An exploration of Natural Science teachers' experiences and perceptions of the National Standardized Achievement Tests: A case study

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Declaration of originality

I, SIMSON NDADALEKA SHAAKUMENI declare that this research is my original work and has not been submitted in any other form to another university. Where use was made of the work of others, it has been duly acknowledged in the text.

Signed by:  Date: 28 December 2012

Dedication

This research is dedicated to Tulimuwo, my wife and Nena, my baby daughter.
They are such a blessing to me and they give me a reason to work harder in all endeavours.

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Abstract

The primary purpose of this study was to capture Natural Science teachers' perceptions of the national standardised achievement tests (SATs), with a view to illuminating whether or not they were able to interpret and use the SATs reports to inform their practice and for improvement purposes as envisaged in the standardised tests' objectives. It further sought to investigate how the grade 7 Natural Science teachers were teaching the subject matter, with a view to understanding the performance of learners as illustrated in the 2010 SATs results.

The study mainly used qualitative methods such as observations, interviews and document analysis. These were complemented by quantitative methods through the use of the questionnaires, which were used to capture the general perceptions and experiences of Natural Science teachers. Thirty-five questionnaires were sent out and ten responses were received.

Quantitative data from the questionnaires were analysed by tabulation to ascertain the frequencies of responses regarding teachers' perceptions and experiences of SATs, as indicated in different scales per indicator. Furthermore, data generated through video-taped lessons, analysis of learners' written notes, interviews and open-ended questions from the questionnaires were inductively analyzed.

The findings of the study revealed that teachers had positive perceptions towards the ideals of SATs. However, their use of the SATs reports in their teaching was inconclusive. The study also revealed that there were no policy imperatives on SATs, in particular, to guide their use in schools. It was also found that teachers were not teaching the syllabus competencies fully and their Natural Science content knowledge was inadequate.

The principal recommendation is that teachers need to acquaint themselves sufficiently with the SATs reports to enable them to use the reports for their intended purposes. Furthermore, teachers need to engage in continuous professional development programmes to improve their Natural Science content knowledge, especially with regard to making information in the textbooks accessible to learners in terms of addressing competencies in the syllabus. Finally, there is a need for policy intervention from the Ministry of Education in Namibia so that the existing tensions between policy formulation and implementation are addressed.

Acronyms and abbreviations

BETD	Basic Education Teacher Diploma
CALP	Cognitive Academic Language Proficiency
DoE	Department of Education
DNEA	Directorate of National Examination and Assessment
ETSIP	Education and Training Sector Improvement Programme
LTSMs	Learning and Teaching Support Materials
LoLT	Language of Learning and Teaching
MBEC	Ministry of Basic Education and Culture
MoE	Ministry of Education
NCBE	National Curriculum for Basic Education
NIED	National Institute for Educational Development
PEEOE	Predict Explain Explore Observe Explain
PCK	Pedagogical Content Knowledge
SACMEQ	Southern and Eastern Africa Consortium for Monitoring Educational Quality
SATs	Standardised Achievement Tests
TIMSS	Trends in International Mathematics and Science Study

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Chapter One

Introduction and research overview

1.1 Introduction

The purpose of this study was to capture Natural Science teachers' perceptions of the national standardised achievement tests (SATs), with a view to illuminating whether or not they were able to interpret and use the SATs reports to inform their teaching and learning of Natural Science for improvement purposes, as envisaged in the standardised tests' objectives. The study further sought to investigate how the grade 7 Natural Science teachers were teaching the subject matter, with a view to understanding the performance of learners as illustrated in the 2010 SATs results.

This chapter introduces the reader to the research study. The context of the study as well as the background to the research, the research goal, the problem statement and the significance of the study are presented.

1.2 Research context

A study by the World Bank on the Namibian education system has revealed some constraints with regard to assessment. The study indicated that Namibia had too few mechanisms to measure the levels of achievement and performance of the school system, particularly at primary level. The mechanisms for providing information to judge the performance of individual schools were not effective. Furthermore, the mechanisms for identifying teaching and learning difficulties and providing feedback and assistance to individual schools about the mastering of the key skills and competences were insufficient (Elley, 2005).

The study report recommended that a system of SATs for the monitoring of learners' acquisition of identified skills and competencies in key subject areas should be developed and implemented nationally at Grades 5 and 7. The baseline data about learners' performance in SATs should be established, and performance targets should be set to monitor the progress of individual schools at Grades 5 and 7. The report finally urged that there should be a flow of diagnostic feedback from the test results to schools and advisory and inspection services in each of the educational regions.

In response to the World Bank report, the Namibian Ministry of Education, with the assistance of the World Bank, developed the Education and Training Sector Improvement Programme (ETSIP) (Marope, 2005). This programme aims at improving the quality of education, in

particular learner assessment and teacher development amongst other components envisaged in ETSIP. The improvement of quality is seen as the most important objective (Namibia, Ministry of Education [MoE], 2007).

The implementation of the first national SATs at grade 7 level was realised in 2010. The tests were developed in Mathematics, English and Natural Science. Diagnostic reports on the levels of achievement at national, regional and school level were the outcomes of the testing.

The data obtained from the analysis of the test results were used in establishing **baseline data** for monitoring the progress of schools over the years. In addition, the diagnostic reports were developed for use by teachers at school level in assisting learners with the problems they are experiencing with the mastering of the key skills and competencies specified by the Namibian syllabi.

The underlying principle of the national standardized achievement tests (SATs) is that the results are not used for promotion of learners to the next higher level in school, but rather to show teachers how well their learners are achieving, relative to national and regional levels. The results also help diagnose difficulties or grey areas in the curriculum for targeted improvement actions.

As mentioned above, the results of the first test provided the baseline data against which schools set targets for future growth. The performance of learners in the tests would assist in identifying areas where professional support for teachers was needed to work towards improved learner performance. The results would also show teachers how much learning had taken place in their grade 7 class in one year at the end of primary schooling (MoE, 2010).

1.3 Research background

At the time of the implementation of SATs, I was an Advisory Teacher for Physical Science and Natural Science. As part of my responsibility (and as proposed by the World Bank report (Marope, 2005)), I was responsible for the dissemination of the Natural Science SATs reports to teachers in Ohangwena region. The dissemination process entails explaining to the teachers the structure of the SATs reports, how to interpret them and use them in their teaching, to address areas that learners find difficult to learn as shown in the report.

The analysis of the SATs reports indicated that many schools scored very low in the three competencies, namely **identifying reflex arc from diagrams**; **describing the influence of drugs on the nervous system** and **classifying elements as metals and non-metals**.

During the SATs reports dissemination workshops, I often asked teachers to briefly give the key information that learners need to acquire in order to master certain competencies in the syllabus. However, to my surprise, some teachers gave information that was at times not actually addressing competencies. This triggered my interest in investigating what the role of teachers could be in the learners' performance in the standardised tests.

During one of the workshops it was pointed out that some prescribed textbooks at the teachers' disposal did not have any illustration of a reflex arc, and the competency required learners to identify a reflex arc from diagrams. Similarly, there were no clear illustrations of elements classifications. There were about seven textbooks for grade 7 Natural Science in the Namibian government's textbook catalogue. This situation prompted me to make some assumptions about teachers' self-confidence in their content knowledge of Natural Science and on their efforts to prepare for their Natural Science lessons. Given the number of textbooks made available in the textbooks catalogue, teachers are required to have a good subject content to enable them to collate information from these textbooks to address syllabus competencies. Hitherto, how do teachers perceive their self-efficacy in the Natural Science content knowledge?

Self-efficacy is very similar to self-confidence and it has been shown to be a powerful predictor of performance (Palmer, 2006). "Self-efficacy is concerned with judgements about how well one can organise and execute courses of action required to deal with prospective situations that contain many ambiguous, unpredictable, and often stressful elements" (Palmer, 2006: 337).

Science content knowledge and pedagogical knowledge are factors that have been linked with increased confidence and self-efficacy of primary teacher education students (Schoon & Boone, 1998; Appleton, 1995). It has been argued that cognitive content mastery (successes in understanding science content) and cognitive pedagogical mastery (successes in understanding how to teach science) could be sources of self-efficacy for primary science teachers (Palmer, 2006).

1.4 Problem statement

SATs were implemented for the first time in grade 7 during 2010. The objectives of this form of assessment are to diagnose the education system and provide feedback to schools and other stakeholders. SATs are not for promotion of learners to the next higher grade, and the information they provide could also be used to inform education policy decisions.

With the implementation of the SATs emerged a task for teachers to understand and be able to interpret and use the resultant reports to inform their teaching and learning activities. For instance, the analysis of SATs results indicated that learners' performance varied from competency to competency nationwide in Namibia. The performance of grade 7 learners in three Natural Science competencies caught my attention. These competencies were:

- Identify reflex arc from diagram
- Describe the influence of drugs on the nervous system; and
- Classify elements into metals and non-metals.

The nature of these competencies is that they are quite easy to understand, yet the national performance was below 50 percent.

Having served as an Advisory Teacher for Physical Science and Natural Science in Ohangwena region, I had been on a mission to monitor how the curricula of the two subjects were implemented, with specific emphasis on the teachers' role in this process. Through school visits, it was often found that learners were not exposed to relevant information that would enable them to master the intended knowledge and skills, and this adversely affected their achievement - particularly in standardised tests.

In my new sphere of work - developing and implementing the SATs to all primary schools in Namibia - I was inspired to find out how Natural Science teachers taught the three competencies mentioned above, particularly with the follow- up standardised tests due in November 2012. The questions that lingered in my mind were related to whether teachers had used the SATs reports for 2010 to inform their teaching and learning in the course of 2012, or would the follow up tests still show the same deficiencies of 2010?

The aspects being studied were to:

- establish whether Natural Science teachers were able to interpret and use the SATs reports;
- observe how teachers taught the competencies in which grade 7 learners performed poorly and;
- Assess the teaching of Natural Science in schools.

This was an effort to understand learners' performance in SATs using teachers' pedagogical practices as lenses.

1.5 The significance of the study

The SATs results provided a picture of how much learning had taken place in the grade 7 classes of 2010. What teachers do in their classes is mirrored in the learners' performance in standardised assessment such as SATs. It is therefore envisaged that the study will shed light on teachers' perspectives on this new assessment practice. It further envisaged creating awareness of the extent to which teachers interpreted the syllabus and the subsequent influence on learner achievement in national assessments. The study would enable me to understand the performance of learners in the SATs, particularly in the three competencies forming part of the focus of this study. Furthermore, this study could lay the ground for further study into the teaching practice of grade 7 Natural Science teachers in light of follow- up SATs.

1.6 Research goal

The main goal of the study was to capture Natural Science teachers' perceptions of national SATs, with a view to illuminating whether or not they are able to interpret and use the SATs reports to inform their teaching and learning of Natural Science, as envisaged in the objectives of the SATs.

Secondly, the research sought to investigate the grade 7 Natural Science teachers' teaching of the content that involves the three competencies, namely identifying a reflex arc from diagrams, describing the influence of drugs on the nervous system and classifying elements as metals and non-metals. This was done with a view to understanding the performance of learners in these competencies, as illustrated in the 2010 SATs results.

To achieve this goal, the following questions were answered:

- What are teachers' perceptions of the grade 7 Natural Science SATs?
- How do teachers interpret and use the Natural Science SATs reports to improve learners' performance in identified poorly performed competencies?
- How were the three competencies in which learners performed poorly in the 2010 SATs taught in 2012?
- What influence does teachers' content knowledge development have on their learners' mastery of competencies in the syllabus?

1.7 Definitions of key concepts in the study

Achievement test: A test designed to measure what has been learned, rather than to predict future performance.

Assessment: Large-scale, system wide measurement programmes for learners' diagnosis or other form of evaluations.

Diagnostic test: Test that ascertains the level of achievement so that instruction might be adjusted appropriately.

Formative assessment: A range of formal and informal assessment procedures employed by teachers during the learning process in order to modify teaching and learning activities to improve learner attainment.

Knowledge integration: A socio-cognitive perspective in which learners identify weaknesses in their knowledge and add new ideas to their repertoire, linking some and distinguishing between others; they also reconcile ideas that appear contradictory.

Low-stake test: A test used to provide results that have only minor or indirect consequences for examinees, programmes or institutions involved in the testing.

Multiple-choice items: The type of selected-response items that requires the test taker to select a correct response to a question from among a small number of specific choices.

Norm-referenced test: Tests designed to measure test takers' traits relative to a norm group, typically a representative sample of peers from a large population of interests, that is, all grade 7 learners in Namibia.

Pedagogical content knowledge: Teachers' knowledge that includes the ways of representing and formulating the subject matter that makes it comprehensible for learners, that is, representations, strategies, analogies, illustrations, examples, explanations, and demonstrations.

Self-efficacy: Judgements about how well one can organise and execute courses of action required to deal with prospective situations that contain many ambiguous, unpredictable, and often stressful elements

Socio-cultural theory: A perspective which posits that learning is socially constructed and mediated by tools and symbols such as language, diagrams *etcetera.*

Standardised test: Any aspect of a test format, procedures or administration that is uniform across test takers.

Summative assessment: The assessment of the learning and the summary of learner development at a particular time after a period of work.

1.8 Thesis overview

My thesis is comprised of seven chapters.

Chapter One introduces the study, stating the goal, the problem, and the significance of the study as well as describing the context of the study.

Chapter Two provides a review of literature related to the research study. It discusses the role of assessment in education with reference national SATs. It also draws from research on science teachers' pedagogical practices and content knowledge development as the potential influencing factor to learners' performance in the SATs.

Chapter Three describes the research methodology; clarifies the aim of the study, explains how the data were analysed and how the ethical aspect of the study was considered. It deals also with the validity of the procedures.

Chapter Four: Phase one- contains the presentation of data gathered through document analysis and questionnaires.

Chapter Five: Phase two- presents data gathered through lesson observations coupled with stimulated recall discussions and interviews.

Chapter Six provides an analysis of the research findings. It also discusses the findings in the context of the literature reviewed and the summary of what emerged from the findings.

Chapter Seven concludes the study by drawing from the discussions of findings in Chapter 6. Recommendations and suggestions for further research, and the limitations of the study are also presented. Lastly, this gives a brief account of my research journey as well as the conclusion of the study.

1.8 Concluding remarks

This chapter presents the aspects of the research study such as the research context, background and goal of the study. The statement of the problem as well as the significance of the study is

also clarified. The chapter ends with definitions of key concepts and an overview of the research chapters.

In the next chapter, I present the literature relevant to my study, and review it in the light of standardised testing in Namibia and in relation to science teaching and learning.

Chapter Two

Literature Review

2.1 Introduction

The purpose of this study was to investigate the role of grade 7 Natural Science teachers in learner achievement, with a view to understanding the performance of learners in the 2010 SATs in Namibia. It further sought to capture Natural Science teachers' perceptions of the SATs, with a view to illuminating whether or not they understand and use the resultant reports in the teaching and learning of Natural Science, as envisaged in the objectives of SATs.

