in the Science Context Questionnaire

This questionnaire has questions which are to find your ideas about some words used in School Science. **It is not a test**, so you need not worry about your answers as being right or wrong. Your responses will be kept very confidential and anonymous. Please supply all information requested and attempt all the questions. After finishing, please drop your questionnaire in the communal return envelope for immediate sealing.

(a) Name..... (b) Admin.No.

(c) Gender: Female ☐ Male ☐ (Please tick)

(d) Language used most while at:

..... (i) School (ii) Home (after school)

Read each question carefully and think about the word that is underlined. Put a *CIRCLE* round the letter (A, B, C or D) next to the sentence or phrase that you think represents the meaning of the underlined word.

1. The rabbit was weighed at midday on ten consecutive days. This means that it weighed
 - A. on the first and tenth days.
 - B. every tenth day.
 - C. every day for ten days.
 - D. ten times every midday.
2. When the stone is lowered into the beaker, it displaces some of the water. This means it
 - A. reacts with some of the water
 - B. pushes away some of the water
 - C. gets bigger.
 - D. simply falls through the water to the bottom of the beaker.
3. The speed limit for the vehicles was 40km/h. This means that vehicles could travel
 - A. between 45 and 35km/h
 - B. at an average speed of 40km/h
 - C. at not more than 40km/h
4. If you are asked to describe how to prepare oxygen, it means that you are to say
 - A. what substances are needed to make it.
 - B. what it is used for.
 - C. how it is made.
 - D. how it behaves
5. The child is dehydrated. This means it has
 - A. not enough water in its body.
 - B. too much water in its body.
 - C. the right amount of water in its body
 - D. just drank a lot of water.
6. Animals generate heat through respiration. This means they
 - A. lose heat

- B. gain heat
 - C. produce heat
 - D. do not need heat
7. The beam balance is a very sensitive instrument. This means that it
- A. can be used to weigh very small things
 - B. can be used only by sensible people
 - C. is hard to understand how it works
 - D. gets spoilt very easily
8. The gas had a characteristic smell. This means the gas had a
- A. nice smell
 - B. smell unlike any other
 - C. strong smell
 - D. bad smell
9. The soil contained a trace of potassium. This means it
- A. used to have some potassium
 - B. had plants which use potassium
 - C. had a very small amount of potassium
 - D. had a large amount of potassium
10. Some students were studying the fundamental laws of science. This means they were studying the
- A. old laws of science
 - B. most important laws of science
 - C. modern and newly discovered laws of science
 - D. most easily explained laws of science
11. The temperature of the liquid was constant. This means it was
- A. staying the same
 - B. getting colder
 - C. getting hotter
 - D. getting hotter then colder
12. The experiment was designed to prove that the brass rod would contract as the temperature fell. This means the rod would
- A. change colour
 - B. become harder
 - C. become shorter
 - D. become longer
13. The teacher felt that the learners' interpretation of experiment was valid. This means the teacher felt it was
- A. worthless
 - B. not correct
 - C. brief
 - D. sound
14. The two chemicals seemed to combine in a spontaneous reaction. This means the reaction
- E. was very quick
 - F. happened by itself
 - C. once started increased vigorously
 - D. was explosive

15. The outcome of the chemical reaction depended on many factors. This means it depended on
- A. the method
 - B. accomplishments
 - C. the experimenters
 - D. influences
16. Working through many exercises improved the student's concept of chemical bonding. This means the student's
- A. issue improved
 - B. design improved
 - C. idea improved
 - D. method improved
17. The class is studying the diversity of plant life in the school compound. This means they are looking
- A. for new kinds of plants
 - B. at the variety of plants
 - C. at the rate of growth of plants
 - D. for plants they can eat.
18. The car's movement was linear. This means the car
- A. moved in a straight line
 - B. kept stopping and starting
 - C. was dangerous
 - D. swerved from side to side
19. The pupil was trying to find a chemical that would retard the reaction. This means the chemical would
- A. speed up the reaction
 - B. make the reaction go the other way
 - C. slow down the reaction
 - D. gives maximum yield from the reaction.
20. If you were asked to find the effect of adding acid to a metal, this means you would try to find
- A. the reason for adding the acid
 - B. the quantity of acid used
 - C. how long the reaction took
 - D. what happened
21. The results of three experiments were consistent. This means the results were
- A. variable
 - B. the same
 - C. adequate
 - D. adjusted
22. The pupil knows the function of her heart. This means she knows
- A. how the heart is made up
 - B. what is wrong with the heart
 - C. what influences the heart
 - D. what the heart does
23. The students were asked to describe the human digestive system. It means they were asked to describe

- A. what humans eat
 - B. what forms a balanced diet
 - C. the difference between the foods humans eat
 - D. the link between the organs involved in breaking down the food
24. By convention, when writing a chemical formula. The symbol of the metal is usually written first. This means that this way of writing
- A. has been accepted as an agreed practice
 - B. is a result of chemical formula
 - C. was developed as metals were discovered first
 - D. has been arrived at but is still not accepted by everybody
25. After studying the various conditions that may be affecting the quantity of solid produced from the reaction, the pupil concluded that the effect of pressure was negligible. This means that the learner felt that pressure needed to
- A. was the only factor operating
 - B. was most important factor
 - C. needs not to be taken into account
 - D. was the first factor to operate
26. Your science teacher said that she was going to evacuate the flask. This means the teacher will
- A. cool it in a vacuum
 - B. close the flask
 - C. clean the flask
 - D. empty the flask
27. The students were able to estimate the volume of water in the container. This means they
- A. measured the volume carefully
 - B. made a careful guess of the volume
 - C. poured out some water from the container
 - D. filled the container from the tap
28. People are asked to switch off light whenever they leave the room in order to conserve energy. This means people are asked to
- A. avoid risk of fire
 - B. make light brighter on switching on again
 - C. to use energy carefully to make it last
 - D. not to make use of light at all
29. The tube may disintegrate when the reacting gases are released into it. This means the tube may
- A. break up into small pieces
 - B. change colour
 - C. be seen to glow
 - D. collapse on itself
30. The teacher referred to the motion of the solid particles suspended in the water as random. This means that the motion
- A. was very fast
 - B. had no order at all
 - C. was starting and stopping
 - D. occurred every ten seconds.

Participation in Small Group Discussions

Would you be willing to take part in small group discussions of the meanings of the underlined words in this questionnaire?

Please tick one box: **YES** ☐ **NO** ☐

This is the end of the questionnaire. Please check that you have answered every question.

Thank you for taking the time to answer the questionnaire

APPENDIX 8b

Memo for the Questionnaire

Marang Centre for Mathematics and Science Education

School of Education

The University of the Witwatersrand

Question/Item	Word	Expected Answer
1	Consecutive	C
2	Displaces	B
3	Limit	D
4	Prepare	D
5	Dehydrated	A
6	Generate	C
7	Sensitive	A
8	Characteristic	B
9	Trace	C
10	Fundamental	B
11	Constant	A
12	Contract	C
13	Valid	A
14	Spontaneous	B
15	Factors	D
16	Concept	C
17	Diversity	B
18	Linear	A
19	Retard	C
20	Effect	D
21	Consistent	B
22	Function	D
23	System	D
24	Convention	A
25	Negligible	C
26	Evacuate	D
27	Estimate	B
28	Conserve	C
29	Disintegrate	A
30	Random	B

APPENDIX 9a

Interview transcript for learners from school A

R: Aah... okay, I would like to appreciate your patience in this research where we were looking at how everyday words actually are misunderstood by grade 12 learners when they are used in science context. Umm... however, after going through your responses I noticed that some of the common misunderstood everyday words are: sensitive, trace, contract, factors, retard, convention, disintegrate. So I would want us to go through those words. Question number 7 in the questionnaire there reads, 'The beam balance is a very sensitive instrument'. This means that it: A. can be used to weigh very small things; B. can be used only by sensible people; C. is hard to understand how it works; D. gets spoilt very easily. Most people actually chose that it gets spoilt very easily, Umm... but the expected answer was A, that is can be used to weigh very small things. So I would want to know why you think people chose D (it gets spoilt very easily).

Learners: Wow... (Learners made some comments to each other which were difficult to pick).

R: Anyone is free is free to make a comment, I am not saying you are the one who chose that answer but you will answer on behalf of the people who chose it. Tell us why you think they might have chosen that. Gets spoilt easily was very common.

Learners: (Laughter) Ja... Ja...

R: So what do you think ...

Learner 1: Because of eeh...

R: Pardon

Learner 1: Because of eeh... sensitive means you are fragile.

R: Okay, sensitive means you are fragile o-k-a-y.

Learner 1: Yes you are fragile

R: Any other opinion?

Learner 2: I think sir, he (learner 1) has answered it.

R: He has answered it?

Learner 2: Ja

R: O-k-a-y

Learner 2: Because when something is sensitive it is fragile, is spoilt.

R: Angry or spoilt or whatever?

Learner 2: Ja, it depends

R: Yes..., can you elaborate more? Fragile yes I understand.

Learner 2: I think if you say something is sensitive it gets ruined easily.

R: Okay thank you. Ja... alright thank you for that. Aah... let's move on to the next one which is number 9, trace, 'The soil contained a trace of potassium'. This means it: A. used to have some potassium; B. had plants which use potassium; C. had a very small amount of potassium; D. had a large amount of potassium. I am sure you have done Fertiliser industry by now you know those NPK maybe you are still doing that I do not know, nitrogen, phosphorus and potassium they are required by plants.

Learners: Yes...

R: so we are saying the soil contains a trace of potassium this means it: A. used to have some potassium; B. had plants which use potassium; C. had a very small amount of potassium; D. had a large amount of potassium. Umm... most people chose B and A used to have potassium; of course the expected answer as you have said was C (it had a very small amount of potassium) but some people chose B and A ... quite a number... used to have some potassium which means maybe it's no longer there. So I want to discuss why someone might choose A or B there as the answer.

Learners: (Make some noise) ... as they try to figure out justification.

Learner 3: B-e-e

R: Ja... B

Learner 3: No, I mean A used to have some potassium. Like the question says the soil contains, so I guess the participant was confused by tense of contained.

R: Okay, so maybe it was there now it's no longer there?

Learner 3: Yes

R: Ja... any other opinion? Girls... we haven't heard anything from girls. Umm... what do you think? Umm... what do you think? What of B (plants which use potassium).

Learners: (Some coughing)

R: Quite a number of people chose that. Yes... o-k-a-y pointing to the learner who had raised his hand.

Learner 4: I guess... I guess they thought that the soil can't contain any potassium so...

Learners: (Laughter)

R: Okay so the soil cannot contain... okay thank you for that. Umm... the next question was number 12.

Learner 5: Contract

R: Ja... the word contract, 'The experiment was to prove that the brass rod would contract when cooled. This means the rod would: A. change colour; B. become harder; C. become shorter; D. become longer. Umm... and a number of people chose A which says that it changes colour.

Learners: No... No... it can't be

R: Ja...?

Learner 6: Maybe they thought maybe it mixes.

R: It mixes?

Learner 6: Ja because if it changes obviously like you mix things together...

R: What things? Can you elaborate?

Learner 6: In an experiment, it has to do with mixing things and change of colour. (some whispering from other learners).

R: Okay

Learner 6: So they were confused by the word experiment

R: Okay... okay... thank you for that. Umm... I think we are making progress; we are left with 3 more words. Number 19, the word was retard, 'The pupil was trying to find a chemical that would retard the reaction. This means the chemical would: A. speed up the reaction; B. make the reaction go the other way; C. slow down the reaction; D. give maximum yield from the reaction. The expected answer was to slow down the reaction, but quite a number chose B that is make the reaction go the other way. (Laughter and comments from learners which were difficult to pick or hear). I beg your pardon... why do you think someone will choose, make the reaction go the other way? (Laughter).

Learner 2: Because they think retarded people think the other way. (Laughter)

R: Okay... (Coughs) ... the other way alright, okay you normally use this word to describe each other sometimes? You are a retard and things like that (Laughs) ... meaning they think the other way, they are not normal?

Learner 2: Ja ... they are slow minded, abnormal.

R: Okay, it's fine, right umm... and then question 24, the word was convention there, 'By convention, when writing a chemical formula, the symbol of the metal is usually written first. This means that this way of writing: A. has been accepted as an agreed practice; B. is a result of chemical formula; C. was developed as metals were discovered first; D. has been arrived at but is still not accepted by everybody. The expected answer there was A but eeh... quite a number chose B and C.

Learner 3: Maybe they were choosing C because they thought umm... because they thought metals were discovered first.

R: Okay, they thought metals were discovered first? O-k-a-y. Yes another opinion

Learner 1: I think C, one would choose C because I think it's usually when you discover something first, you would like... you sit down and agree and ...

R: Okay

Learner 1: Ja, you like sit down and produce...

R: Okay it makes sense, okay ... okay... the last one, disintegrate, number 29 on the last page number 29, 'The tube may disintegrate when the reacting gases are released into it. This means the tube may: A. break up into small pieces; B. change colour; C. be seen to glow; D, collapse in on itself. The expected answer was that it would break up into small pieces but quite a number chose C and D... I beg your pardon... pardon...

Learner 3: People did not know what the word disintegrate mean. They had no idea of what the word mean.

R: So it's a difficult word? ... What the word mean?... disintegrate, okay... any other opinion? Yes ...

Learner 4: Sir, they didn't know what this word mean

R: Is it?

Learner 4: Yes... it's talking about ...

R: Ja...

Learner 4: They see the word collapse ...

R: Ja ...

Learner 4: Now they see this word collapse on itself ...

R: Ja...

Learner 4: So they just thought it was the answer.

R: Okay thanks for that. O-k-a-y ... thanks you very much for your contribution towards this research. I really appreciate that and wish you good luck in your Prelims (Preliminary examinations).

APPENDIX 9b:

Interview transcript for learners from school B

It was unfortunate that some recordings were not captured despite the back-up which I had. As such some of the information was lost. However, I had some field notes which I made regarding the learners' view on the meanings of some of the words which were not captured.

R: Okay, can we ... shhh! Can we have one meeting? These guys want us to look at number 25 and 26. Sorry ... sorry ... can we go back to the questionnaires. I will read question 25 (researcher reads item 25). The expected answer was C. Okay, but I want to find out what do you understand by the word negligible? Yes ... (pointing at a learner)

Learner 1: Sir, when I answered, I appreciated it from the word neglect.

R: Neglect?

Learner 1: Yes

R: Okay

Learner 1: ... and mmm ... neglecting will be obviously sir, not taking into account.

R: Not taking into account?

Learner 1: That's how I answered it.

R: Okay that's good. Any other opinion? So we have met this word in science or somewhere else?

Learner 1: In science

R: In science? Do you remember exactly how you met it, what were you talking about? Do you remember? Negligible ... yes (pointing at another learner)

Learner 2: In Physics when they say air resistance is negligible.

R: Sometimes you find it when you look at umm ... when you look at Projectile motion where they say air resistance is negligible?

Learners: Yes ... yes ...

R: Right mmm ... let's go back to the question umm ... alright we will move on to question 26 (teacher reads the question).

Learners: D (shouting)

R: Do you know the meaning of the word evacuate? What is meant by the word evacuate?
The understandings of the word evacuate? Yes (pointing at a learner).

Learner 3: Clearing of something?

R: To clear something? Okay, thank you. Any other?

Learner 4: Sir you know? There is thing it's always in companies.

R: Ja ...

Learner 4: ... even here at our school when there is fire they say evaluation plan.

R: Ja ... okay

Learner 4: Ja ... I thought of it when it's like getting out so ...

R: What were they doing there?

Learner 4: In the situation like ... where there is fire the way you get out of the building.

R: So you learners will know how to move out?

Learner 4: Ja ... it's called evacuation plan.

R: Okay that's good. So to evacuate is to do what? To remove? To take out? So what was the answer there?

Learner 4: I chose D (empty the flask).

R: Umm ... D that's good, that was the expected answer, that's correct.

Learner 2: What about C (clean the flask)?

R: What do you mean? Maybe can you justify why you chose C – to clean.

Learner 2: When you clear something, it's like you are cleaning something.

R: Remember there are no wrong answers, we want to see how you understand these words, so that's fine that is his opinion there. Maybe one last word which I forgot is number 14. I am

taking you back again to the second page. The researcher reads the question 14. Let's look at the word spontaneous, have you had it somewhere before?

Learners: Yes ... yes ...