This chapter therefore looks at the role of assessment in general, with reference to assessment of learning (summative) and assessment for learning (formative). Furthermore, the chapter elucidates the state of standardised achievement test practices in Namibia, and other issues related to the teaching of science in Namibian schools. Reference is also made to the international assessment practices similar to SATs in Namibia.

The chapter also gives attention to issues related to science teaching and learning in a Namibian context and also draws from international research on science teaching and learning, considering that the results of SATs mirror the teaching and learning that has taken place in the classrooms. The theoretical framework in which the study is grounded is also presented, with a view to illustrating its underpinning of the Natural Science teachers' instructional practices.

2.2 Learner-centred education approach

The Namibian education system is underpinned by learner-centred pedagogy. The National Curriculum for Basic Education (NCBE) states that:

> Preparation for a knowledge-based society requires a learner-centred approach to teaching and learning. This means that the point of departure is always what the learners already know and can do, then acquiring new knowledge through ways of working which are relevant and meaningful for them, and learning how to apply their knowledge creatively and innovatively. Knowledge is not learnt for its own sake, but must always lead to new understanding and new skills and the creation of new knowledge. At each step of the way, learners must show how competent they are in what they understand and can do (MoE, 2010:4).

However, a study conducted by Nyambe (2008) on the Namibian teacher educators' interpretation and practice of learner-centred pedagogy revealed that there was a systematic disjuncture between teacher educators' ideas about learner-centred pedagogy and their practice

of it. The teacher educators were responsible for teacher training in the Basic Education Teachers Diploma (BETD) programme at a former college of education. The BETD programme is deep rooted in the learner-centred pedagogy.

Many primary school science teachers in Namibia are products of this programme. Some teachers went through pre-service mode and others through in-service training. Since teacher educators are responsible for training of teachers, the possibility may exist for the teachers involved in this study to have been influenced by their teacher educators' disconnected interpretation of learner-centred pedagogy and practice.

I should point out that I am a product of the same programme and hence developed professionally to perhaps acquire a better understanding of learner-centred pedagogy, further from the perception that it is merely changing from teacher-centredness to learner-centredness (Nyambe, 2008). Furthermore, I should indicate that I was not able to confirm whether the findings thereof could be generalised to all BETD teacher educators at all colleges of education in the country.

2.3 Assessment

2.3.1 Role of assessment in education

Assessment is one of the most powerful educational tools for promoting effective learning when used not only to measure what learners have learned, which is described as assessment *of* learning (summative) but also as part of teaching and learning, which is referred to as assessment *for* learning (formative) (Gardner, 2006). According to Gardner (2006), assessment *of* learning is the process by which evidence is gathered in a planned and systematic way in order to draw inferences about learners' learning, based on professional judgement, and to report at a particular time on learners' achievements.

Assessment in the form of standardised testing has assumed a prominent role in recent efforts to improve the quality of education. Furthermore, the current emphasis on standardised testing as a tool of education reform continues a long tradition of using tests to change pedagogical priorities and practices (Abrams & Madaus, 2003).

SATs are new in Namibia's assessment practice. They were implemented in grade 7 for the first time in 2010, and Natural Science was one of the subjects on which such tests were developed and administered.

The development and subsequent implementation of the SATs in the Namibian education system is aimed at complementing teachers' efforts in assessment of learning in identified subject areas, in particular, Natural Science in this study. SATs provide information about how learners are acquiring the competencies and skills in the syllabus at the end of primary education.

Furthermore, assessment for learning is seeking and interpreting evidence for use by learners and their teachers to decide at what level the learners are in their learning, and what they need to achieve and how best to get there (Gardner, *ibid*). The SATs not only provide information about the performance of the education system, they are also intended to assist teachers in identifying areas of difficulty in the syllabus, and where learners are not acquiring intended competencies and skills. This feedback is necessary for teachers to review their teaching strategies in those areas where learners are not acquiring the mastery of prescribed skills and competencies in the syllabus.

Assessment thus provides a framework in which educational objectives may be set and learners' progress charted and expressed. Hence, promoting children's learning is a principal aim of schools, and assessment lies at the heart of this process (Ministry of Basic Education and Culture (MBEC), 1999).

According to McTighe and Ferrara (1994: 5), assessment in education is viewed as important because it provides information about learning, and that it can be used to:

- Diagnose learner strengths and needs;
- Provide feedback on teaching and learning;
- Provide a basis for instructional placement;
- Inform and guide instruction;
- Communicate learning expectations;
- Motivate and focus learner attention and effort;
- Provide practice applying knowledge and skills;
- Provide a basis for learner evaluation; and
- Gauge programme effectiveness.

Research indicates that improving learning through assessment depends on simple key factors (Black & William, 1998: 14):

- The provision of effective feedback to learners;
- The active involvement of learners in their own learning;

- Adjusting teaching to take account of results of assessment;
- Recognising the profound influence assessment has on the motivation and self-esteem of learners, both of which are crucial influences on learning; and
- The need for learners to be able to assess themselves and understand how to improve.

Shepard (2000:4) asserts that "within the constructivist paradigm, assessment should be at the heart of any educational enterprise". However, other authors cautioned against the danger of assessment-driven pedagogy (Wilmot, 2005) at the detriment of learners. This is so because research shows that teachers' assessment practices are weak as they encourage rote learning and are often normative rather than criterion-referenced. This leads to competition and de-motivates weaker learners (Black & William, *ibid*).

In South Africa, the assessment guideline documents (DoE, 2002a, b) indicated that outcomes-based orientation places assessment at the heart of teaching and learning. Teachers should start with the outcomes to be assessed before selecting the assessment type and activity. Moreover, what is intended at the end should be clarified and shared with learners. However, in order for assessment to be of good quality, it has to be valid and reliable.

2.3.2 Validity of assessment

Validity of assessment means that intended results of assessment are obtained and can be used in evaluating each and every learner's mastery of the objectives and competencies in the syllabus that learners actually studied. Scores from an assessment are valid if the questions match the objectives in the syllabus.

Furthermore, the scores from an assessment are valid if the questions require the same kind of thinking skills as stated in the syllabus. In the Namibian context, for example, scores from an assessment are valid if questions are written in the language understandable by all learners (MBEC, *ibid*).

2.3.3 Reliability of assessment

Reliability means that assessment results must be consistent. The scores from an assessment are consistent if, for instance, two teachers mark the same group of learners' answer scripts, and award more or less the same scores (MBEC, *ibid*).

The scores from an assessment are reliable if learners get the same scores for the same work today as five days to come. The scores are consistent if the learners' responses to one set of

questions are quite similar in quality to learners' responses to another set of questions on the same topic.

If the learners' marks fluctuate a lot, depending on which teacher marks the papers, on which day the learners happen to be assessed, or on which sample of questions happen to be asked, these scores are unreliable (MBEC, *ibid*).

2.4 The inception of standardised achievement tests in Namibia

As part of education reform in Namibia, the Ministry of Education, with the assistance of the World Bank, developed the Education and Training Sector Improvement Programme (ETSIP), based on a comprehensive study by the World Bank (Marope, 2005). This programme aims at improving the quality of education, in particular, learner assessment and teacher development amongst others. The improvement of education quality is seen as the most important objective to achieve in ETSIP.

The study by the World Bank found the following constraints with regard to assessment in the Namibian education system:

- Namibia has too few mechanisms to measure the levels of achievement and performance of the school system, particularly at primary level;
- The mechanisms for providing information to judge the performance of individual schools are not effective; and
- The mechanisms for identifying teaching and learning difficulties, and for providing feedback and assistance to individual schools about the mastering of key skills and competences are insufficient (Elley, 2005).

To overcome these constraints in the assessment system, especially at primary level, the following interventions have been implemented in ETSIP (Namibia, Ministry of Education [MoE], 2007):

- A system of SATs for the monitoring of learners' acquisition of identified skills and competencies in key subject areas was developed and implemented nationally at Grades 5 and 7;
- Baseline and performance targets were set to monitor the progress of individual schools at Grades 5 and 7;
- There had been a flow of diagnostic feedback from the test results to schools and advisory and inspection services in each of the educational regions; and

- Professional and administrative capacities were being established at the Directorate of National Examinations and Assessment (DNEA) to manage and administer the new testing system.

In response to the ETSIP's drive for education system quality improvement, particularly in the area of learner assessment and teacher development, the implementation of the first national SATs at grade 7 level was realised in 2010.

Diagnostic reports on the levels of achievement at national, regional and school level were the products of the testing. The data obtained from the analysis of the tests results were used in establishing a **baseline** for monitoring the progress of schools over the years. In addition, the diagnostic reports were developed for use at school level to assist teachers with the identification of problem areas where learners were experiencing difficulties with the mastery of the key skills and competencies specified by the Namibian syllabi.

2.5 The implementation of national standardised achievement tests in Namibia

The SATs are 'low stake' assessment. The underlying principle of the SATs is that the results are not used for promotion of learners to the next higher level in school, but rather l for the following purposes:

- to show teachers how well their learners are achieving, relative to national and regional levels;
- to help diagnose difficulties or grey areas in the curriculum for targeted actions;
- to provide the baseline against which schools set targets for future growth;
- to provide professional support for teachers to work towards improved learner performance; and
- to show teachers how much learning has taken place in their grade 7 class at the end of primary schooling.

Measurable themes (skill areas as stated in the syllabus), topics (learning objectives) and basic competencies were selected for assessment by multiple choice test items (questions) for this purpose (MOE, *ibid*). In assessment using multiple choice questions, learners might get items correct by guessing. Thus, the probability of correct response includes a small component that is due to guessing (Baker, 2001).

Consequently, the results obtained from a test that uses multiple choice items may not be reliable. Yet, at the same time the results obtained from a test that uses free-response items may be questioned as well, due to the subjectivity of the marker.

To make the results of the national SATs more reliable, a rigorous reliability coefficient test was done on the test forms (question papers). The Natural Science test had three forms (A, B and C). These forms carried different questions, to cover as many basic competencies in the syllabus as possible. However, the difficulty and discrimination of these test forms have been equated, since each learner answers only one form.

A study done on the perceptions of Namibian Grade 5 teachers on SATs expressed generally positive views about the practice. Many cited that the SATs serve as an incentive for teachers because they help the teachers to identify the competencies where learners performed poorly, and this enables them to assist learners accordingly (van der Merwe, 2011).

Question papers used in these tests are not publicised, to prevent teachers from teaching to the tests. The report that is available to schools indicates the basic competencies on which tests were set. The report encourages teachers to teach the syllabus competencies well so that learners can perform well in external assessments such as the SATs.

2.6 Similar international assessment practices

Countries around the world are striving for excellence in the teaching and learning of mathematics and science, in their quest to prepare their students for knowledge-based economies. The SATs are benchmarked against international practices such as the Trends in International Mathematics and Science Study (TIMSS) (Wagemaker, 2008).

TIMSS is thus aimed at helping countries make informed decisions about how to improve teaching and learning in mathematics and science. In other words:

> It provides comparative information about mathematics and science achievement at the fourth and eighth grades across member countries in relation to the various curriculum and instructional approaches used. This enables policy makers and educators to focus on the quality of educational achievement, to monitor curricular implementation and effectiveness, and identify promising instructional practices (Wagemaker, 2008:3).

In general, participating countries use TIMSS in various ways to explore educational issues, including:

- monitoring system-level achievement trends in a global context;

- establishing achievement goals and standards for educational improvement;
- stimulating curriculum reform;
- improving teaching and learning through research and analysis of the data;
- conducting related studies (for example, monitoring equity or assessing students in additional grades) and;
- training researchers and teachers in assessment and evaluation (Wagemaker, 2008).

Unlike some other African countries, Namibia does not participate in TIMSS. However, Namibia does participate in the Southern and Eastern Africa Consortium for Monitoring Educational Quality (SACMEQ).

2.7 Science teaching and learning

2.7.1 Lesson planning

The national subject policy for Natural Sciences stipulates that lesson planning is compulsory, regardless of years of teaching experience (MOE, 2009). Clark and Peterson (1986) define lesson planning as a fundamental physiological process that allows the teacher to visualise the future. The translation of lesson plans into classroom practice is vital in achieving the objectives of the lesson. However, McCutcheon and Milner (2002) assert that to date less attention has been paid to the analysis of lessons taught. My study entailed an analysis of two lessons taught by two teachers, with a view to illuminating possible influences their pedagogical practices might have on learners' achievement in the SATs.

Coleman, Graham-Jolly and Middlewood (2003) argue that the success of the learners remains to a large extent the responsibility of the teacher, because all learners can learn and they can reach a high level of competency. The onus is therefore on a teacher to use a variety of teaching and learning methods, and to allow each learner sufficient time and multiple opportunities to master knowledge and skills.

Yildirim (2003) too argues that lesson plans include writing of, and a guide to future actions. Lesson preparation is worth the time, because written plans force teachers to carefully think on how to reach the goal and ensure learner achievement. It is necessary for plans to be written as this could provide a trail of evidence that could be used to gain insight into teachers' pedagogical content knowledge.

2.7.2 Teaching strategies

There are many ways in which subjects can be taught. The role of the teacher should be to use a variety of teaching models and know the underlying philosophy for each model (Settlage & Southerland, 2007). One of the common teaching methods used in Namibian schools is the question and answer method. According to Settlage and Southerland (2007:140), "an effective teacher knows how to use questions and knows when it is the right time to ask what type of question". Questioning in teaching helps stimulate individuals to learn on their own and questioning should propel and compel learners to want to know more.

When using the question and answer method as a teaching strategy, the teacher needs to pay attention to the pace at which questions are asked. Waiting time is crucial in fostering classroom science discussion (Settlage & Southerland, *ibid*). In her research on science teaching, Marry Budd Rowe found that when learners were not given enough time to respond to a question, the lesson becomes an interrogation where the teacher rapidly fires questions and repeats questions or calls another learner to answer when there is no immediate response forthcoming from learners (Settlage & Southerland, *ibid*).

Hoyle and Stone (2000) posit that part of science education is about learners developing the skills of critical thinking, and when teachers use good questioning techniques, learners' prior knowledge is activated, and this gives the teacher access to their thinking.

Teaching is the act of organising and shaping learning experiences for learners and the purpose of teaching is to facilitate learning. Teachers need to match learners and what they know with the intended curriculum in ways that make learning achievable (Loucks-Horsley, 2010). Teaching is a profession requiring specialised knowledge. Research shows that there is a relationship between teachers' science content knowledge and instructional practice and student achievement, citing that teachers' content knowledge is related to learners' learning. Furthermore, teachers' content knowledge influences how teachers engage their learners in subject matter and how they evaluate, choose and use instructional materials (Loucks-Horsley, *ibid*).