R: Where? Who can tell us? Where you have heard the word and what's your understanding of the meaning of that word? Yes can you speak up (pointing at a learner?)

Learner 5: Yes sir, I heard about it somewhere in Chemistry when they spoke up about spontaneous reaction.

R: Okay, any other opinion? The rest of us have never heard of this word spontaneous?

Learner 6: Me, I think I have heard of it from somewhere else sir ...

R: Ja

Learner 6: I heard about it in a song

R: Okay, how do you understand it now that word?

Learner 6: Happened differently.

R: Happened differently? Okay, any other opinion? Okay let's go back to the question.

Learner 6: Sir, tell us the answer, what was the expected answer?

R: The expected answer there was B (happened by itself), that was the expected answer but the most common answer there was C and D, quite a few chose D.

Learner 4: Sir, just that the word was spontaneous ...

R: Ja

Learner 4: ... it sounds like something extra ordinary so if you did not know it, you will choose C or D

R: So it's failure to understand the meaning of the word. Once again thank you for your participation, I would want to thank every one of you for your participation in this research

APPENDIX 9c:

Interview transcript for learners from school C

R: Umm ... morning everyone

Learners: Morning Sir ...

I would like to thank you for your participation in this research, I know that some of you or most of you who are here actually responded to that questionnaire which I gave you and it made it possible that aah ... I collect that information for the successful of this research. So I would like to thank everyone who participated in that umm ... questionnaire. I am doing my MSc at Wits and umm ... it wasn't going to be possible without your help or your participation in that. So umm ... I went through your responses which you did and aah ... I have got a few questions which I would want us to go through together and see why some of you chose those certain meanings. Remember it was about everyday words and their meanings when they are used in science context. So I want to find out why some of you chose what they chose during the ... in response to the questionnaire so I will give you a copy of the questionnaire so that we can go through the words. I am not going to say who chose incorrect meanings, remember it wasn't a test isn't it? We wanted to see how you guys umm ... interpret or understand those meanings of those words. Right umm ... right umm... I would want us to look at number 4 on the questionnaire; I will read the question Teacher reads the item 4. Quite a number chose A to say the substance it is made of and others chose C (to say how it behaves. So I would want us to discuss someone would choose the substance it is made of that is A as an answer there ... You are free to say whatever you think. Y-e-s (pointing to a learner).

Learners: Whisper to each and difficult to pick what they saying to each other.

R: The expected answer was how it is made that was the expected answer, how it is made, to prepare oxygen that was the expected answer but some people chose A (... substance it is made of), what would is the reasoning behind.

Learner 1: When you say to prepare oxygen, you think of umm... substances that are used to make it.

R: So you think of the reactants?

Learner 1: Yes ...

R: Okay, any other opinion ... umm ... alright let's look at the other option which was very common, which was C (how it behaves). If you are asked to describe how to prepare oxygen it means that you are to say C (how it behaves). What makes someone choose such an option... such an answer? Yes ... pointing to a learner.

Learner 2: No comment. (laughter)

R: Okay ... number 7, this was very umm ... okay ... this one was quite funny actually. Teacher reads the question –item 7 ... D(gets spoilt very easily) that was the most common answer even though the expected answer was A, most of the people chose D as the answer. So I want to hear the reasoning behind choosing D, what was on their mind?

Learner 2: When you think of sensitive ... you think of that is to spoil

Learner 3: something that is fragile sir ...

R: you think of something which is fragile?

Learners: Y-e-s

R: Okay ... can you elaborate more, something is fragile what happens?

Learner 2: Breaks easily ...

R: You think of breaking (Laughter)

Learner 2: Y-e-s ... y-e-s

Learner 3: Spoilt easily ...

R: Spoilt easily ... Okay ... umm ... actually we are anticipating that, A will be the best answer – can be used to weigh very small things, but most of you chose D, I understand the reasoning behind that choice of D, that you are looking at someone who is fragile ...and therefore that person can easily be spoilt.

Learner 4: Sir, I also think that not knowing what a beam balance is, could make us choose D, beam balance, I think the word is confusing.

R: Okay ... some people might not have known what it is? ... Okay thank you. Let's move on to item number 9 which is trace ... umm ... Teacher reads the item 9 to the learners: I am sure you have done the fertiliser industry by now.

Learners: Yes ... sir

R: N: P: K ... Ja some people chose A (used to have some potassium). So I want to hear from you what will be the reasoning behind that, for someone to choose A.

Learners: Ja ... N: P: K

R: Now some people chose A (used to have some K as the answer). Yes, so I want to hear from you what you think would be the reason behind that for someone to choose A.

Learner 5: Some thought there was high potassium at the start now there is a small trace of potassium left behind.

R: So you are saying some potassium were used up by ... by the plants? Ja...?

Learner 5: Y-e-s

R: Okay ... and therefore ...?

Learner 5: small traces are left now

R: Okay any other opinion ...? Ja ... because we can have some different views okay ... there are a few who chose D (that is had a large amount of potassium)

Learner 4: It's trace sir ... so when you talk about large amounts ... someone who chose D sir ... I don't know sir ... (Laughter)

R: Maybe they didn't know the meaning of the word?

Learners: Yes .. Yes ... (some whispering and giggling)

R: Okay, thank you for that, let's move on to item 12 umm ... which is contract. The experiment was to ... Teacher reads the question 12. The expected answer there was to become shorter.

Learners: Yes ... Yes ... to become short

R: But umm ... to my surprise there is quite a number who chose to become harder

Learners: all wanted to respond and it was difficult to hear

Learner 5: By saying contract we mean it gets into smaller size, the fact that they were cooled we take that it was hot and some point it gets colder after some time.

Learner 7: Yes sir, I said so ... I watched fantastic 4 (Laughter) so what happened is that they heated the metal to a very high temperature and they quickly cooled it and it became very hard so you don't expect the metal piece to become smaller but to become harder.

R: Okay ... come again.

Learner 7: Sir, when you heat metal sir, to a high temperature and then you quickly cool it, it becomes harder, you can't expect the metal piece to become smaller.

R: Ok-a-y ... so that was the reasoning behind that.

Learner 7 & others: Ja ... we expected it to be harder.

R: Ok-a-y which movie is that?

Learners: Fantastic 4 ... fantastic 4 ... (some noise and laughter).

R: Thank you for that umm ... shh ... any other contribution on item 12 before we move to the next one. Let's go to the next one number 13. Teacher reads item 13. Umm ... quite a number chose C to say it was very brief and they are some who chose ...

Learners: A ... yes ... A

R: But the expected answer was A (well argued) but there are some who chose C, what would be the reason behind choosing C?

Learner 5: Not knowing what the word valid means.

Learner 3: I disagree ...

Learner 6: Why?

Learner 3: Because it's C, I say valid if ... if you gave a valid explanation it's to the point.

R: It's what? It's brief ... it's to the point?

Learner 3: Yes ...

R: Alright ... any other opinion there?

Learners: No ...

R: It's fine, let's move on to ... item 14 spontaneous. (Teacher reads item 14) ... D(was explosive) that was the most popular one.

Learners: C ... C ... (shouting)

R: Haah ..

Learner 2: C ... I chose C ...

R: You chose C

Learner 2: Yes ... I said C

Learner 8: I chose A

R: Why? Why? Did you choose A?

Learner 8: It fits the sentence ... (Laughter)

R: We want to know the reasoning behind.

Learner 4: The don't know the meaning of spontaneous. Learners speak in Zulu + English difficult to capture the words

R: Umm ... in fact the expected answer was B there, happened by itself.

Learner 2: B sir ...

R: Ja ... that was the expected answer, you don't need an external heat or any other ... for it to react so ... and then some chose C(once started increased vigorously).

Learner 2: Y-e-s

R: can you tell us why you chose C?

Learner 2: I think spontaneous and vigorous go together (Laughter by other learners)

R: okay ... they need each other, so they are always together?

Learner 2: Ja ...

R: Okay ... it's fine we are fine left with about 3 or 4 words umm ... question 19, this was very interesting. B (make the reaction go the other way) was the most popular answer, C ... D The expected answer was slow down the reaction (C) but most people chose B.

Learner 5: We act differently ...

R: Act differently? Shh ... let's give each other a chance to talk ... any other opinion there? (some whispering amongst learners).

Learner 1: You are slow ...

R: You are slow?

Learner 1: Yes

R: There are quite a few who chose the other one ... make the reaction go faster maybe they didn't know the meaning ... then number 21. The teacher reads the item 21.

Learners: D was the answer.

R: That was the expected answer but they are some of you who chose A (variable)

Learner 5: Oh ... they thought of constant variable ... so they thought the words go together.

NB. Confusion between consistent vs constant variable

R: Ok-a-y ... ok-a-y they thought constant means consistent?

Learner 5: Y-e-s

R: Alright ... let's move on to number 25. Teacher reads item 25

Learners: C ... C ...

R: You are correct, that was the expected answer but quite a number chose D so I would want you to tell me why you think they chose D (was the most important factor) ... (some noise).

Learners: Haiyi ... haiyi ... No [haiyi is a Zulu word]

R: Umm ... we are almost there now number 26. Your science teacher said that, the teacher reads item 26.

Learners: D ...

R: You are right but some of us chose B(close the flask) and others chose A (cool it in a vacuum)

Learner 4: C was close ...

R: C was close? Why are you saying that?

Learner 4: When you evacuate sir, you are cleaning out sir...

R: Any other opinion? Any other view ...? Okay thank you for that and then the last one now, 29 umm ... Teacher reads item 29. D was the most popular answer.

Learners: A ... A ...

R: Yes it was the expected answer but I want to know why some people chose D (some noise) ...why do you think some people chose D (collapse in on itself) ... umm ... pardon?

Learner 2: it falls away

R: It falls away?

Learner2: Ja ... collapse into itself

R: Therefore D? Any other opinion, why ...

R: Okay ... Okay ... thank you very much for your participation in this interview, at least I got the reasons why certain people chose certain meanings. I would want to thank everyone who participated and I am sure that this research will go a long way, the idea behind is to try and help you the science learners by ensuring that the teachers do explain the meaning of these words because sometimes we take it for granted that we are sharing the same meaning when in actual fact we are not. Therefore, this causes confusion and misconception amongst the learners so I would want to thank you for your participation in the questionnaire and interview and your input is greatly appreciated.

Learners: You are welcome

APPENDIX 9d:

Interview transcript for learners from school - D

R: Aah ... firstly I would like ... I would want to thank every one of you who participated in the questionnaire as I said before that I am doing my MSc at Wits and ... aah ... it's on the meanings everyday words used in science context, how they are misunderstood by grade 12 learners. So I ... I would want to thank every one of you who did respond to the questionnaire which I administered last time. Umm ... but today I am just here to discuss some of the responses which you wrote in that the questionnaire without pin-pointing fingers to anyone. Umm ... I have got about maybe five ... sorry seven words which we need to discuss today. The first one is number 4 which I am going to read (Cough) – Teacher reads item 4 in the questionnaire. So some of you guys chose umm ... umm...they chose A and others chose C but the expected answer was B

Learners: Umm ... was what ...?

R: I expected you to choose B ... so let's look at A... response A, what do you think can make someone to choose A there in that context? Or maybe you are the one who chose A can you tell us

Learners: (Some noise) ... aiyi... aiyi ... (laughter)

R: I know that you didn't chose A but what makes someone choose ... A or go for A?

Learner 1: So for A, I think when you prepare like you prepare food you explain how

R: okay the substance that it is made of ... okay ... so someone will just say how to prepare the thing?

Learner 1: Ja ... most of the time when you prepare ... (not very clear)

R: Any other opinion?

Learner 2: Umm...

R: Yes ...

Learner 2: I am taking that they used oxygen, someone already think they are talking about substances like elements, things like that.

R: Ok-a-y ... (cough) ... okay thank you for that, umm ... and then there are a few who chose C let's look at C (how it behaves) ... quite a few chose C.

Learners: (Laughter) ... learners make comments which were difficult to capture

R: Eeh ... what do you think about C?

Learner 2: Aiih ... doesn't make sense.

R: Doesn't make sense? O-k-a-y ... it's fine let's go to the next question (item 7) ... I will read the question maybe you can tell me the answer there. Teacher reads item 7

Learners: (Laughter) ... I said A ... I said D

Learner 3: I said A ...

Learner 4: I said D

R: Okay those who chose D can you tell us why you chose D?

Learner 4: Because the underlined word sensitive which means very fragile like any disturbances would disturb the recordings.

R: Ok-a-y that's your opinion. Any other opinion? Yes, umm ... A was the expected answer, but quite a number chose D.

Learner 3: Yes ... I know it (Laughter)

R: Maybe as he is saying that he associated umm ... sensitive to being fragile or can easily get angry or you are very sensitive so ... that's why they ended up choosing D as the answer. Thank you for that. Umm ... maybe let's move on to the next item, which is item number 12 ... aah ... number 9 ... (some noise). Umm ... I suppose you have done fertiliser industry... fertiliser industry where you look at N, P and K as the primary elements, alright it involved potassium this one. R reads the question. What do you think there?

Learners: C ... C ... (shouting)

R: Ja ... C is the expected answer but there are quite a number who chose A (some noise) – used to have potassium.

Learner 3: Ja ...

R: Can you elaborate, how does it make sense to you?

Learner 3: used to have ...

R: Used to have umm ...

Learner 3: Is to contain

R: Can you elaborate more?

Learner 3: It was once there now it's not there

R: Okay ... you mean K was once there?

Learner 3: Umm ... yes

R: So it has disappeared now?

Learners: (Laughter)

R: So it was once there and was used up?

Learner 3: Or taken out (some whispering amongst learners and laughter)

R: Aah ... there are quite a few who also chose umm ... D (had a large amount of K)

Learners: Eish ... no way ... no way

R: (Some noise) ... how do you evaluate that?

Learner 4: They thought it was Life Science

R: Haah ... it was Life Science? (Some noise), what about Life science, what happens in Life science? ... learners talking to each other and difficult to pick up what they are saying.

Learner 4: Those people Sir it was clear that the answer is C

R: so it was clear that the answer is C?

Learner 4 : Ja ...

R: alright, umm ... okay it's fine, thanks for that. Let's move on to item number 12 ... umm ... The teacher reads item 12. What do you think was the answer?

Learner 5: Become shorter

Learner 6 : No become harder ... become harder B

R: But a number of you wrote become harder.

Learner 5: How ?

R: So I want to hear ... (some noise learners talking to each other) ... Guys let's have one meeting shh ... I can't hear what he is saying ... shh ... yes

Learner 5: I think they were thinking of like contract ... what is it?

Learner 7: Construction?

Learner 5: Yes ... construction (Laughter and some whispering)

R: umm ... any other comment on this one ... why should someone choose becomes harder? I am sure they some reasoning... there is a reason behind that ... yes ... (pointing at learner 6)

Learner 6: When I saw this option sir ...

R: Ja ...

Learner 6: I only saw harder because I thought about what can't get shorter in my own ... so I thought harder meant contract in a sense.

R: Okay ... (cough) ... yes (pointing to the other learner)

Learner 7: I think in Life science when a muscle contract it becomes harder

R: Is it? Ok-a-y ... alright thanks for ... your contribution there ... umm ... I am sure another common answer was A (change colour) ... some noise, I am talking about things which did not happen (laughter) it happened. (Laughter and some whispering) ... Pardon? Let's hear ...

Learner 8: When something changes temperature you know ...

R: Umm ...

Learner 8: You think it changes colour ... obvious ... that's why maybe people ...

R: Okay

Learner 8: Ja ... I am not saying that ... he didn't choose A as the answer.

R: Okay ... it's not him ... (Laughter) ... Ya bona

Learner 9: ya bona nabhekile emfetu ... (Zulu)

R: Okay thank you for that ... umm ... then question 14 ... (some noise) ... question 14 ... umm ... I will read: Teacher reads item 14. That was a very common answer referring to D (was explosive) ... some noise from learners.

Learner 2: It's B ...

R: Yes that was the expected answer but there were some of us who wrote ... who chose D ... and others chose A (was very quick) ... umm ... yes, can you explain to us why ...

Learner 3: Because when you use the term spontaneous it means it immediately happened, something immediately happens very quickly ...

R: Okay ...

Learner 2: The response was spontaneous ... (some noise)

R: What of someone who chose ... D ... was explosive ... what was that someone thinking? (some laughter and whispering) ... Okay that's your own opinion ... alright umm ... right. Question 15 ... I think half of the participants wrote the unexpected answer ... (laughter)... let me read it ... Teacher reads item 15

Learner 4: Influences (he shouted) ... is it the correct one?