Research on the most effective teaching methods has been inconclusive; however, the effectiveness of teaching depends on the aim of the teaching, on individual learners and on the teacher. If the aim is to develop practical skills, practical exercises will be more effective than watching videos. Likewise if the aim is to make learners understand some difficult theory then teacher explanation will be more effective than an open-ended practical. It is therefore important

to be clear about the aim of a particular lesson before deciding on the most appropriate style of teaching (Woolnough, 1994).

2.7.3 Natural Science teachers' confidence in Science content

The Natural Science subject policy guide has underscored the need for science teachers to constantly develop their teaching skills by engaging in continuous professional development programmes. By so doing, they will gain more robust understanding of science content and strategies for its delivery during teaching (MoE, 2009).

SATs endeavour assisting teachers identify areas where learners are not acquiring the intended skills and competencies; however, if teachers' knowledge is underdeveloped, they are less likely to effectively help learners with their learning of science. Davis and Petish (2001) reiterate that science teachers should have substantive and syntactic understanding of science and learners' knowledge, skills, attitudes, and beliefs. However, teachers who themselves hold alternative conceptions about science ideas they are teaching cannot identify those same ideas in their learners as needing improvement.

While I was an Advisory Teacher for Physical Science and Natural Science, one of my responsibilities was to monitor the teaching and assist teachers with teaching methods and subject content. To do that, I had to visit schools and observe teachers teaching and observe them during workshops.

In this regard, it is deemed worth investigating the role teachers play in the performance of learners in the Natural Science SATs, with reference to their self-confidence in the Natural Science content.

2.7.4 The role of prior knowledge in learning science

According to the National Curriculum for Basic Education (NCBE) (MoE, 2010), learners do not come to school like empty vessels to be filled with information. They possess varying experiences and are already learning. Teaching which does not build on that experience and learning will limit the learners' thinking, and the learners will not see the connection between the world outside school and what is taught and learnt in school (Stears, Malcolm & Kowlas, 2003).

Teaching should always begin with helping the learners realise what they might already know about something, or what ideas or questions they might have about it even if they do not know, and by relating to the environment within and around the school. The form of human capital that

learners bring to the classroom does not have to be accurate at the outset, even in those few situations where they must provide one right answer; these may all be the start of an enquiry (MoE, 2010).

The NCBE emphasises that "learning in school must constantly relate to, involve, and extend the learners' prior knowledge and experience, and this must be complemented and challenged by the knowledge that the school provides from beyond the immediate sphere of the learner" (MoE, 2010: 30).

Stears, Malcolm and Kowlas posit that:

> Constructivist approaches to learning advocate for curricula that build on learners' experience, interests and prior knowledge. Socio-cultural knowledge arises not only from children's ethnic backgrounds but also from socio-economic conditions, their environment and the personal circumstances of their lives. These circumstances may influence the worldview and activities of learners to such an extent that they feel alienated from schooling (2003:1).

Science teachers need to understand the role of learners' prior knowledge in bringing about understanding of scientific concepts. According to Rochelle (1995:1), "learning proceeds primarily from prior knowledge and only secondarily from the presented materials". This helps learners to assimilate new experiences easily because they incorporate the new information onto their existing understanding. Roschelle further states that:

> Prior knowledge is best seen as raw material to be refined. Scientific knowledge is not a type of knowledge, but rather a refined product, for which prior knowledge supplied the raw materials and social interaction supplied the tools (1995:17).

To help learners make the most of the new experience, teachers need to understand how prior knowledge affects learning. For this reason, science teachers need to integrate learners' prior knowledge into their lessons to enhance learners' acquisition of the subject matter.

The performance of learners in the SATs, based on the three competencies, namely identifying a reflex arc from diagrams, describing the influence of drugs on the nervous system, and classifying elements into metals and non-metals, may be reflecting a shortcoming in the ways in which these areas were presented to the learners.

2.7.5 The role of language in science teaching and learning

The communicative dimension of language cannot be over-emphasized in teaching and learning, particularly in science education. Namibia, like many other African countries, has a rich diversity of language and culture. There are 14 written languages with a standardised orthography

(Totemeyer, 2009). However, there are an additional 16 oral languages for which no orthography exists.

This multilingualism does not only pose a general communication challenge, but it also impacts on the teaching and learning of learners from such varying ethnicities and mother tongues. For this reason, Namibia adopted English at independence in1990, as an official language and subsequently the language of learning and teaching (LoLT), despite the fact that the majority of Namibians could not speak, read or write English at that time.

Namibian learners are second-language speakers of English and are not acquiring what Cummins (2000) refers to as the cognitive academic language proficiency (CALP). "CALP is the type of language proficiency needed to read textbooks, participate in dialogue and debate ... it requires both higher levels of language and cognitive processes to develop the language proficiency needed for success and achievement in school" (Kocakulah, Ustunluoglu & Kocakulah, 2005:3).

Learners who are struggling to learn science and science concepts in a foreign language lose at least twenty percent of their capacity to reason and understand in the process (Kocakulah, et al., 2005). Many Namibian learners may be experiencing reasoning capacity reduction as a result of English language being literally their third language.

Learners are thus faced with a dual challenge of not only striving for language proficiency, but they have to learn the science content as well. Equally, this gives teachers a dual task (Probyn, 2009). They have to teach the science content (which is a language in itself) as well as the English language.

In Namibia, this dual task is recognised in the subject policy guides. That is, teachers should teach English across the curriculum. In other words, all academic subjects are taught in English, therefore teachers should make a concerted effort to help learners develop their reading, writing and spelling skills (MoE, 2009). For this reason, the lesson plan format distributed countrywide makes provision for teachers to integrate reading and writing activities in their lessons.

Research found that learners who study science in their mother tongue did well in science compared to those who learned it through a foreign language (Kocakulah, et al., 2005). This is also reflected by Dzama and Osborne (1999), who state that African students encounter difficulties when learning science in a second or third language. They therefore recommend the use of both the foreign language and the mother tongue in science classrooms in Africa.

2.7.6 The role of practical work in science teaching and learning

Practical work has been hailed as an essential component of doing science. Hands-on learning experiences are key to the development of skills and the tying together of practical and theory. Good quality practical work does not only engage students with the processes of scientific enquiry, but also communicates the excitement and wonder of the subject. Practical work is an integral part of the learner-centred pedagogy.

Practical work can be defined as any teaching and learning activity in science which at some point involves students in observing or manipulating/handling the real objects and materials they are studying (Millar, 2004; Hattingh, Aldous & Rogan, 2007). Practical work has had its fair share of praise and criticism in practice, since its inception in science curricula, from developing problem-solving and manipulative skills to being seen as ill-conceived and having little educational value (Hodson, 1990).

In Namibia, the National Curriculum for Basic Education (NCBE) envisaged the development of scientific literacy, which entails understanding scientific processes, the nature of scientific knowledge and the ability to apply scientific thinking skills ... to enable learners to formulate hypotheses, investigate, observe, make deductions and understand the physical world in a rational scientific way, through the Natural Sciences (Namibia, Ministry of Education [MoE], 2008). These could be achieved through the use of practical work and demonstrations as part of the practice in science classrooms.

Wellington (1998) argues that practical work can improve learners' understanding of science and promote their conceptual development by allowing them to visualise the laws and theories of science. Practical work is motivating and exciting as it generates interest and enthusiasm and helps learners remember things. It is for this reason that slogans such as 'I do and I understand' were invoked.

An effective strategy for improving practical work is to shift from a 'cookbook' approach, where learners have to follow a set of instructions to verify and confirm predetermined scientific principles, to the Predict-Explain-Explore-Observe-Explain (PEEOE) approach (Maselwa & Ngcoza, 2003), where learners are encouraged to make predictions and explain them before exploring the concepts, make observations and explain them in their own words. This approach enables learners to get involved in 'hands-on', 'minds-on' and 'words-on' practical activities that would enhance conceptual understanding (Millar, 2004; Maselwa & Ngcoza, 2003).

2.8 Theoretical Framework

2.8.1 Pedagogical content knowledge (PCK)

This study is grounded in the theory of pedagogical content knowledge (PCK), a concept developed by Lee Shulman in the late 1980s, in which he revealed that teachers have three kinds of knowledge, and that one piece of that knowledge varied from subject area to subject area (Shulman, 1986). "Shulman claimed that teachers needed strong PCK to be the best possible teachers. He asserted that teachers had a unique way of looking at practice and his intrigue with the manner in which they did so encouraged an examination of teachers' pedagogical thinking in ways that it was anticipated, would reveal what teachers must know to best teach their content to students" (Loughran, Mulhall & Berry, 2004:371).

Teachers need general pedagogical knowledge (PK). This knowledge refers to the broad principles and strategies of classroom management and organization that appear to transcend subject matter and is considered the most appealing manner in which teachers organize and present subject matter by telling, explaining, guiding, illustrating, demonstrating, and using texts, computers, media, or workbooks to repackage subject matter into a form that is accessible to the learners (van Driel, Verloop & de Vos, 1998; Okanlawon, 2010). Every teacher of any subject area needs that same basic kind of knowledge.

The second type of knowledge that every teacher needs is content knowledge. The content knowledge (CK) is the substance (subject matter) of what teachers will teach (van Driel, Verloop & de Vos, 1998).

The third type of knowledge is pedagogical content knowledge (PCK). This is the knowledge of how to facilitate the learning of the subject the teacher will be teaching to learners in a variety of classroom contexts. In his own words Shulman (1986: 9) describes PCK as a "particular form of content knowledge that embodies the aspects of content most germane to its teachability' and that comprises 'the ways of representing and formulating the subject that make it comprehensible to others".

PCK comes at the intersection of CK and PK, and the key ingredient to developing PCK is repertoire. A repertoire consists of teaching ideas and activities that teachers can do with learners in their classroom for them to learn. The repertoire gives the teacher the security of knowing that they have things to do and materials to help do them. PCK also encompasses knowledge of learners' ideas about specific topics. Subject matter knowledge and experience in teaching are

assumed to be two necessary ingredients for the development of teachers' PCK (Davis & Petish, 2000).

In my study, two Natural Science teachers were observed teaching the topics about the composition of air and the characteristics of living organisms, although the ideal situation would have been to observe them teach topics involving the nervous system and drugs as well as elements of the Periodic Table, since they are three competencies in which learners performed poorly in the SATs. The PCK concept would help me analyse these teachers' repertoires of teaching ideas in facilitating and mediating learning of Natural Science during the lessons.

2.8.2 Socio-cultural and knowledge integration perspectives

This study is also underpinned by two complementary theoretical perspectives, socio-cultural and knowledge integration. The socio-cultural perspective as identified with Vygotsky (1978) is deemed appropriate to inform this study. The socio-cultural theory posits that learners participate in a broad range of joint activities and internalize the effects of working together; they acquire new strategies and knowledge of the world and culture (Scott & Palincsar, 2012).

Learners' participation in social interactions and culturally organized activities influence their learning of science. Learning is thought to occur through interaction, negotiation, and collaboration. Wertsch (1991) has identified that social interaction is mediated by tools and symbols, which could include language (see Section 2.7.5), diagrams and so forth. Teachers as experts in the subject should scaffold learners and mediate learning through the use of tools.

Mediation overlaps and complements scaffolding in that Vygotsky's theory of scaffolding describes the assistance that a teacher gives learners to help them safely take risks and reach higher than would be possible by the learners' efforts alone. Vygotsky's theory of scaffolding helps teachers assist their learners in achieving those skills. Scaffolding is provision that makes the specific learning tasks and activities easier for the learner and thus more likely to be successful (Turuk, 2008).

Blending the socio-cultural theory with knowledge integration perspective, which is a view of how people learn (Linn, 1995), is believed to be a powerful ground for this study. Knowledge integration has been successfully used in analysing and describing learners' learning of science (Davis & Petish, 2001).

It is argued that in the socio-cognitive perspective, learners are assumed to learn through adding ideas to their repertoires, making links and distinctions where necessary, and identifying weaknesses in their own knowledge. They also reconcile ideas that appear contradictory (Linn & Hsi, 2000).

Science learners who appropriately link several types of knowledge have better integrated and thus more robust understandings of science content (Davis & Petish, 2001). In this study, the knowledge integration idea is focused towards an assumption that science teachers' content knowledge development has a significant influence on learners' learning of science. Knowledgeable teachers ensure congruence between assessment and pedagogical practices.

2.9 Concluding remarks

As part of national assessment, national SATs are a very important component of Namibia's education system, particularly at primary level. It is therefore crucial that teachers understand the principles underlying this practice and integrate them into their daily pedagogical practices.

The underlying premise of SATs is that information about primary school learners' learning and to some extent how certain competencies in the syllabus have been taught would be made available. The onus is on teachers to be able to interpret the reports with a view to identify grey areas for teaching and learning improvement.

SATs in Namibia are low stake assessment, as compared to similar practices elsewhere in the world. They are used for diagnosing the education system whereas in other parts of the world (USA, for example), they are used for graduating learners to the next higher level in schools and to hold schools accountable for their performance. Hence, teachers' views regarding standardised tests in the Namibian context may not necessarily resonate with that of their counterparts elsewhere in the world, in this regard.

However, some international assessment practices, such as TIMSS, serve the same purpose as Namibia's SATs. These tests are aimed at providing information about educational achievement for teaching and learning improvement decisions.

Teaching encompasses different skills and knowledge that teachers have to develop continuously. The concept of pedagogical content knowledge in itself entails key elements that an effective teacher should possess. Moreover, teachers should regard themselves as learners as they need to identify the weaknesses in their knowledge and constantly integrate new ideas into their existing repertoire.

In the next chapter, I explain how the research study was carried out. The research goal, design, orientation, the choice of research site, and participants are discussed and justified.

Chapter Three

Research Design

3.1 Introduction

In this chapter I explain how the research was carried out. The research goal, design, orientation, the choice of research site, and participants are discussed and justified. The techniques used to generate and analyse data, the methods of data analysis and validation, and ethical considerations are clarified.

3.2 Research methodology

3.2.1 Research design and orientation

Research design is an outline of the stages involved in the whole research process and the data generation techniques employed, together with the steps that will be taken to analyze the data (Maxwell, 1996). Research design therefore entails the underlying structure and interconnection of the components for the study and the implications of each component for the others (Maxwell, *ibid*).

A qualitative investigation following an interpretive case study approach was used for this study. However, questionnaires which are typically quantitative in nature were used to capture teachers' general views about SATs. According to Creswell (2006:8), "the combination of quantitative and qualitative approaches provides a better understanding of research problems than either approach alone".

Combining qualitative and quantitative approaches is a powerful tool in obtaining a clear picture of the data and of the research subjects. Furthermore, combining qualitative and quantitative research approaches allows triangulation of data, which is essential in achieving validity in research (Patton, 1990).

3.2.2 Interpretive paradigm

An interpretive paradigm seeks to understand the subjective nature of human experience. In other words, this approach attempts to get inside the person and understand their actions from within (Cohen, Manion & Morrison, 2007). For these reasons, it relies on field studies, with emphasis on observations and in-depth interviews (Jackson, 1995).

An interpretive approach is concerned with interpreting and understanding human actions. The goal of interpretive research is to reach an understanding of some phenomenon that is not yet well understood. Interpretive research assumes that the best way to understand such a phenomenon is by studying it in natural contexts such as a classroom. The aim is to provide a rich description of the phenomenon and, if possible, to develop some explanation for it (Ellis, 1993).

This study sought to capture Natural Science teachers' perspectives on grade 7 Natural Science SATs, with a view to establishing whether or not they were able to interpret and use the resultant reports in their teaching and learning activities aimed at improving learners' learning of the identified competency areas as asserted by the SATs' objectives.

Furthermore, an effort was made to investigate the grade 7 Natural Science teachers' pedagogical practices with a view to understanding the role they played in learners' performance in the SATs. The SATs reports indicated that learners' performance in the three identified competencies (although they were not the only ones in which learners performed poorly) was not good in most of the primary schools across the country (see Chapter 4, Graph 4.1).

Interpretive research places primary emphasis on the process of understanding. In this study, I thus endeavoured to identify patterns that might emerge and interpret them in order to gain a better understanding of the phenomenon being studied (Connole, 1998).

3.2.3 Case Study

Case study research is a qualitative research approach in which researchers focus on a unit of study known as a bounded system (Gay, Mills & Airasian, 2009). A case study is an investigation defined by an interest in a specific phenomenon within its real-life context (Anderson, 2000; Cohen, Manion & Morrison, 2007).

Case studies are particularistic (focused on a particular phenomenon), descriptive (the end result includes a rich description of the phenomenon focused on) and heuristic, in that they illuminate the readers' understanding of the phenomenon under study as they serve as a narrative account that provides new insights into the way things are and the kind of relationships that exist among participants in the study (Gay, et al., 2009).

Case studies are useful when describing the context of the study and the extent to which a particular programme or innovation has been implemented. They are also useful for researchers

who are interested in providing causal explanations such as describing the process by which a particular innovation had a particular effect on the participants in the setting (Gay, et al., *ibid*).

The underlying intention of national SATs was to provide feedback to teachers about their learners' acquisition of skills and competencies in the tested curricula. In this case, teachers' perceptions, interpretation and use of the grade 7 national SATs report were sought to illuminate whether or not the implementation of tests provided the intended information, aimed at improving learner performance in the education system. Furthermore, it was deemed important to explore how teachers' content knowledge of Natural Science could have contributed to the way the learners had performed in the standardised tests.

3.2.4 Research goal and questions

The main goal of this study was to investigate how the grade 7 Natural Science teachers taught the subject matter in response to learners' poor performance in the 2010 SATs, particularly in the three competencies in the Natural Science syllabus, namely, *identifying a reflex arc from diagrams, describing the influence of drugs on the nervous system and classifying elements as metals and non-metals*.

As mentioned in Chapter 1, Section 1.4, this was done with a view to understanding the performance of learners in the three competencies, although it was not possible to observe teachers teaching those three competencies. However, examination of learners' written notes and teachers' lesson plans and interviews provided crucial evidence with regard to how the three competencies were taught. Furthermore, the lessons that were observed, although on other competencies that the teachers were teaching at the time of my data gathering, provided a platform for me to get firsthand exposure to teachers' Natural Science pedagogical practices, in light of what is discussed in Chapter 2 (Section 2.7.1).

To achieve this goal, the following were the research questions:

- What are teachers' perceptions of the grade 7 Natural Science SATs?

To answer this question, questionnaires with three indicators (see Appendix D) were used to capture the general impression in this regard. These indicators were: Natural Science teachers' perceptions, interpretation and use of the SATs reports.

- How do teachers interpret and use the Natural Science SATs reports to improve learners' performance in identified poorly performed competencies?

This question was answered through the open-ended questions in the questionnaires as well and by interviewing the teachers.

- How were the three competencies in which learners performed poorly in the 2010 SATs taught in 2012?

To answer this question, an analysis was done of learners' written notes on topics related to the three competencies, and of teachers' lesson plans, to ascertain how they were taught. The grade 7 Natural Science syllabus was used to cross-check the competencies and content in the learners' note books.

- What influence does teachers' content knowledge and pedagogical practices have on learners' achievement?

This question was answered through lesson observation coupled with stimulated recall discussion as well as through interviews conducted after the lessons. The lessons were video-taped. Interviews and stimulated recall discussions were audio-taped. The video and audio data were transcribed.

3.2.5 Research Site

I was an Advisory Teacher for Physical Science and Natural Science in Ohangwena region for almost four years. I have since moved to the Directorate of National Examinations and Assessment (DNEA) as an Education Officer for Research and Development. I was new to the teachers in Khomas region, where the study was conducted, and had to work harder to establish a good rapport with the participant teachers by visiting different schools and introducing myself to the teachers. Through these efforts I managed to get two teachers who opened up to participate in the case study. This study was thus conducted in two urban primary schools in the township of Katutura in Windhoek, Khomas region.

Being an Education Officer in the body that administers the SATs, the DNEA, and having access to the reports on performance of all regions in the country, it placed me at an advantage as I could compare and identify the performance of all different regions in different competencies.

This helped in providing a generalised picture of how learners performed country- wide, particularly in the three competencies of interest in this study.

The Khomas region is one of the regions whose learners' performance in the 2010 grade 7 SATs overall was better than other regions. However, the performance of many schools in this region in the three competencies was lower than other competencies tested as evident in the SATs reports (see Chapter 4, Graph 4.2.1 and Appendix K). This means that the majority of learners were not mastering the three basic competencies.

If learners were doing well in some competencies, why were they not doing the same in the three identified competencies? It was against this background that I decided to focus on the three competencies, namely identifying a reflex arc from diagrams, describing the influence of drugs on the nervous system, and classifying elements into metals and non-metals. Given the magnitude and type of study (case study) as well as based on the number of teachers that agreed to participate, the research was limited and conducted at two primary schools.

3.2.6 Research participants

Ten teachers from ten schools in Khomas region answered the questionnaires, although thirty five questionnaires were sent out. The questionnaires (see Appendix D) were used to capture the general perceptions of grade 7 Natural Science teachers of SATs. This was done with the intention of ascertaining teachers' general awareness of this assessment practice, since it was implemented for the first time in 2010 and the first follow up tests were scheduled for November 2012.

A comprehensive qualitative investigation concentrated on two teachers from two primary schools. The two teachers were chosen based on their willingness to participate. Other teachers seemed not too keen on participating in the detailed study although they answered the questionnaires. The initial idea was to observe teachers teaching the content on reflex arc, nervous system and drugs, and classification of elements, as these were the areas where learners did not do well in the SATs. The performance of many schools nationwide in these three competencies as tested in the SATs (see Chapter 4, Graph 4.2.1) was below 50%.

Unfortunately, this was not possible because the teachers who agreed to participate had already taught those competencies earlier in the year. I was however able to examine learners' written notes on the three competencies. Due to this technicality, I was only able to observe what teachers were teaching at that present moment as I believe it will still illuminate the teaching practice in general and its possible influence on learners' learning. One teacher (T1) was

teaching the *composition of air* while the other (T2) was teaching the *characteristics of living organisms*.

The lessons were videotaped and stimulated recall discussions were held with individual teachers. Thereafter, semi-structured interviews were conducted to probe for further clarifications.

Gay, et al. (2009:135) say that "because many potential participants are unwilling to undergo the lengthy demands of participations, sampling in qualitative research is almost always purposive". Purposive sampling is a process of selecting a sample that is believed to be representative of a given population.

For this reason, I have familiarised myself with the research setting, have obtained information that I have used to select participants whom I judged to be informative, before selecting the sample (Gay, et al., *ibid*) as the tests were written in all the public primary schools in Namibia.

3.3 Data generation techniques

3.3.1 Document analysis

Document analysis entails a detailed examination of documents produced across a wide range of social practices, taking a variety of forms, from the written word to the visual image (Wharton, 2006). Documents, as a record of human activity, provide a valuable source of data in case study research. Documents can provide a rich source of data pertaining to the day-to-day activities surrounding the case (Olson, 2009).

The SATs results were presented in reports that were furnished to all primary schools that took part in the tests country wide. These reports consisted of two key parts: the percentage correct scores and the description of performance level categories by competencies (see Table 4.2.1(a) and (b) respectively).

The SATs reports were analysed to ascertain the performance of schools in different competencies whereby the performance in the three competencies, as identified, was poor across the country as illustrated by the national average (see Chapter 4, Table 4.1).

Learners' written work, teachers' lesson preparations and textbooks used by the teachers, focusing on the three identified competencies were also analysed to assess the validity and reliability of data gathered through other techniques.

3.3.2 Questionnaire

The questionnaire (see Appendix D) was used to obtain the general perceptions of ten Natural Science teachers in Khomas region. The questionnaire gathered data using the Likert scales (**Agree, Not Sure and Disagree**) and also provided for open-ended questions for comments. Questionnaires allow the researcher to gather a large amount of data in a short period of time. However, the return rate may not be as the researcher anticipated. Some participants might have no intention of completing the questionnaire; some who meant to complete could have put it off for too long and eventually forgotten or lost it. For these reasons, follow-up on questionnaires is advised (Gay, et al., 2009).

Thirty five questionnaires were sent out to schools and only ten were returned. Follow-up effort proved futile as teachers kept promising and eventually could not locate the questionnaires. This was an interesting experience as it confirmed what research says about questionnaires' return rate (Gay, et al., 2009). I decided to work with the ten questionnaires received and went on with the study.

Aspects that were explored included teachers' perceptions of the national SATs, the interpretation and use of reports of test results (potential value, their use or intended use of it, how they have used it, any difficulties they may have in interpreting it). These aspects were referred to in the questionnaires as indicators.

3.3.3 Observations

An observation is generally regarded as an important data- gathering strategy for a qualitative researcher because it can be done anywhere (White, 2005). Observations were carried out to capture teaching practices of two Natural Science teachers with a view to understanding the performance of learners in the SATs. The lessons were videotaped to capture the teachers' actions during the lesson, with minimal identification of learners. Their interactions within groups were not captured (Kasanda, Lubben, Gaoseb, Kandjeo-Marenga, Kapenda & Campbell, 2005).

Stimulated recall discussions were conducted with the teachers after the lessons. Lyle (2003:861) defines stimulated recall (SR) as "an introspection procedure in which (normally) videotaped passages of behaviour are replayed to individuals to stimulate recall of their concurrent cognitive

activity". He adds that stimulated recall has been used extensively in educational research in teaching and other fields.

Stimulated recall discussions were also used to analyse teachers' pedagogical practices with a view to capturing how they communicate the content to learners, mediate learning and how their content knowledge impacts learners' understanding of science concepts during the lessons.

I have taken cognisance of the critique that during the stimulated recall discussions, there exists the possibility that the teacher may be reacting to what he/she is viewing on the videotape, rather than recalling the taped episode, and that narratives produced from stimulated recall may not represent the conscious or unconscious cognitions taking place at the time of the videotaped episode (Tjeerdsma, 1997; Wilcox & Trudel, 1998). Nonetheless, this procedure further served as member checking by the teachers for ethical purposes.

3.3.4 Semi-structured interviews

Follow–up to questionnaires and lesson observations, semi-structured interviews with the two participant teachers were conducted to get clarification on particularly the interpretation and use of the SATs report and to solicit their experiences of teaching Natural Science in their schools. This was done to capture teachers' views about their own pedagogical practices, how their teaching repertoire helped them to teach well or constrained their practices.

The semi-structured interviews were also used to ascertain the extent to which teachers interpreted the SATs reports in order to be able to identify grey areas in the Natural Science syllabus. My semi-structured interviews involved pre-prepared questions and follow-up/probing questions that were not prepared. Semi-structured interviews allow the researcher to ask what they really want to, but also allow for probing in search for meaning and understanding (van der Mescht, 2011). The interviews were transcribed *verbatim*, to illustrate the teachers' exact words.

3.3.5 Piloting

Pilot testing provides information about deficiencies and suggestions for improvement (Gay, et al., *ibid*). The questionnaires and the interview schedule for the semi-structured interviews were piloted to ten teachers. In the questionnaires, one question on the appropriateness of the English usage in the test forms (question papers) was removed because teachers did not have access to

the test forms if they were not appointed as test administrators. This is because the assessment design underpinning the SATs does not allow question papers to be publicised.

It also came to light that the question seeking to establish whether teachers were using the report needed to be personalised so that teachers could answer it based on their own contexts, as they were not sure whether other teachers were using the reports or not. A critical friend who is an expert with questionnaires was asked to scrutinise the questionnaire and advice was given on how to improve it.

3.4 Data Analysis

Quantitative data from the questionnaires were analysed by tabulation to ascertain the frequencies of responses regarding teachers' perceptions and experiences of SATs as indicated in different scales per indicator. The scores of the responses of teachers on the scales were presented on a bar graph (see Chapter 4, Graph 4.3).

In qualitative research, findings are typically expressed by quoting interviews or relating experiences the researcher has had in the field (Jackson, 1995). Data generated through video-taped lessons, analysis of learners' written notes and interviews were inductively analyzed by transcribing the video-taped and audio-taped interactions with teachers, with a view to establishing analytic statements (categories/themes) regarding teachers' pedagogical practice when dealing with subject content.

According to White (2005:186), the following comprise the cyclical process of data analysis:

- Becoming familiar with the data and identifying main themes in it (reading);
- Examining the data in depth to provide a detailed description of the setting, participants and activities (describing);
- Categorising and coding pieces of data and physically grouping them into themes (classifying); and
- Interpreting and synthesising the organized data into general conclusion or understanding (interpreting).

During this cyclical process, the generated data sets were used to identify themes related to teachers' interpretation with regard to the use of the SATs reports, the ways in which teachers attempted to mediate learning during the lessons, and the possible influence of teachers' Natural Science content knowledge on learners' acquisition of intended skills and competencies.

3.5 Validity

According to Cohen, Manion and Morrison (2007:133), "validity is an important key to effective research. If a piece of research is invalid then it is worthless. Validity is thus a requirement for both quantitative and qualitative/naturalistic research".

In qualitative research, validity might be addressed through honesty, depth, richness and scope of the data achieved, the participants approached, the extent of triangulation and the disinterestedness or objectivity of the researcher (Cohen, et al., *ibid*). I also did member check by giving the transcripts of interviews to the research participants, and through the stimulated recall discussions.

To achieve validity and reliability of data gathered, methodological triangulation was employed. Methodological triangulation involves using more than one method to gather data, such as document analysis, interviews, observations and questionnaires, in the context of this study (Guion, Diehl & McDonalds, 2011). Furthermore, the reliability of the questionnaire was ensured by piloting it with teachers who were not part of the study.

3.6 Ethical Considerations

Various authors have alluded to the ethical dilemmas that a qualitative research is often confronted with as a result of human participants. Several ethical issues must be considered when conducting research in education.