R: It's not the expected one (Laughter). The expected answer was A the method ... can you justify why you chose influences.

Learner 4: You know when you are doing your research project. Nee, you have what is called variables and now in our understanding is that variables are factors that umm ... affect the outcome ... of the project itself so that's why ... the reaction which is dependent on many factors is the influences.

Learner 3: I saw the method could also umm ... like change the chemical reaction.

R: Because when you are conducting an experiment, the way you are going to conduct the experiment, has got so many variables, the way you are doing to be doing it cooperating those variables which you are talking about so they are included in the method, the method which you are going to follow.

Learner 4: Ooh ... Okay ... (some noise)

R: So it's inclusive of that but, of course influences is another way ... word for ... or is similar to factors.

Learner 4: Ja ... so we thought of ... like ... substituting

R: You just substituted the word?

Learners: Ja ... we just substituted

R: Yes, pointing to a learner

Learner 2: influences and factors like what Thabang (not real name) said is expected to be ... when we say depending on many factors ... many influences.

R: Umm ... many influences ... okay.

Learner 2: Every experiment has many influences ... like ...

R: umm ... right ... thank you for your contribution there umm ... there are some who chose, it dependent on the experimenters (the people who are carrying out the experiment)

Learner 5: I guess certain people who aren't focused like who want to take safety precaution umm ... considering the factors and the experiment will go the other way could have different factors like influences ...

R: Okay ...

Learner 5: Ja ... outcome ... so ...

R: okay, thank you for that let's move on to number 19: Teacher reads the item 19. Which one do you think is correct?

Learners: C ... C ... (shouting the answer)

R: But quite a number chose: make the reaction go the other way. You guys sometimes you use this word retard isn't it?

Learners: Ja ... yes

R: What makes someone choose that one?

Learner 1: I said going the other way.

R: Okay ... what was the reasoning behind that?

Learner 1: Because like ... normally a human functions in a certain way, retarded people function in the opposite way that's I thought, the other way (Laughter).

R: Ok-a-y ... umm ... if you do not operate like a normal person then you are abnormal.

Learners: Umm ...

R: Okay thanks for that ... I think the second last one number 24, convention ... (Researcher reads the question) What do you think is the answer?

Learners: Shout ... A

R: That was the expected answer but some chose B (is a result of chemical formula) some chose C (was developed as metals were discovered first), why do you think they chose B?

Learner 2: I think they just saw chemical formula that's why they chose B.

R: Okay ... they linked that chemical formula in the question?

Learner 2: Ja ... (Laughter)

R: Ok thanks for that, then the last one before you go ... 29 ... the last page, (Researcher reads the question), the expected answer was ...?

Learners: A (shouted)

R: Yes that was the expected answer but some chose D (collapse in on itself ...) I want to hear why ... shh ...

Learner 4: Because the prefix on that word dis... you know the prefix there gives us the idea of dis ... maybe collapsing you think about destruction breaking into small pieces, you think of that.

R: I think I am done, I think everyone who have contributed something towards this discussion and I am sure it will go a long way in this research project so that, umm... other learners in future can benefit from this research, thank you for your time, I know that it was not easy you now stressed by the Prelims which are around the corner, but you managed to give me the time.

APPENDIX 10a:

Interview transcript for school A teacher - Mr M

R = Researcher

R: Umm... afternoon Mr M.

Mr M: Afternoon

R: Firstly I would want to thank you for... umm... allowing me to conduct my research using your learners. I know that all the matric teachers were actually busy trying to finish the syllabus and umm... to get the learners ready for the preparatory examinations which are around the corner, but you managed to sacrifice your time that I come and talk, administer my questionnaire to your students and also conduct my interview with them as well (cough), Umm...

Mr M: It's a pleasure sir.

R: So today I just want to ask you a few questions pertaining the questionnaire which the learners were responding to.

Mr M: Okay

R: Firstly I would want to know how many years you have of teaching experience.

Mr M: Umm... that is five years now.

R: 5 years?

Mr M: Ja...

R: Okay... that's fine. Have you been enjoying the work? (Laughter) teaching...?

Mr M: There you know when you teach science, the thrill of it is always in the challenge of opening up children's mind and appreciating science.

R: Okay

Mr M: So year on year it has its own challenges and that's what keeps me going.

R: Okay

Mr M: I don't think I will come to a point whereby I feel redundant or absolute.

R: Okay, that's good. Umm... my first my first question to you is... you know that the questionnaire was about how everyday words are misunderstood by learners when they are used in science context. Umm... so I want to know as you are teaching your learners do you normally take time to explain the meanings of umm... these everyday words as you use them in the science context as you are teaching them? Ja do you take time to actually explain umm... those words in the way you use them as you are teaching your learners? (Cough).

Mr M: I think some words I... I always refer to basically when I am introducing a concept maybe, I see there is a word that is used in science I first build it from the English context.

R: Okay...

Mr M: It's like I ask them, what does this word mean generally in English, and they tell me and then I now build it to explain that science concept or that...

R: Okay, that's okay... thank you for that. I don't know, I just want to find out, it could be that some of the teachers who teach science might not be... aware that umm... sometimes when you are teaching these learners the-e... when we express ourselves to them they may not take umm... we may not share the same meaning with them. I can say okay this happens like that but the learner might take it in a different way, umm... to have a different meaning and yet I will be assuming that maybe the learners will take it in the way I have really expressed to them. I don't know, I want to find out if you were aware that sometimes learners have got problems in understanding science because of these everyday words, they fail to understand the meanings of these words and literally end up failing to understand the science we are teaching them. I want to find out if you were aware of that.

Mr M: Umm... to a certain extent I am aware but how bad the problem is, that's where you cannot really measure or say. I got a glimpse of how bad the problem is when I saw your questionnaire.

R: Okay

Mr M: When I saw a few answers that's when I realised that probably there is a lot of misconceptions with these words.

R: Okay...

Mr M: So that i-s- Ja that's the problem, you don't know really understand how deep the problem is and how much they understand with some words you can take it for granted as an educator but you realise that these students are not keen on reading or improving their English per say.

R: Okay

Mr M: Some words you expect that they know but you realise that actually they do not know what the word means totally.

R: Okay... so you only realise it maybe later?

Mr M: Yes, you only realise it later when you have an assessment, then you realise it. You do a diagnostic analysis then you see that here the student did not understand the concept but maybe the word.

R: Okay ...

Mr M: ... as it is being used in the question.

R: Okay

Mr M: That is what throws them off.

R: No it's fine. Thank you for that. Umm... I just want to find out in your own opinion, umm... if you think maybe proficiency in the language of instruction which in this case is English that is what we use for teaching. Do you think that proficiency in the language of learning and teaching can actually assist a learner to understand the meanings of these words when they are used in a science context? Just want to find out what you think about it.

Mr M: From the point of view of an educator?

R: Yes from your own opinion. Do you think if someone, if a learner is proficient in English therefore they might or don't have this problem.

Mr M: To a certain extent, yes.

R: Okay...

Mr M: To a certain extent but I really would not blame poor pass marks in science because of lack of proficiency in English because it's only certain terms according to the work schedule that are problematic. So I would not blame it on the language or blame it fully on the proficiency in English.

R: Sorry may you come again?

Mr M: I will not blame it fully on a learner's proficiency in English.

R: Okay...

Mr M: Y-e-s although to a certain extent, yes it contributes.

R: Okay... okay... thanks for that umm... then... umm... I do not know, now that you are aware that our physical science learners are actually challenged by the meanings of these words, which we use umm... when we are teaching science, can you maybe suggest what we can do as science teachers to try and alleviate this problem, so that at least, whenever we are teaching our learners we are sharing the same meanings. The way we want them to understand science is exactly the way they are going to understand.

Mr M: Umm... I think now the onus is on us educators, what we can do is possibly at the beginning of each new topic or chapter, we pick out these words and give the learners as homework just on definitions of these terms.

R: Okay

Mr M: Just on definitions of these terms, they do research based on the chapter such that when they come for lesson they have a picture or they know what these terms mean.

R: Okay

Mr M: Y-e-s or you work on it prior to the lesson then as you teach the words are explained or the terms are explained. I will assume understanding will be better that way.