According to Callahan and Hobbs (1998:1), "the primary concern of a researcher should be the safety of the research participants". Privacy and confidential concerns should also be approached carefully. Lankshear and Knobel (2004:101) state that "educational research ethics are concerned with ensuring that the interest and well-being of people are not harmed as a result of the research being done".

Prior to the research, permission to conduct research (see Appendix A1 & A2) was sought from the Director of Education in Khomas region, where the participating schools are located. Consent to participate in the study (see Appendix B) was also sought from teachers.

An explanatory letter accompanied by the proof of permission to conduct the research in the region was sent with the questionnaires to schools (see Appendix C).

The aim of the research was explained to the participants, assuring them that confidentiality and anonymity would be upheld throughout the study. Participation would be voluntary and

withdrawal at any point of the study would be allowed. This was applicable to the two participant teachers for interviews and lesson observations.

Furthermore, it was explicitly indicated that the video-taping would be used for the purpose of this study only. However, participants would be urged to be truthful as the outcome of the study could inform important interventions for continuous professional development of all teachers.

3.7 Limitations

Given the small and localized sample of teachers, viz., a total of ten teachers for the questionnaires and the small size of the sub-sample of two teachers for the interviews and observations, the results may not be generalized across the Khomas region or the whole of Namibia. Furthermore, it was not possible to observe the two teachers teaching the three identified competencies due to work schedule congestions, which could have enriched the findings.

3.8 Concluding remarks

The research study was conducted such that it combined qualitative with quantitative methods through the use of questionnaires. This was done in order to triangulate the data regarding the perceptions of Natural Science teachers on SATs in Khomas region, the data regarding the interpretation and use of the SATs reports aimed at improving learner achievement.

Although the research sample is small, the data generated could illuminated the perceptions of teachers on the national SATs and the extent to which Natural Science teachers were able to interpret and use the reports to inform their classroom practices as envisaged in the underlying principles of those tests in Namibia. The study attempted to provide new lenses through which to look at primary school teachers' content knowledge of Natural Science and pedagogical practices for targeted support and guidance.

In the next chapter, I present the findings from the first phase of the data gathering process.

Chapter Four

Data presentation and analysis: Phase One

4.1 Introduction

In this chapter, findings from the first phase of the data gathering process are presented. The first phase of the study aimed to find out what perceptions the grade 7 Natural Science teachers had of the SATs as a new form of assessment in Namibia, as it was implemented for the first time in 2010.

Furthermore, during this phase, the study endeavoured to establish whether teachers were able to interpret the SATs' reports and eventually use them to improve learners' learning of identified competencies in the Natural Science syllabus.

Data gathering techniques used in this phase were document analysis and questionnaires. Document analysis of the SATs reports provided baseline data that informed the choice of the main data gathering techniques for the study. Data from document analysis of the SATs reports and prescribed textbooks for grade 7 and questionnaires are presented in this chapter.

4.2 Document analysis

4.2.1 Standardised achievement tests report

There are two SATs reports that each school receives. One is quantitative and the other is qualitative. The quantitative section gives the overall performance comparison of the school, region and national in percentage scores while the qualitative section gives the competency-based description of the performance level categories (see Table 4.2.1 (b)).

For illustration in this study, a simplified extract of the two sections of the report is shown in Table 4.2.1(a) and Table 4.2.1(b) respectively.

		Cognitive Level	National % scores	Khomas Regional % scores	School % scores
Competencies	Identify a reflex arc from diagrams	Knowledge	46	58	30
	Describe the influence of drugs on the nervous system	Comprehension	21	54	43
	Classify elements into metals and non-metals	Application	21	33	34

Table 4.2.1(a): Quantitative section showing percentage scores

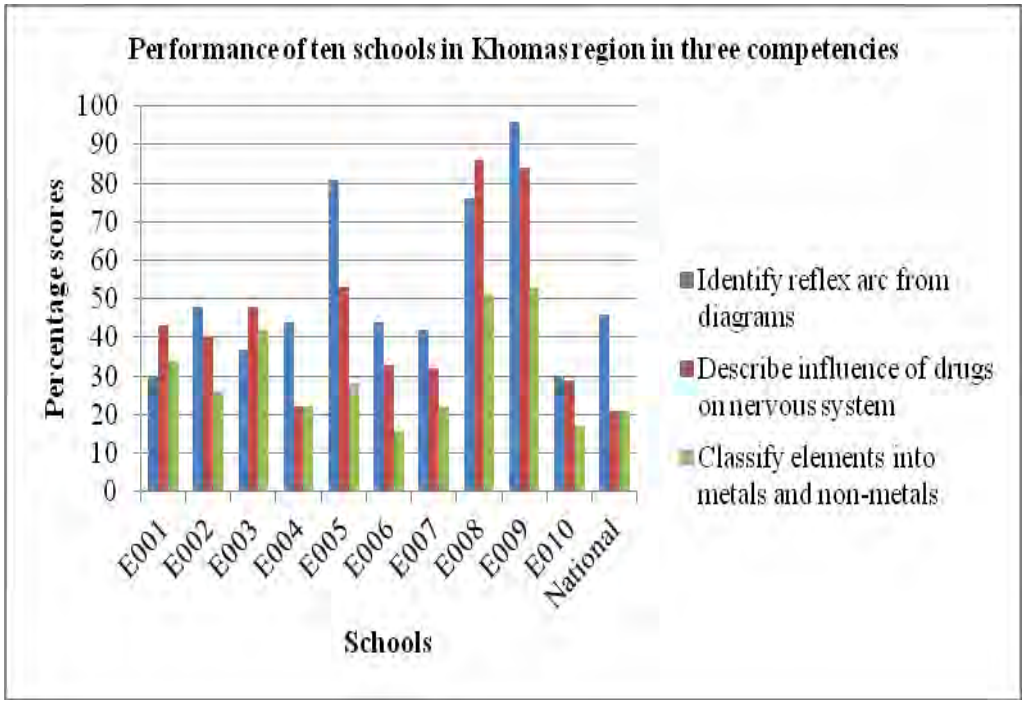
Table 4.2.1 (a) above shows the key information that the report seeks to communicate: percentage scores per competency as it appears under national and regional groups, and individual school. The competencies are as they appeared in the Natural Science syllabus, although in the whole report some competencies were narrowed to enable them to be assessed by multiple choice questions. Several questions were based on the competencies and cognitive levels according to Bloom's Taxonomy.

		Performance Level Categories			
Competencies	**Cognitive Level**	**Below Basic**	**Basic:**	**Above Basic:**	**Excellent**
Identify a reflex arc from diagrams	Knowledge	A learner cannot identify a reflex arc from diagrams	Can identify a reflex arc from diagrams	Can identify a reflex arc from diagrams	Can identify a reflex arc from diagrams
Describe the influence of drugs on the nervous system	Comprehension	Can describe **one** influence of drugs on the nervous system	Can describe **at least one or two** of the influence of drugs on the nervous system.	Can describe influence of drugs on the nervous system such as loss of brain control	Can describe influence of drugs on the nervous system such as loss of brain control
Classify elements into metals and non-metals	Application	Cannot classify elements into metals and non-metals	Can classify **some** elements into metals and non-metals	Can classify **most** of the elements into metals and non-metals	Can classify **most** of the elements into metals and non-metals

Table 4.2.1(b): Qualitative section showing description of performance level categories

In the report, learners were classified according to their abilities (performance). Table 4.2.1(b) above shows the description of what learners can do in each performance category per competency.

Graph 4.2.1 below shows an example of how some schools in the Khomas region performed in the three competencies. The national average is included for comparison.



Graph 4.2.1: Performance of some schools on three competencies in the Khomas region

As is evident from Graph 4.2.1, many schools in Khomas region performed poorly in the three competencies in comparison with the national average. The percentage scores for many schools often fell below 50%. The schools whose performance is shown are those whose teachers responded to the questionnaire.

4.2.2 Textbooks

According to the approved textbook catalogue for 2012 from the National Institute for Educational Development (NIED), there are four prescribed textbooks for grade 7 learners in Namibian schools (MoE, 2012). However, only three are commonly used in schools. These textbooks are "Friendly Earth Series Natural Science and Health Education", "Natural Science and Health in Context" and "Go for Natural Science and Health Education".

An analysis of information based on the three identified competencies contained in the prescribed grade 7 textbooks was done.

Friendly Earth Series Natural Science and Health Education

This textbook is well aligned to the Natural Science syllabus in terms of topics listed. However, further scrutiny revealed that it does not explicitly or sufficiently illustrate necessary information needed to address the three basic competencies in the syllabus. In the first instance, it does not contain any diagram illustrating a reflex arc as the syllabus requires. Hence, if a teacher is not confident enough, it is possible to skip this competency due to lack or shortage of information, because without a diagram learners would never be able to identify a reflex arc.

Secondly, the way the content matter is presented in this textbook about the influence of drugs on the nervous system did not use the word 'influence' as is in the syllabus, although it clearly states that drugs can cause loss of memory or brain control or that they were addictive amongst others causes. These are the facts that the syllabus refers to as influence of drugs on the nervous system.

As far as the competency "classify elements into metals and non-metals" is concerned, the textbook only defined the term 'element' and went on to state that "all elements that exist on Earth are classified in a table called a Periodic Table and on this table, scientists have classified together elements with similar properties and separated those which are different from one another" (Herbert & McNamara, 2008:36).

Furthermore, in the diagram of the Periodic Table there is no indication of which elements are metals and which are non-metals. The grade 7 syllabus requires learners to know at least the first 10 elements on the Periodic Table, as well as few specified elements with atomic numbers higher than ten, for example, U, Cu, Au, Fe, Ag, Al, N, Pb, Cl and their symbols. They should also be able to classify them as either metals or non-metals.

Natural Science and Health in Context

This textbook also shows quite good alignment to the grade 7 Natural Science syllabus in terms of topics listed. However, as with the previous textbook, it lacks diagrams to illustrate the reflex arc. Nor does it have a diagram to show the nervous system in general under the subtopic 'The nervous system and drugs'.

This textbook came close to using the syllabus language by stating that "drugs affect the nervous system by changing the brain's chemistry or by weakening the transmission of nerve impulses. It further states that the main effects of drugs are sleepiness, dulling of pain (numbness) and

illusion" (Elphick, Olivier, Tyson & Beljon, 2005:129). Like the previous textbook, it uses the word 'effects' instead of 'influence' as stated in the syllabus.

Unlike "Friendly Earth Series Natural Science and Health Education", this book gives a much clearer picture when it comes to the classification of metals and non-metals. It clearly states that "if you look carefully at the Periodic Table shown above (on page 47: *my addition*) you will see that the elements can be classified as either metals or non-metals" (Elphick, et al., 2005:47). The Periodic Table referred to clearly illustrates the part containing metals and the other with non-metals, by shading the blocks containing non-metals and leaving the blocks containing metals clear and then added the key ("Friendly Earth Series Natural Science and Health Education") for example, un-shaded = metals, shaded = non-metals).

Go for Natural Science and Health Education

This textbook is somewhat different from the two other textbooks ("Friendly Earth Series Natural Science and Health Education" and "Natural Science and Health in Context") discussed above, in that it responds to the syllabus much more explicitly. One of the few similarities with others is that it is also aligned quite well to the grade 7 syllabus. It is more illustrative in that most of the concepts are represented with colourful and meaningful sketches and diagrams. It also exhibits many meaningful activities to consolidate the content and make learners think more, through unanswered questions related to learners' experiences.

This textbook has a sketch of a reflex arc, particularly the knee jerk reflex and eye-light reflex. This kind of illustration will surely contribute greatly to the learners' mastery of basic competencies such as identifying a reflex arc from diagrams.

Another similarity with the other two textbooks is that it does not use the word influence. It simply states that "drugs can make parts or all the nervous system work more quickly, slowly, in a confused way or stop working all together. It further states that drugs have different effects on the nervous system such as memory loss, altered responses to sights, sound, time and touch, disturbances in thinking *etcetera*" (Darwin, 2008:165).

This textbook has a diagram of a Periodic Table as well and its hydrogen is at the correct position. It does not illustrate which elements are metals and which are non-metals on the Periodic Table; although an effort was made to show which common elements are solids, liquids and which ones are gases. This information is not sufficient in terms of determining which

elements are metals and which are non-metals, as there are non-metals that are solids for example, boron or carbon.

However, an effort was made to achieve this competency in one of the activities where learners are required to classify different materials into metals and non-metals; and eventually, the one requiring learners to name metals and non-metals in the Periodic Table and classify oxygen, water, copper, carbon dioxide and aluminium as metals or non-metals. This textbook is better to use in all schools if all learners are to get better scores in the SATs as it appears more accessible in terms of graphics used to illustrate different concepts. Moreover, I believe the language used in this textbook is appropriate for grade 7 learners.

4.3 Questionnaires

Thirty-five questionnaires were distributed to teachers and only ten were received back. Follow-up on other questionnaires proved to be a futile exercise. The questionnaire captured the gender as well as the years of Natural Science teaching experience of teachers. However, this information was not relevant to this study in terms of analysis. The gender information was necessary for ease of reference when using the responses, for example, she or he. The years of teaching experience was needed to ensure that the targeted group of teachers were experienced and not new teachers.

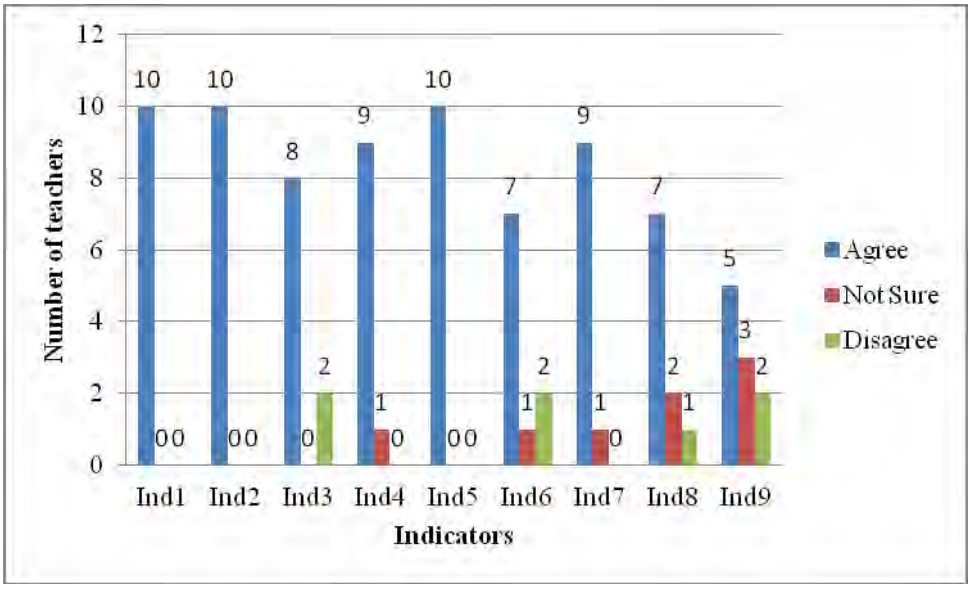
This information enabled me to select the teachers for interviews and lesson observations. The study was intended for teachers who had taught Natural Science before and during the baseline testing year which was 2010, in Khomas region. The respondents' years of experience ranged from 2 to 26.

The questionnaire attempted to capture teachers' general perceptions about SATs since it is a new form of assessment of learning in the Namibian education system. It was implemented for the first time in grade 7 in November 2010 as a baseline test and the first follow-up tests were expected to be written in November 2012.

The questionnaire comprised nine indicators and was supported by open-ended questions (see Appendix D). The responses were expected to agree or disagree with the indicators in the questionnaires. Table 4.2.2 and Graph 4.2.2 below show how the teachers responded to the questionnaires.

Indicators	Code	Agree	Not Sure	Disagree
Helps inform the teaching and learning of Science	Ind1	10	0	0
Helps teachers identify grey areas in the syllabus	Ind2	10	0	0
Helps monitor learner improvement from year to year	Ind3	8	0	2
Report is user friendly (format)	Ind4	9	1	0
Report is clear and understandable	Ind5	10	0	0
Report provide sufficient information to teachers	Ind6	7	1	2
All competencies tested are in the syllabus	Ind7	9	1	0
Teachers can interpret the report (meaning & understanding)	Ind8	7	2	1
Report is used by teachers in their teaching	Ind9	5	3	2
Total Number of respondents		10		

Table 4.2.2: Teachers' responses on their perceptions of standardised achievement tests



Graph 4.2.2: Teachers responses on perceptions of standardised achievement tests

Table 4.2.2 and Graph 4.2.2 show the general perceptions of teachers about SATs. As evident, most teachers agreed with the indicators in the questionnaire.

4.3.1 Teachers' responses to open-ended questions

The codes **T1** to **T10** used below represent the ten teachers from whom questionnaires were received and **LRS** represents learners.

4.3.1.1 Teachers' perceptions of standardised achievement tests

The questions asked under this indicator served to capture teachers' perceptions of the SATs: these questions were:

- How do you think the test results would help to inform the teaching and learning of science in your school?
- How would the test results help teachers to provide assistance to learners with the competencies they find difficult to learn?
- How would the tests results serve as a good measure to monitor improvement of learners' performance over the years?

Most teachers agreed with the notion that SATs help to inform the teaching and learning of Natural Science in the schools and that the test results helped teachers to provide assistance to learners in competencies they find difficult to learn. Similarly, they felt that the test results would be a good measure to monitor whether or not there was an improvement in the performance of learners over the years.

T1 explained that "*the test results inform the nation about how Science teachers are delivering the subject, it also inform teachers about areas in the syllabus where learners are having difficulties and finally to see how learners were achieving the basic competencies*".

T2 stated that "*the test results help to identify areas of difficulties where learners need assistance and provide targeted assistance to learners. The questions asked are broadly asking general knowledge of all the work done previously*".

T3 explained that "*the test always indicate the strengths and weakness of learners which is a good yardstick for the teacher for improvement. These strengths and weakness might differ from year to year which give an indication on what to improve or work on every year. The tests also provide teachers with the awareness of what those competencies are and thus they can work to improve those competencies during their teaching/lessons*".

T4 expressed that "*the tests help the teacher to relate the basic competencies with cognitive levels and also indicates how specific teaching should be. The test is set nationally and this motivates teachers to work harder each year*".

T5 stated that "*the themes and competencies where my learners performed weak, I will put more effort and if learners perform weak in a certain basic competencies, teacher will put more emphasize on what they did not master or to the individual learner*".

T6 explained that "*the teacher should use the feedback when preparing lesson to concentrate on areas, learners performed poor by putting more emphasis on the competencies*".

T7 explained that the test "*reminds a teacher of competencies not covered and/or not well understood so the teacher can plan for remedial lessons on those difficult competencies*". This teacher however did not agree with the notion of these tests being a good measure for improvement or lack thereof over the years, asking that "*how can I measure the performance of learners if not the same learners are in the grade every year? Unless it starts with grade 5, but what about the new admissions? They also contribute to a higher or low percentage each year*".

T8 stated that "*teachers need the report to improve on the weakness and maintain the strength because the test results will help teachers to identify the competencies with low percentages and put more emphasis on those competencies. The report would help to monitor the learners' performance by comparing the results over the years*".

T9 explained that "*the test results will help a teacher to know the level of understanding of each learner. In this case, teacher will provide better assistance to learner, knowing exactly which areas of competencies learners need more attention*".

T10 indicated that since the tests are administered before the end of year examinations, in this way "*learners would gain experience and knowledge whenever they are taking the year end exams. It also help guide in developing teaching aid, learning materials and different techniques to present different competencies by looking at the learners performance. The test gives the teacher an overview of the competencies which were not well presented and achieved*".

The comments made by these teachers show that they are aware of the potential benefit of using the standardised achievement test reports to inform their teaching and learning repertoires.

4.3.1.2 Teachers' interpretation of the standardised achievement test reports

The questions I asked under this indicator attempted to find out if teachers were able to interpret the SATs reports in terms of the quantitative and qualitative sections of the report (see Tables 4.2.1 (a) and 4.2.1 (b)). The questions were:

- Have you received any guidance on how to use the information in the school report in your teaching or not (at a workshop or from a visiting Advisory Teacher)? Explain.
- Has your school performed better or poorer in Natural Science SATs than the schools in the region? Explain.
- Is there a competency, or competencies, in the report where the percentage correct scores were below 20 % in the Natural Science test?
- What percentage of the Grade 7 learners in the school demonstrated insufficient knowledge and skills across all themes in the Grade 7 Natural Science syllabus?

Teachers mostly agreed that they understood the meaning and could explain the data; hence they could interpret the standardised achievement test reports. However, two teachers did not indicate their choices.

T1 indicated that guidance was provided on how to interpret the reports. He could identify how his school performed compared to other schools in the region. He also indicated that 8% and 46% of his learners were classified below basic and basic achievement categories respectively.

T2 indicated that she was able to interpret the standardised achievement test reports although no guidance on how to interpret the report was given and she pointed out that her school performed better than many other schools in the Khomas region. However, she was not correct in stating that 27% of learners at her school demonstrated insufficient knowledge and skills across all themes in the syllabus, in other words learners who are classified in the below basic achievement category.

T3 also received guidance on the interpretation of the report and stated that his school's performance was second best in the Khomas region; attributing this success to the standard that they set for themselves and the monitoring system in their school.

T4 did not indicate whether he agreed or disagreed that he was able to interpret the report but indicated that no training was provided on how to interpret the SATs reports, however, he could correctly indicate that his school did reasonably well as only 21% of learners demonstrated insufficient knowledge and skills across all themes in the syllabus.

T5 indicated that guidance was provided on how to interpret the reports and that her school performed better than many other schools in the region, pointing out that only 3% of learners were classified below basic achievement category.

T6 specified that she received guidance from her principal on how to interpret the SATs report. She added that her school performed quite well compared to other schools in the region. She also correctly identified that only 2% of their learners were classified in the below basic achievement category.

T7 replied that he received guidance on how to interpret the report and pointed out that his school performed poorly. "*I have a high percentage of learners in below basic achievement category than the region*". He added that 33% of his learners demonstrated insufficient knowledge and skills across all themes in the syllabus.

T8 also agreed that she was able to interpret the report since training was given to her, adding that her school performed better than many schools in the region as only 6% of her learners demonstrated insufficient knowledge and skills across all themes in the syllabus.

T9 indicated that he did not receive any training on how to interpret the report and therefore was not sure about how his school performed. He stated that "*I would like to suggest that teachers receive training on how to interpret and use the report information in their teaching, a workshop is needed*".

T10 responded that a workshop was held to guide them on how to interpret the reports. He also indicated that his school did not do very well as 38% of learners were classified in the below basic achievement category.

The general impression of the teachers' responses on the interpretation of the standardised achievement test reports was that they were able to interpret the report, particularly with regard to how their schools performed, which is indicated by the percentage of learners falling in certain categories. However, none of the teachers made reference to the meaning of percentage scores as indicated in the reports, which are brought about by the performance of learners in each competency, topic and theme.

4.3.1.3 Teachers' use of the standardised achievement test reports in teaching

This indicator was not well answered. Many teachers left some questions blank and others made comments that otherwise needed follow- up. Some of the questions asked in this regard were:

- Do you have a copy of the Grade 7 Natural Science SATs reports for use in your planning of lessons or in your teaching?
- What have you learnt from this report?

- Is there information which is unnecessary and which could be taken out of the SATs reports?
- Have you compared the competencies tested in the SATs school report with the competencies in the syllabus?
- Have you taught all the competencies in the SATs reports to your 2012 Grade 7 learners?
- How are you using the information in the report in your teaching?

However, as reflected on Graph 4.2.2, teachers mostly agreed that the report format was user-friendly as the information was clear and understandable. Moreover, it provided sufficient information for the teachers, and they were using the report to inform their planning of teaching, although three teachers were not sure about the use of the reports in their own teaching and did not explain further.

T1, for instance, disagreed with the notion that teachers were using the report in their teaching although he did not elaborate on his own practice. He stated that "*perhaps teachers lack commitment toward their work or Science may not be their area of specialisation, so there is a need to be informed and I think this questionnaire is a wakeup call so that they can start revisiting the report and see where learners have failed*".

T2 indicated that she used the report by "*identifying learners who are below basic average for learning support*". This comment needed further elaboration because the 'how' question is still not answered; bearing in mind that learners who wrote the test are now in grade 8 and this questionnaire was answered by the current grade 7 teachers.

T3 also gave a comment that was not clear. When he responded to how he was using the report in his teaching, he said "*it gives me a better understanding of the level of competencies for remediation and enrichment and I keep the report at the back of my mind when I am teaching, so the report puts me in a better position when teaching*".

T4 often replied that he was not sure about the use of the report and left most of the questions on this indicator unanswered although acknowledging that the report was user friendly and understandable.

T5 commented that the report was useful, "*I have learned from the report that the topics that I have rushed through and cover within a short period, learners have performed weak*". She added that "*I first list all the themes/topics where my learners performed bad, I then studied these*

topics in the performance level descriptors whenever I am at the topic where my learners perform bad since 2011".

T6 did not give any explanation as to how she uses the reports despite agreeing that the report was clear and understandable but mentioned that the report informs her of the weaknesses to concentrate on.

T7 agreed that the report was clear and understandable and that he uses it but despite disagreeing with the use of the report by teachers, he pointed out that "*I only wait to reach that competency in my syllabus and compare it with the competency stated in the report. Competencies in the report are narrowed and I teach many*". This indicates that he uses the report anyhow.

T8 explained that she uses the report by identifying competencies with lower percentages and put more emphasis on them every time she started a new topic. She added that "*my quality of teaching had improved because in 2010 only eight (8) learners scored A symbols and in 2011, seventeen (17) learners scored A symbols in Science*".

T9 was in a precarious situation, he indicated that he did not have a copy of the report and hence could not say he uses the report although he has seen for other schools and does not understand very well how to use it.

T10 stated that he uses the report very often. He explained that he uses the report to reflect on before and after the lesson presentation, adding that the report encourage him to develop different teaching approaches and as a result 89% of his learners had passed Natural Science in 2011.

Many teachers were aware of how to use the report although at times their explanations were not satisfactory.

T5, for instance, made a clearer explanation than others by indicating that she first listed all the themes/topics where her learners performed poorly and then studied those topics in the performance level descriptors (which is the qualitative section of the report) *whenever I am at the topic where my learners perform poorly*. This is what is expected of all teachers to do when they have to use the reports.

In a nutshell, teachers were expected to use the reports as follows (MoE, 2010):

- Identify the percentage of learners falling in the below basic achievement category in their school report (quantitative section);

- Identify the lowest performing competencies in their school report (quantitative section);
- Study the performance level descriptions to ascertain what learners in the below basic achievement category cannot do per competencies in their school (qualitative section); and then
- Design instructional intervention to assist learners who may have insufficient knowledge and skills to acquire more proficient and advanced knowledge so as to be classified in the above basic and excellent achievement categories.

When teachers follow these steps, they could discover that there might be competencies that appear easy for learners to master, however, SATs reports might show a different picture. The three competencies forming the basis for this study have been explicitly named several times in this thesis and will not be repeated. As indicated on Graph 4.1, the national average performance in these three competencies was below 50% although they are not in their nature or formulation difficult to acquire.

4.4 Concluding remarks

The SATs reports serve as an incentive for teachers as they show them how learners are doing in the tested competencies. Hence, teachers' understanding of the ideals of this kind of assessment would contribute to efforts aimed at improving the quality of teaching and learning, particularly at primary school level, as envisioned in the ETSIP.

The SATs reports encourage teachers to reflect on their own practice, particularly with regard to the type of information required to address competencies in the syllabus. Teachers need to ensure that their content knowledge is well developed to enable them to teach more effectively. Often teachers rely strongly on textbooks and often give learners information as is in the textbooks, without aligning or enrich it to meet the syllabus demands. This practice could be detrimental to learners' mastery of prescribed competencies in the syllabus. Information in the textbooks needs to be made accessible to learners and teachers need a variety of sources to verify textbook content and ensure that it is accurate and addresses the competencies of the syllabus.

Teachers' responses to the identified potential benefits of SATs were more positively inclined, given the percentage agreement per indicator in the questionnaire. At this stage, this is indicative of the fact that the majority of the teachers have received the test reports and are using them to inform their teaching.

In the next chapter, I present the data gathered during phase two of the study, which attempted to uncover possible influences that Natural Science teachers' content knowledge and pedagogical practices had on learners' achievement in Natural Science.

Chapter Five

Data presentation and analysis: Phase Two

5.1 Introduction

Given the varying performance of learners in the SATs, the data gathered during this phase of the study attempted to uncover possible influences that Natural Science teachers' content knowledge and pedagogical practices had on learners' achievement in Natural Science.

This chapter presents the main findings of this study. Data- gathering techniques used in this case were lesson observations, which included examining learners' written notes in their note books and teachers' lesson plans, stimulated recall discussions, which took place after the review of the video-taped lessons with the two teachers, and semi-structured interviews.

5.2 Lesson observations: Teaching skills and content knowledge

I observed the teaching of two teachers of the ten who answered the questionnaires. These two teachers had shown a willingness to participate in the detailed study, others were reluctant. The observation was done in an effort to establish how their teaching practice could have influenced the performance of learners in the identified competencies, as illustrated by the SATs results. The original idea was to observe teachers teaching the content on the three identified competencies mentioned in Table 4.2.1 (a). Due to the reluctance of teachers to participate, coupled with the inconvenience brought about by my work schedule, it was not possible to observe the teaching of those specific competencies. I believed that the teaching of other competencies could possibly give me an insight into the normal teaching practice of the two teachers.