R: Okay. I don't know, looking at your syllabus challenges because I have heard some other science teachers saying that Umm... the syllabus is quite long. How feasible do you think that will be in terms of syllabus coverage if you are going to... to do that?

Mr M: (Coughs). I think, now if we employ that strategy at an early stage, possibly in grade 10 and encourage learners to study science on their own as CAPS requires or NCS requires, I will not take the lead part, they (learners) will take. I think the work schedule is okay, it's sufficient according to the plans that they have.

R: Okay

Mr M: But for science learning, the work schedule is actually quite a bit much for our learners.

R: Okay

Mr M: Y-e-s but if it was a situation where they (learners) do work prior to the lesson, then you just explain, give an exercise

R: Okay

Mr M: You can move but whether really teaching is taking place and then understanding is another topic altogether.

R: Okay... so it's better for them (learners) to do it outside the teaching time, I mean the learners?

Mr M: Y-e-s

R: Okay

Mr M: Yes, prior to teaching time (softer voice)

R: That's fine, thank you for that. Umm... I do not know whether you have any comment you would want to make, pertaining this study.

Mr M: The issue of language?

R: Umm...

Mr M: Umm... well as you are doing this study my only request is, if possible you... you.. you make some of those terms, I think you have studied them already?

R: Ja

Mr M: Make them available to other educators so that we work on them, I think what I saw from my results, I think other educators in other schools are also... are possibly overlooking those terms.

R: Okay

Mr M: So if you could give them at some workshops, we (teachers) going to lessons being on the lookout of certain words that we assume are understandable to the kids but are not according to your survey.

R: Okay. Ja... we will see how far this study takes us but I think umm... I would want to thank you for your participation and your contribution towards this research, I am sure it will go a long way in helping our learners. It may not benefit the current matrices but I am sure the future matrices might benefit from this study. Aah... so I thank you for your time once again for your patience and input towards this study.

Mr M: You are welcome sir, I think the future learners will really benefit from it.

R: Okay. Thank you, thank you for that

APPENDIX 10b:

Interview transcript for school B teacher – Mr K

R: Umm ... afternoon umm... Mr K

Mr K: Afternoon Sir

R: Firstly I would like to thank you for affording me the opportunity to come to your school and interview your learners about aah ... to administer my questionnaire to your learners on how meanings of everyday words are misunderstood when used in science context. I know that you were very busy with your learners trying to cover your syllabus and preparing them for the prelims, it was not easy for you but you had to sacrifice your time so that I can come.

Mr K: Ja ...

R: However, to just conclude my research I would also want some input from you regarding the questionnaire umm ... which I gave your learners.

Mr X: Okay ...

R: My first question ... there are only a few questions; they are not many about four questions. The first one: I would want to know how long you have been teaching science.

Mr K: I have been teaching Physical science for the past ... 5 years.

R: 5 years? Ok-a-y ... but you might have some experience maybe not in this country maybe from where you come from.

Mr K: Y-e-s

R: Maybe you can also tell me maybe ... the total...

Mr K: Total?

R: Yes, the total years of teaching.

Mr K: Plus or minus 7 years

R: Plus or minus 7 years okay, thank you. Right I just want to know from you if when you are teaching your learners Physical sciences do you ... explain the meanings of those everyday words to them, when you are teaching them.

Mr K: Y-e-s, I do explain

R: Okay

Mr K: ... and the children normally write it down and they use it in everyday life.

R: Okay ... umm ... I don't know umm... thank you for that umm ... Mr K umm ... I don't know where you aware that these ... the meanings of these everyday words are actually

misunderstood by learners when they are used in science context. Where you aware like in my ...

Mr K: Ja ... they do get confused when the ... the ... sentence is being used in science and also umm ... get confused when those words are given in the question for them to answer.

R: Okay ... so you are aware that umm... okay because umm... there is a difference between everyday words and science words like work, power ... we normally use power and work in our everyday conversation, but in science they have got specific meaning ...

Mr K: Ok-a-y

R: But those words like work and power are not everyday words they are science words. By everyday words, I mean words like prepare, consecutive ... all those common words. Where you aware that such words can be problematic for ... to learners in the understanding of science.

Mr K: Yes, umm ... it can also be (laughter) umm ... when it's used, children (learners) normally get confused of these words like umm ... magnitude.

R: Okay

Mr K: ... magnitude and direction.

R: Okay ...

Mr K: If the question is requiring the learner to calculate for the magnitude and direction of an object, children get confused looking for the correct formula that they can use for magnitude.

R: Ok-a-y ...

Mr K: But, I normally explain to them that the correct content would be the magnitude of a distance, the magnitude of the speed, the magnitude of the work done when they are calculating they get confused because the magnitude is being used they ... they don't follow the content words that is ... maybe they get confused of those words.

R: Ok-a-y ...

Mr K: They get confused with magnitude when they calculate it for an object.

R:O-K-a-y ... thank you for that contribution umm ...you find that umm ... here in South Africa we use English as the medium of instruction with our learners when teaching, that's the language of teaching and instruction to most of our learners it is a second language. English umm ... do you think if someone is more proficient in speaking English they will be able to understand science in terms of the meanings of these everyday words, do you think they will be in a better position to understand these words when they are used in science context than some ...

Mr K: Y-e-s, I do believe that if the children are fluent in English the scientific terms becomes easier because eeh ... they normally use these in their everyday life but if they are using their vernacular language when the scientific terms is being used they get confused because those scientific terms normally confuses the learner because sometimes they use it ... as the English language but the explanation on English will give a similar but not the same as being used in science.

R: Ok-a-y ... alright thank you for that umm ... umm ... I don't know in your own opinion because this appears to be a problem or a challenge to us as science teachers ... can you suggest ways which we can adopt as science teachers to try and alleviate this problem because sometimes when we are teaching these learners we assume that, the way we are expressing ourselves to them is the way they will be taking it and sometimes they will be making their own meaning to what we are saying to them.

Mr K: In my opinion I suggest it would be better if some of these words can be changed so that it will be easier for the learners to really understand because I believe the children do know but they get confused when these scientific terms have been used. If there is no way, then umm ... scientists must develop umm ... something that can accommodate these learners that will make it easier for them to ... to study the subject.

R: Okay, can you maybe suggest ... can you suggest ... can you maybe give one example ...

Mr K: One example? ... like where I said about the magnitude ... umm ... magnitude and direction if they can make it a straight forward that is calculate the distance without using the word magnitude, it will be easy for the children to know what they are looking for and the direction will be easy for them to know which angle that the object move to the East or West or to the North or to the South it will be easy for the children to be able to do it. They get confused when those scientific terms are used.

R: O-k-a-y ... thanks you very much for that elaboration. Is there anything you would want to ... share or to comment on ...

Mr K: Oh ... no... no ... I think (laughter) I am okay... I am okay everything is fine, thank you.

R: Okay ... thanks you Mr K ... for your time. I know that you had other things to do but had to sacrifice you time to come and umm ... discuss these issues with me. I know that if it wasn't for your learners and yourself, this research was not going to be possible so I really value your input and your sacrifice and your contribution. Thank you very much and I am sure it will benefit some of the learners in future.

Mr K: Okay ... you are welcome

R: Thank you

APPENDIX 10c:

Interview transcript for school C teacher – Mr N

R: Good morning Mr N

Mr N: Good morning, how are you today?

R: I am okay and you?

Mr N: I am fine.

R: I would like to thank you for providing me with this opportunity, to ... ummh ... administer my questionnaire to your learners. I know that it wasn't easy because you were trying to complete your syllabus and you had to sacrifice your time to actually help me administer and then also to conduct an interview with the learners. I greatly appreciate your help and understanding in this regard but I have got a few questions I would like to ask you pertaining to the questionnaire. I know that you didn't respond to it but ummh ... I just want to find out a few things from you as a teacher, ummh ... when you are teaching your learners I want to find out if you take time to explain meanings of aah ... everyday words as you are teaching them?

Mr N: Ja ... yes we do and even come up with synonyms, what other words can be used in place of this one.

R: Okay ...

Mr N: Ja ...

R: Ummh ... okay ... ummh ... do you mean you explain everyday words or the scientific terms because there is a difference. What we call technical terms and non-technical terms.