The observation of the two teachers was conducted as agreed with them. **T1** was teaching the composition of air and **T2** was teaching the characteristics of living organisms. My reason for observing the lessons was to get more insight in order to understand the two teachers' teaching skills, for example, how the teachers expressed themselves during the lessons as well as how they mediated learning of science and established the level of the content knowledge development on the areas they dealt with. Scenarios from the lessons that appeared to indicate an aspect of the former and the latter's possible influence on learners' acquisition of knowledge and skills, as specified in the syllabus, were captured in the video.

5.3 T1's Lesson: Air around us (40 Minutes)

T1 started the lesson by revising the work done in the previous lesson before introducing the new topic. The teacher used a question-and-answer method for most of the lesson, and performed a practical demonstration at the later stages of the lesson.

The new topic was started with questions such as "*what is air*?", and learners were given time to think. They responded that air was "*gases that surrounding us*" [sic]. Their responses were often acknowledged by the teacher even when he was not satisfied with such responses. Follow-up questions were asked, such as "*where do we find those gases*?" despite the fact that learners had already mentioned that gases were in their surroundings. Learners appeared at times out of words and they responded that gases were "*everywhere sir*". The teacher appeared not to have listened to learners attentively.

As learners were not giving the desired answers despite the fact that they had apparently dealt with the topic in grade 6, the teacher then mentioned that air was a mixture of gases. Learners were reminded that a mixture was "*a combination of substances*". As the lesson progressed, learners were told that they were going to identify gases of the air that they had learned in grade 6.

When learners were asked to identify the gases of the air, they gave responses such as "*hydrogen*" and the teacher acknowledged that hydrogen was indeed one of them. At grade 7 level, that was incorrect, as the amount of hydrogen in the Earth's atmosphere is negligibly small. The teacher proceeded to ask for more examples of gases in the air and learners listed them correctly as "*nitrogen, oxygen, carbon dioxide*". One learner mentioned *chlorine* quite loudly enough but the teacher did not pay attention to him by indicating whether it was incorrect or it was indeed part of the gases of the air.

The learner who mentioned *chlorine* started an argument that chlorine is also a gas therefore it should be in air as well. I realised that the teacher was either not sure or he wanted learners to find out for themselves. He eventually asked the learners to find out on the internet, books, encyclopaedia *etcetera*, whether *chlorine* was part of gases of the air as homework. The lesson went on with questions and answers about the composition of air in terms of percentages which was correctly done.

The next part of the lesson that was worth noting was on the component of air which is water vapour. The teacher intended to prove to learners that there was indeed water vapour in the air.

He asked learners whether it can be proven that there was water vapour in the air. Learners responded that it was possible because "*when one breathed out near a mirror or cold window pane the wetness could be seen*". The teacher made it clear to learners that he was going to demonstrate to them scientifically whether or not there was water vapour in the air.

He started the demonstration by asking learners to collect dishes containing a blue powdered substance from the front of the class. The teacher asked the learners what it was and learners gave all sorts of guesses such '*blue sugar*', '*blue soap*' *etcetera*. The teacher informed the learners that the substance was not blue sugar but 'blue *unhydrous*[sic] copper sulphate powder' and wrote it on the chalkboard as such.

The substance was in fact 'hydrated copper sulfate' which is blue in colour due to the water particles trapped within its crystals. It was not correct for the teacher to say it was blue '*unhydrous*' copper sulphate as this contradicts the properties of this substance, especially when it is still blue. Even worse, the word 'unhydrous' should have been written as anhydrous which means no water of crystallisation was present in the crystals of copper sulphate. Further incorrect information was that anhydrous copper sulphate is in fact white and not blue as the teacher had put it to learners.

The teacher went on to explain to the learners that he conducted and found out that when blue copper sulphate powder was left in the open, the presence of water vapour in the air turned it into white. He concluded with this statement ***"the blue 'unhydrous' copper sulphate powder in the presence of water vapour it turns white"*** and this is what learners copied down from the chalkboard into their note books as shown in Figure 1.

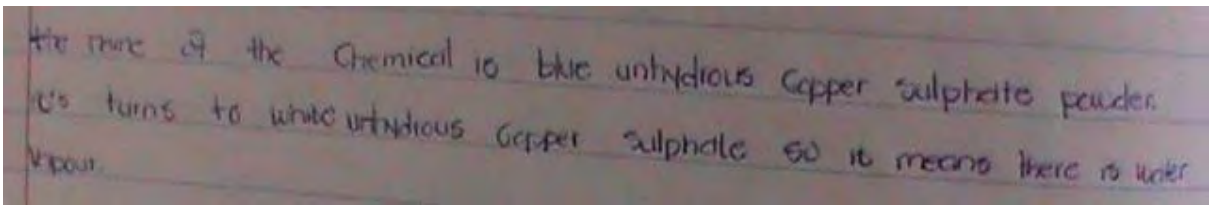


Figure 1: Extract of learners' notes on test for water in the air

One learner came close to reminding the teacher that something perhaps was wrong and if the teacher was confident in his science content knowledge and teaching skills, he could have realised that something was not right. The learner asked whether blue *unhydrous* copper sulphate would not turn to 'white hydrous copper sulphate' instead since it was now white.

The teacher acknowledged the question and asked the rest of the class what *unhydrous* meant. He repeated the question and made it even more difficult for grade 7 learners to answer by asking them "*what is unhydrous copper sulphate*?" He asked learners to look it up in dictionaries but learners could not find anything to that effect.

As no answer was forthcoming from learners, he tried to explain that "*unhydrous is something dry, is not wet, is dry but it captures moisture, even if it captures moisture or water vapour but is still dry, that is how we find out if there is water vapour. Now I don't have the white, I don't have the white copper sulphate, but if we had the white copper sulphate, it can change back to blue*".

While the teacher was seemingly lost in his explanation, one learner asked "*teacher, if you take the white copper sulphate, what do you do to change it back to blue*?" The teacher diverted the question to the learners and they replied "*put it in a dry place*". The teacher acknowledged that "*put it in a dry place... I love that, very good, that is a scientific thinking, you put it in a dry place where there is no water vapour, the process is reversible*". The teacher did not realise that his explanations were not correct until the lesson was over.

The teacher had a very good idea of demonstrating to learners a scientific phenomenon, using real objects and substances, however, his understanding of the test for presence of water was incorrect and learners took note of such incorrect information.

At the end of the lesson, learners were given homework but it was not related to the work done during the lesson. The teacher asked the learners to write down the procedures of scientific processes to find out if oxygen was present in the atmosphere. "*Discuss in groups and we are going to share ideas tomorrow*".

If that was the type of assessment that the teacher gives to learners after the lessons, then there would be a gap between classroom assessment and external assessment such as the SATs. Learners were not assessed on what they learnt during the lesson. In other words, there was no assessment of learning.

5.4 T2's Lesson: Characteristics of living organisms (40 minutes)

T2 did not review any homework or any other work done previously. She started by asking learners if they were done with the topic electricity and informed them they were going to start with a new topic. I could not establish whether the learners were told previously that they were done with the topic on electricity.

The teacher indicated that the topic was not exactly new because it had been taught in grade 6. She also used a question- and-answer method throughout her lesson; however, she prepared pictures on small pieces of paper as learning support materials.

The teacher started by asking learners what they could remember from grade 6. The first question was "*what are the living organisms*?" Since learners were not responding she rephrased the question, "*who are the living organisms*?" Learners replied that living organisms were mammals or people. The teacher was not satisfied and kept demanding answers from learners. Learners eventually started mumbling between the two terms biotic and abiotic although often incorrect in terms of examples they gave. The concepts of biotic and abiotic were eventually clarified.

The teacher then asked the learners, "*Who are the living organisms, the biotic and abiotic isn't it*?" and all the learners replied with a loud "*yes*". I could not understand where that was coming from since it was clarified that living organisms were biotic and non-living things were abiotic. The teacher then mentioned that "*now we are going to concentrate on both living and non-living but let us concentrate on with living organisms today*". This statement brought out one of the teachers' shortcoming that I had not noticed since the beginning of the lesson and that was the English language proficiency.

As the lesson progressed, learners were given small papers with pictures on them. They were then asked to carefully identify the characteristics of living organisms in their notebooks. The teacher asked the learners "*what type of characteristics is described on that picture? Look at the picture and identify what are the characteristics of that one, is showing what*?"

It emerged during this activity that learners were unable to identify correct characteristics illustrated by the pictures although the topic was dealt with in grade 6. At the same time as the lesson progressed, the teacher repeatedly mentioned that "*all living things are abiotic and biotic*". Either she was not listening to herself or somehow she got totally confused. She gave learners assistance and all diagrams were identified and matched with a characteristic of living organisms.

The teacher then made the following remarks "*I say we are repeating. Alright, we know now the living organism the characteristics of the living organisms those are the five characteristics of the living organisms* (referring to reproduce, respire, grow, feed and excrete). *Now, because we are trying to find out how the living organisms are.... living, we cannot leave ... when we are*

talking about living organisms without talking about the senses". The way the teacher kept expressing herself showed that she lacked skills in terms of English language proficiency.

The lesson took a new twist and now it was focusing on senses. The teacher asked questions such as "*What are the senses of a living organism*? *What are your senses*?" This kind of questioning intensified and here is a detailed extract of the teacher-learner dialogue:

T2: Living organisms have got sense, what are those?

LRS: I think they can smell.

T2: They can smell. Why do they smell? Why do you smell? What is helping you to smell something?

LRS: The nose

T2: I didn't ask what do they use, I say why...what is the need for us to smell?

LRS: To know their surrounding.

T2: To know their surrounding, remember that plants and animals, like now let us take an example of the other animals, the wild animals. Why do they use a smell to them, why the smell important to them? The wild animals... even to you. Why do we think that we have to smell?

The excerpts above indicated that the teacher was asking too many questions consecutively without giving learners enough time to think so that they could answer the questions. Consequently, learners started to mention the types of senses and the teacher kept confirming their responses although sometimes her comments were not correct. The interaction went on as follows:

LRS: They taste
T2: All the living organism they can taste.
T2: You can hear, you respond when you hear, you react; we are reacting to the sense. What else?
LRS: they can see.
T2: Yeah, they can see. We can see, is it not correct? All the living organism they can see.
LRS: No!!!! No teacher (choir) One learner: teacher, do you mean that even the plants can see?
T2: That's why they are moving, they can also may be see, they can use the sense to search for the sunlight, is correct!!! Some plants they can even close at night, some plants they can.

These excerpts show that the teacher had some English language deficiencies. They also indicate some elements of inadequate content knowledge. In terms of biological sciences it is not correct to say all living organisms can taste or they can see. The teacher was literally confused by the fact that both plants and animals were living organisms, but it did not necessarily mean they all taste or had sight.

The lesson was concluded as follows:

"*Now, what did we say today? We talked about the characteristics of the living organisms and we said that the characteristics are the one which differentiate between living and non-living things. We talked about the sense, they are five and you must know what is the work of the sense to us, what is the importance and what are they*".

The lesson was concluded without any form of assessment for what was learnt.

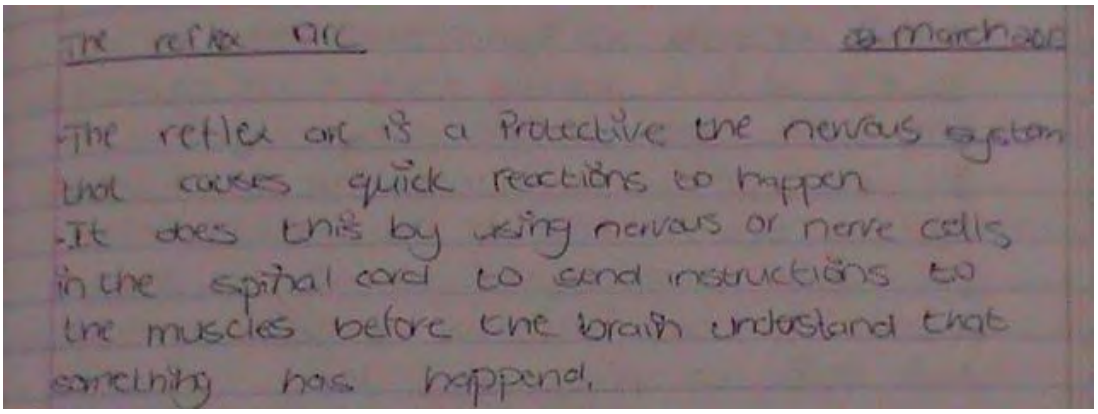
5.5 Lesson preparations and learners' written notes

The two teachers were writing out their lesson preparations although this was not done every day. The lesson preparations were followed for the two lessons that were observed.

The errors that transpired in the **T1**'s lesson were also evident in the lesson preparation form. While for **T2**, there was no error in the lesson preparation form. This somehow indicates that the lack of coherence was only in the spoken English and not on what was written.

Lesson preparation forms for previous topics involving the nervous system and drugs and elements were examined. It was found that the three identified competencies were noted as they appeared in the syllabus by both teachers. However, the learners' written notes do not reflect sufficient information, particularly about identifying a reflex arc from diagrams, and classifying elements into metals and non-metals.

The only information found in the learners' books of the two teachers (T1 and T2) close to addressing the competency that requires learners to identify reflex arc from diagrams, was a description that explained the basic function of the reflex arc as shown in Figure 2; which is a separate competency in the Natural Science syllabus. There were no diagrams of a reflex arc and this indicates that this competency was not addressed at all. The competencies tested in SATs are exactly the same as those in the syllabus.


The reflex arc 28 March 20[illegible]

The reflex arc is a protective the nervous system that causes quick reactions to happen
It does this by using nerves or nerve cells in the spinal cord to send instructions to the muscles before the brain understand that something has happened.

Figure 2: Extract of learners' note on reflex arc

Moreover, there was information about the influence of drugs on the nervous system as illustrated in Figure 3. However, the learners' notes carry the key word '*effect*' while the syllabus and the questions in the SATs used '*influence*'. The use of these two words interchangeably might be the cause for confusion among learners and that could have affected their performance.