Mr N: We start from everyday meanings when you are looking at power, what power would mean eeh ... in the streets and then we get into the scientific or technical meaning of the word. The teacher did not know the difference between technical and non-technical words

R: Okay ... thank you for that ummh ... then my second question is are you aware that aah ... of the difficulties that learners encounter with language of teaching and learning when you are teaching them because most of our learners are second language English speakers and we use English as a medium of instruction in schools.

Mr N: Ja ... we ... we pick that one up we are aware because, where the learners are required to explain they meet a lot of challenges, they can't explain. Their level of proficiency in English is sometimes very alarming.

R: Okay ... ummh ... so in other words you are aware of the problem?

Mr N: Ja ... Ja ... we are aware of the problem and we try our best, but sometimes when you over generalise or over simplify some of these eeh... scientific terms you lose the thrust, the

actually expected thrust. It's not uncommon when you ask a learner to explain what is this ...? They usually respond by saying, 'The what- what that you said in the last ... eeh... lesson'. They are these so limited some of them.

R: Okay ... okay ... thank you for that, umm ... in your own opinion do you think proficiency in the language of instruction can actually help learners to understand these meanings better?

Mr N: Ja ... Ja ... it would help a lot because one major problem that they have is that they turned to waffle a lot.

R: okay

Mr N : They tend to waffle a lot if they had the right terms they would say it in a few words.

R: okay ... alright thank you for that and then the last ... my last question is umm ... in your own opinion ... umm ... can you suggest maybe ways which science teachers can actually adopt as a way of actually trying to alleviate this problem of language because sometimes when we are teaching these learners, we don't share the same meaning ... the way I express myself thinking that my learners are going to understand it, sometimes it's not like that. So with that back ground can you suggest umm ... ways which you think might be helpful to the science teachers to try and overcome those challenges.

Mr N: I think ... umm... first thing is to have a general view of how then English language is taught in the first place.

R: Ok-a-y

Mr N: Because we assume that ... umm ... that umm... part of language is being dealt with in another department.

R: O-k-a-y

Mr N: ... and umm ... also see how ... science related subjects are also being taught like the language usage in this eeh ... I am talking here about Life sciences, Natural science at lower level.

R: Okay.

Mr N: Apart from that I think aah ... it might be helpful to kind of test this language usage.

R: Can you elaborate.

Mr N: Meaning of terms

R: Okay

Mr N: As a way of preparing learners might be helpful

R: At what level do you think this can be applied?

Mr N: (Laughs) ... at all levels because we teach ... on the assumption that they know all these terms.

R: Okay... (Pause) ... alright I don't know if you have got anything else you want to share ... maybe how long you have been teaching? I might need to know.

Mr N: 5 years here.

R: 5 years here I mean in your ...

Mr N: 21 years

R: Thank you. Anything you would want to share?

Mr N: It's really a big problem ... umm ... the other areas are not complementing our efforts like English and Maths.

R: Ok-a-y

Mr N: I think in my case it's a situation where I am not given an opportunity to screen the learners you get stuck with learners who cannot do Physical science.

R: So they are just imposed on you, you don't select?

Mr N: Aah ... we don't.

R: Okay don't you say if someone fails Maths then they don't do science?

Mr N: We do it like that but I am not involved in the process.

R: Mr N, I would like to thank you for your contribution. I am sure that whatever, you have shared with me is going a long way to try and address these issues which are befalling our science. The idea behind is we are trying to umm... look at how everyday words affect the understanding of science and try and help our future kids obviously these current matrices might not benefit from this.

Mr N: You are welcome.

APPENDIX 10d:

Interview transcript for school D teacher – Mr Y

R: Afternoon ... Mr... afternoon Mr Y

Mr Y: Good afternoon

R: Firstly, I would like to thank you for helping me out ... to use your learners in my research. I know that you were busy trying to finish your syllabus before the Prelims, but you had to sacrifice your time ... your teaching time so that I could administer my questionnaire to them and also conduct the interview. I greatly appreciate your assistance in that regard. However, from ummh... what I have gathered from the learners, ummh... I would like to discuss a few things with you regarding the misunderstanding of everyday words when they are used in science context but, before we go into that I would like to know how many years you have been teaching.... your teaching experience.

Mr Y: Ja... almost 20 years now ... (laughter)

R: 20 years, ok-a-y and in this country (in South Africa) ?

Mr Y: 5 years

R: 5 years?

Mr Y: Y-e-s

R: Okay thank you for that ... so that's a lot of experience ... Hee... 20 years is a lifetime (laughter)

Mr Y: Ja ... (laughter)

R: okay ... thank you ... thank you for that. Ummh ... I just want to ask you about 4 or 5 questions. The first one is, 'Do you explain, when teaching your learners, do you explain ummh ... the meaning of everyday words as they are used in a science context?

Mr Y: Ummh ... (Noise from learners outside- the teacher had to go outside his office to silence the learners, hence the researcher had to repeat the question again).

R: I will repeat the question again, 'Do you explain the meaning of everyday words when used in science context to your learners?

Mr Y: Ummh ... in real life situation when we are teaching, normally ... we don't go that far. There are certain words which we just take for granted, ummh... we just assume ... ummh ... learners understand and we are communicating. Umm maybe it's only when you get odd answer or ... you don't get any response at all that's when you realise that Ummh ... either you are not being understood or you are not being clear to them (learners) or they have ummh ... different meaning altogether with what you are trying to explain, so ... in real life we don't, we don't

R: Okay thank you, so sometimes time is the limiting factor?

Mr Y: Ja...

R: You just assume that it's straight forward and ...

Mr Y Ja ...

R: That's okay

Mr Y: Unless, ummh... they ask you a question like... I want to emphasise something like aah ... the topic which is work you know, when we are doing work aah ... calculation on work... right, aah... That's a typical example about when I have to explain what we mean by work at home and work in the classroom and so forth, but aah... under normal circumstances we just take things for granted and that's why learners don't ... they don't understand us maybe ...

R: Okay thanks for that. So are you aware that ... of the difficulties that learners encounter with the meanings of these everyday words, where you aware that sometimes when these everyday words are used in science context they can be misunderstood by the learners such that they fail to understand whatever you are trying to communicate to them, where you aware of that?

Mr Y: You ... see ... you ... see we don't go that far sometimes we just assume they are understanding us but, ummh ... when you do that research that's when we can discover and from the discussion which you were doing yesterday with learners that's when I realise that eeh... these things which we assume are ... not supposed to be assumed.

R: O-k-a-y it's fine, thank you for that ummh... I don't know, in your own opinion do you think that proficiency in the language of instruction which in this case is English, if someone is proficient in English, do you think it will help them to easily understand some of these words when they are used in science context?

Mr Y: Ummh ... I don't think it's proficiency ... ummh ... even if someone from England, I think it has to do with the culture, language... eeh... the learner's language ... ummh ... it being a second language to them eeh... usually it has different meaning even if the teacher is ... from England, ummh ... the learners may still understand certain words in their own culture, in their own way of doing things. So ... it's not strictly because of proficiency as such ...

R: Okay ...

Mr Y: The way I see it ... because remember ... eeh ... these learners are always communicating to themselves to ... to their friends, to their parents at home ... eeh ... they interpret things differently, they have got different perceptions. So it has to do with their culture, it has to do with ummh ... Ja the language and particularly ... ummh ... people living in a certain group or ethics have their own perceptions of seeing things.

R: Okay it's fine. Thank you very much for your elaborations on that. I don't know that you are aware can you suggest ways that other science teachers can actually do or what we science teachers can actually do to try and alleviate ummh ... this problem because sometimes we think we are sharing the same meaning with the learners when we are actually not. As you have seen sometimes you assume that they know what you mean and yet they interpret that information wrongly. So I am saying in your own opinion, can you suggest what science teachers can do ... and ... to try and help learners overcome this challenge.

Mr Y: ummh ... as a way of minimising but ... I don't think maybe it could be eradicated totally but I think we can minimise that, if we plan our work, if we plan our work ahead of time and do research on concepts which you want to cover ... ummh... ummh... we look at maybe their prior knowledge what they know or understand about certain concepts and then aah ... we ... we can ... it helps us to plan now. Ummh ... what are the misunderstandings? What are the misconceptions? And what they think or what they know ... ummh ... before you actually teach them, that helps but now because of lack of time ... lack of ... we also racing with the curriculum, the syllabus and so forth, we ... we ... don't go that deep to to ... to do enough ... such findings or such preparations, but I think aah ... given aah ... enough ... preparation we should be able to identify such problems before we actually aah ... teach the lessons or teach certain concepts.

R: Okay ...

Mr Y: Ja ...

R: Okay ... ummh ... we need to plan our work ahead and then try and find out areas of concern.

Mr Y: Ja...

R: Before we actually teach the learners?

Mr Y: Umm ...

R: I think that will contribute ... that will actually help but as you are saying that time is always the challenge, the syllabus is long and it's difficult to move on at the same time.

Mr Y: Ja ... Ja it's true.

R: Okay, thank you for that ... and then I don't know if you have any other suggestion(s), any other comment you would want to make regarding this ...

Mr Y: I don't have much but maybe just to ... ummh ... this is just an eye opener, ummh ... such kind of research ... they help us as teachers to realise that when we think we are teaching, sometimes we are not as effective as we are intending to do or as we are expected to, because there is a lot of assumptions which we don't research for ahead of time or plan for before we teach these concepts. So I think once we have ummh ... this knowledge, once such researches are done it will help us to keep things in order and we apply.

R: Thanks once again Mr Y for your valuable contributions towards this research.

Mr Y: Thank you very much.

R: Thank you. I hope we will meet again when the results are out.

APPENDIX 11 A Total % score per learner in the questionnaire and the % mean - School A

Code s	% Scor	School A		
A1	50			
A2	67			
A3	80			
A4	83			
A5	53			
A6	80			
A7	87			
A8	83			
A9	70			
A10	90			
A11	87			
A12	53			
A13	67			
A14	70			
A15	53			
A16	83			
A17	60			
A18	37			
A19	97			
A20	90			
A21	70			
A22	70			
A23	63			
A24	63			
A25	83			
Total	1789			
Mean	63,9			

APPENDIX 11 B

Total % score per learner in the questionnaire and the % mean - School B

Codes	% Score	School B	
B1	87		
B2	67		
B3	67		
B4	63		
B5	93		
B6	87		
B7	77		
B8	97		
B9	80		
B10	80		
B11	87		
B12	63		
B13	73		
B14	83		
B15	60		
B16	73		
B17	63		
B18	67		
B19	80		
B20	77		
B21	93		
B22	67		
B23	73		
B24	73		
B25	37		
B26	40		
B27	73		
B28	77		
Total	2057		
Mean	73,5		

APPENDIX 11 C

Total % score per learner in the questionnaire and the % mean - School C

Codes	% Score	School C	
C1	83		
C2	60		
C3	67		
C4	87		
C5	80		
C6	60		
C7	80		
C8	90		
C9	60		
C10	83		
C11	73		
C12	77		
C13	83		
C14	87		
C15	67		
C16	43		
C17	53		
C18	80		
C19	80		
C20	83		
C21	47		
C22	87		
C23	63		
C24	90		
C25	73		
C26	83		
C27	77		
C28	83		
C29	60		
C30	83		
C31	77		
Total	2299		
Mean	74,2		

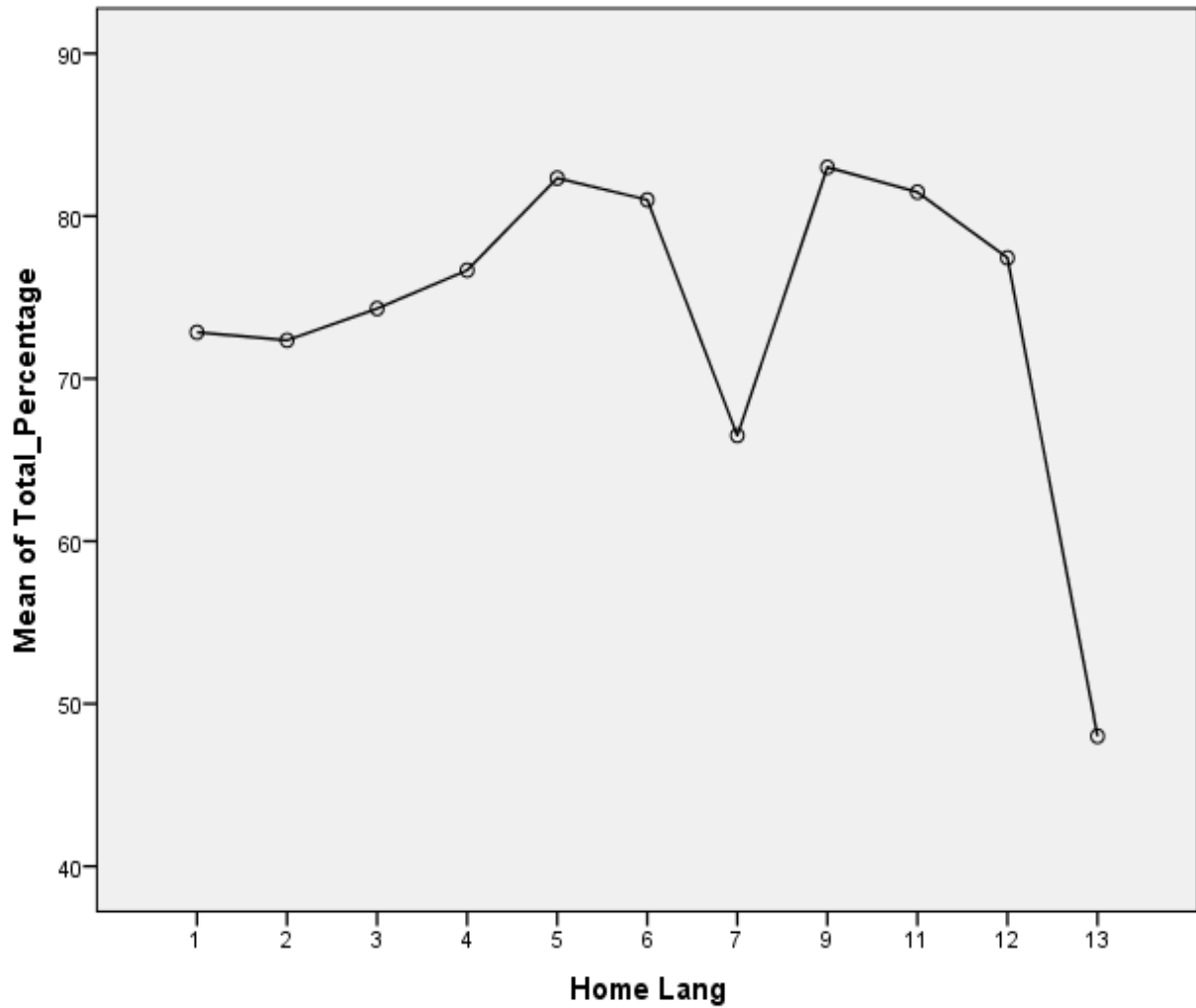
APPENDIX 11 D

Total % score per learner in the questionnaire and the % mean - School D

Codes	% Score	School D	
D1	87		
D2	90		
D3	67		
D4	90		
D5	63		
D6	63		
D7	73		
D8	97		
D9	90		
D10	100		
D11	83		
D12	90		
D13	93		
D14	87		
D15	60		
D16	77		
D17	90		
D18	80		
D19	77		
D20	93		
D21	70		
D22	90		
D23	87		
D24	40		
D25	70		
D26	67		
D27	87		
D28	93		
D29	97		
D30	90		
D31	77		
Total	2518		
Mean	81,2		

APPENDIX 12A

Total mean score percentages against Home language of participant learners



Key

1 = IsiZulu; 2 = Sipeidi; 3 = Tswana; 4 = Tsonga; 5 = Xhosa; 6 = Sotho; 7 = Ndebele; 8 = Afrikaans; 9 = Venda; 10 = Swati; 11 = English; 12 = Other 13 = Didn't indicate

APPENDIX 12B

Mean total percentages of Female and Male participant learners

	Gender	N	Mean	Std. Deviation	Std. Error Mean
Total %	Female	52	73.31	14.480	2.008
	Male	63	77.00	13.716	1.728

The sample used in the study consisted of 52 female learners and 63 male learners as indicated in the above table. The percentage mean for female learners (73.31%) in the questionnaire was slightly lower than for male learners (77%) but the difference was not statistically significant. This indicates that the understanding of meanings of everyday words used in science context was independent of the gender of the participant. Female and male participant were equally facing the same challenges as was reflected by the above results.