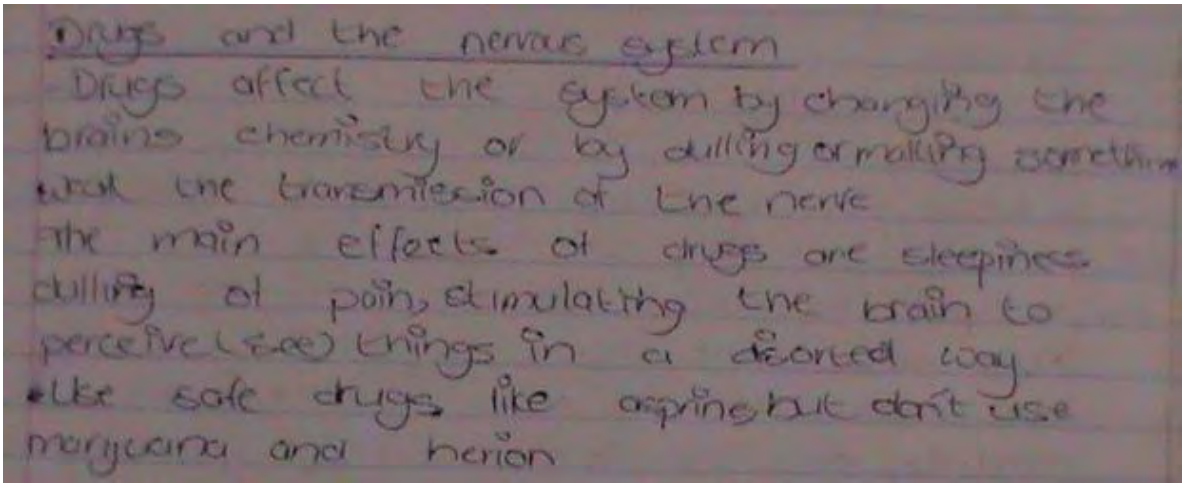

Drugs and the nervous system
Drugs affect the system by changing the brains chemistry or by dulling or making something
what the transmission of the nerve
The main effects of drugs are sleepiness
dulling of pain, stimulating the brain to
perceive (see) things in a distorted way.
Like safe drugs like aspirin but don't use
marijuana and heroin

Figure 3: Extract of learners' notes on drugs and nervous system

The written notes of learners for both teachers did not show any classification of elements into metals and non-metals as stipulated in the syllabus. All the learners' books show a list of elements and their uses although there was no competency in the syllabus requiring learners to recall the use of elements in grade 7. Figure 4 shows an extract from a learner's book which was common in all other learners' books. The syllabus required learners to be able to classify elements into metals and non-metals, not just to list them. A sketch of the Periodic Table could have been used to illustrate the classification of elements or at least present them in Tables.

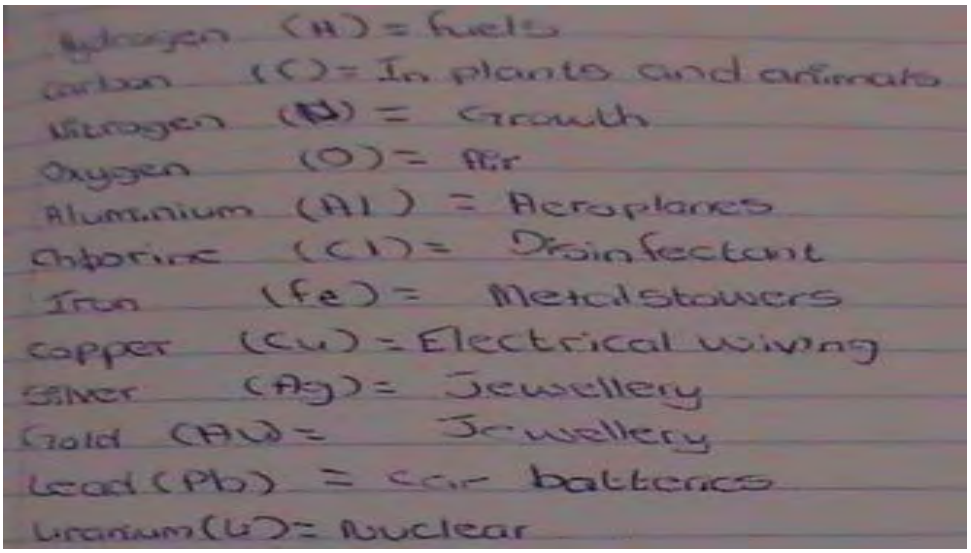


Figure 4: Extract from a learner's book on classification of elements

The notes that learners wrote serve to assist them when they are studying at home, however, if such notes are not sufficient or not accurate, they will adversely affect learners' attainment and subsequently their performance, particularly in national assessments such as the SATs.

5.6 Stimulated recall discussion (Post lesson discussions)

5.6.1 T1: Air around us

After the lesson the teacher was given a chance to watch the video of the lesson and there were a few things that needed to be pointed out. The first was on the composition of air. It was indicated that one of the gases in air is hydrogen, which is not entirely appropriate for the grade 7 level. Although correct that hydrogen is one of the gases in the air, it would have been more appropriate to clarify that it exists in very little amount.

With reference to up to date resources such as Wikipedia.org, I explained that hydrogen does exist in air but in negligible amount (0.000055%) The teacher said that the textbook he was using clearly showed that hydrogen was part of gases of the air, pointing out that "*but it is here in the textbook other gases in air include hydrogen, carbon dioxide...*" It was explained that it was not appropriate to specify hydrogen *per se*, it should have been included in other gases such as the noble gases. The presence of hydrogen in the air has no significant effect, unlike such gases as nitrogen and oxygen. The teacher was advised to cross check information in various sources before presenting to learners to ensure accuracy.

The second issue that was picked up was on the testing for the presence of water vapour in the air. The teacher mentioned that '*unhydrous*' copper sulphate was blue and when it was left in the air it turned white which was incorrect. I told the teacher that if copper sulphate was blue it was hydrated, meaning there was water of crystallization present. When heated, it becomes white and that is when is correctly called anhydrous copper sulphate, meaning there is no water of crystallisation present.

The teacher demonstrated that he did not understand what he was dealing with and asked "*but are they not two, there is this blue and the white?*". I explained that copper sulphate was indeed one substance that changes colour when the amount of water in it changes. When it contains water of crystallisation it is blue, and when it is white, it does not contain water of crystallisation. The teacher promised that he would go back to his learners to correct this misconception.

It was noted that there were no pictures of a reflex arc in the learners' books; this aroused an interest in finding out how the teacher dealt with the competency. In this regard, the teacher responded that "*I know, I understand that one. I made copies of the reflex arc for learners but I didn't check where they kept it"*. It would have been useful for learners to have these pictures in their note books!!

5.6.2 T2: Characteristics of living organisms

After the lesson, there was no time to review the video immediately. The teacher was given a copy of the video to review at home and the discussion was held the next day. The teacher was asked if she realised that she was asking learners too many questions repeatedly without giving them a chance to think and reply. She replied that she thought asking questions would help learners answer the questions but apparently did not realise it until she watched the video.

During the course of the lesson, the teacher differentiated between biotic and abiotic factors as being living and non-living respectively; however, at some point in the lesson the teacher was referring to biotic and abiotic factors as living organisms. The teacher asked the learners "*who are the living organisms? The abiotic and biotic, isn't it?"* This was quite confusing to learners and they replied with a loud "yes". The teacher acknowledged her mistakes but indicated that she had not realised that she was making such errors. Some notable errors that the teacher mentioned during the lesson were:

- *All the living things, remember that living things then we say abiotic and biotic;*
- *All the living organism they can taste; and*
- *All the living organism they can see.*

The teacher was asked why she was using 'who' instead of 'what' in some of her questions. She indicated that she tries to rephrase her questions when learners do not reply. She indicated perhaps her English language skills were not up to standard.

5.7 Interviews

The two teachers were interviewed individually after they had presented their lessons. As indicated in Chapter 3, the interviews were conducted to clarify particularly the issue of the interpretation of the SATs reports and ascertain how they were using the reports to identify areas in the Natural Science syllabus where learners were not acquiring the intended knowledge and skills. The interview was further intended to capture teachers' views about their own pedagogical practices, how their teaching repertoires helped them to teach well or constrained their practices.

5.7.1 T1 (Male teacher)

T1 was a trained Natural Science teacher who was in possession of a Basic Education Teacher Diploma (BETD) from a former college of education. The year 2012 was his third year of teaching. He teaches at an urban public primary school in Windhoek. The school caters for learners of different ethnic groups.

5.7.1.1 Conception of standardised achievement tests

T1 demonstrated certain awareness of the ideals of SATs in Namibia, however his expression was not entirely convincing. When asked what SATs were trying to achieve, in his opinion he replied that "*is actually is to... to find if learners are meeting their basic competencies and they are try to find out they can just ummm...! may be like teaching environment, if teachers are well trained in teaching their subjects and what the other negative factors that may be affecting the learning"*.

T1 received training on how to interpret and use the SATs reports for teaching and said that he was confident about his understanding. When asked to give an example of how to interpret the reports, he explained as follows:

Example here I can look at the first one science test, theme 1- Healthy Education whatever healthy body ummm! human body and development. Looking at this one we have nation, region and school, now we are comparing the two, for example the nation which is 51% ouh! first with cognitive level, this is the thing that is required the learner. We look at national which is 51%, regional 61% and school 62%, ok. This show that the school is doing well which is better compare to other regional and national. When it come to the second here, the school, the national is 54%, the regional 66% and the school 64%, this show that the school were dropping there, they did not do well on that one.

The explanation given above exhibits some understanding of how to interpret the SATs reports, but only in terms of the overall performance comparisons. For example, how the school fared compared to regional and national norms. However, that was not sufficient because the teacher did not even refer to the second section of the reports, which is crucial in illustrating the competency-based descriptions of performance level categories.

When he was reminded of that section he explained that:
I understand this one (referring to the second section of the report)*, just like the one I explained before, you find that if a learner, a learner did not do well, ...ok, we have below basic, basic, above basic and excellent. Now if a learner did not do well, did not do well in a topic that means that learner fall under below basic and some learners who show some knowledge fall under basic, those that score about 60% there fall under above basic and the others with more knowledge will be in excellent. This actually the level how learners are being judged according to the knowledge they know when they sat for those tests.*

5.7.1.2 Use of standardised achievement tests reports in teaching

T1 gave an account of how he uses the SATs to inform his teaching. He explained that he attended a workshop with other Natural Science teachers where they discussed the themes in the syllabus and compared the performance of schools in the standardised tests. They found that there were certain topics that learners were not grasping in many schools and they tried to speculate on possible contributing factors.

They wrote down the possible problems that learners were facing and singled out competencies such as "*state the end product of digestion of starch, fat and protein*" as one of the topics that learners did not do well on in the tests. The national average on this competency is 34%, which

concurs with their findings. They also came to a realisation that most of the topics where learners did not do well were introduced to the learners for the first time in grade 7.

T1 indicated that there were several factors that compounded the learners' inability to acquire the skills and competencies. He cited teachers' exposition as one the factors. Saying: "*the teaching itself that takes place in class, may be the teacher was not putting enough effort to help the learners understand the topic, ...because when you teach at least you need to have to have some teaching aid*".

The importance of using learning and teaching support materials in teaching cannot be over-emphasised. One of the competencies where learners did not do well was "identify reflex arc from diagrams", and hence if learners are not exposed to such diagrams, there was no other way they could acquire the knowledge.

The other factor that **T1** pointed out was the commitment of learners to school work, stating that "*even like the teacher has delivered the lesson well, it depend to the work of the learner, because some learners still go there with their books and revising what they have learnt, ...but some learners just go there and forget. But if they keep on reading and reading they will be able to remember. This is the thing that is causing some learners to fall under below basic, because you cannot just point to the teacher that I did not do well because the teacher did not do this, a well-trained teacher teaches according to basic competencies in the syllabus*".

T1 indicated they also looked at how they can go about helping learners understand the topics better and stated that "*according to my own practice, whenever I am teaching I look at the topic, like ok, this is when I taught it the previous year and what the standardised achievement tests results, so this gives an indication on what to improve compare to what I did the previous year*".

What the teacher had expressed is in line with the ideals of SATs, however, this was only evident at the descriptive level but not in practice, as there was no evidence of implementation in practice.

5.7.1.3 Natural Science content knowledge

T1 indicated that he was well trained to teach Natural Science at the college of education and that he was very confident in his Natural Science content despite the unavailability of resources in his schools such as laboratory or library for learners to use. In his own words he said "... *I had*

a well-trained Lecturer, who was ... uum who taught us well and I am thankful for that because she really demonstrated to us what we suppose to know and all things we have done, research here and we demonstrated in the classroom. We were well trained".

He also indicated that his content knowledge helps him teach better, saying

> "*..it help me teach better, it also helping me teach, teach better so helping me to reflect myself the way I taught, reflect myself how I conduct the lesson. I don't just teach today and realise that ah–ah something went wrong and tomorrow I don't rectify the mistake before continue with something else. I don't do that".*

However, looking at the lesson observed (Section 5.3) and what was evident in the learners' written notes (Section 5.5), particularly on the three competencies identified, there was a clear gap in terms of congruence.

5.7.1.4 Teaching skills

T1 demonstrated that he had sound knowledge about teaching methods. He highlighted the importance of linking learners' prior knowledge to the new content matter. When asked how he introduced new topics to learners, he explained that:

> *I ask learners what they learn the previous day as a reminder. If there was homework, we rectify the homework before we go the next topic. And then eh.., first of all to like.., to understand you write the topic on the chalkboard, to understand if the learners dealt with the topic before, you see in form like questioning, how do you understand this term and try to assess mentally, mental activity development of the learners if they have some basic knowledge of what is about to be introduced to them*.

T1 indicated that he ensured that his learners understood what was taught in class by questioning and through assessment. He expatiated that*"... to see if learners understand is in two ways, like in a question in a method asking questions while teaching and like a small assessment in form of writing that involve the content that you taught and mark it and that is when you see whether they understand. I also give tests, topic tasks and investigations*".

Again at descriptive level, **T1** expressed good teaching ideas, however, as indicated in section 5.3, in practice those ideas were not evident as the lesson ended with no assessment of what ought to be learnt.

T1 furthermore said that there were challenges he faced when teaching Natural Science in his school. Firstly, learners were able to communicate very well in English but their written English

was often problematic. He cited that *"as a teacher you have to look at the learner's thinking like what was the learner trying to say or write"*.

Secondly, **T1** said that there was a general lack of commitment among the learners. Learners were not committed to their school work and sometimes parents' involvement in their learners' learning was minimal. The third one was about the lack of resources at school, stating that although teachers were supposed to prepare their own learning support materials, some things just needed to be in the classroom to make teaching more effective. The challenges are many but those are the few that I can mention for now.

5.7.1.5 Natural Science textbooks

T1 indicated that all learners were in possession of at least one prescribed textbook. He indicated that he was monitoring the textbooks every Friday, and sometimes he found that some learners were not taking good care of their textbooks, as some do lose them. He said that all learners have the Natural Science and Health Education textbooks, and as a teacher he had two more textbooks which learners did not have due to lack of financial resources.

Again at a descriptive level, he said he was using three textbooks to compare the content but as evident in Section 4.4.1, the teacher could have checked in other textbooks which did clarified that hydrogen gas is one of the gases in the air but in negligible amount. **T1** described the content of the textbooks as fine, as it was addressing the basic competencies in the syllabus and that he had always made an effort to get information from other sources.

5.7.2 T2 (Female teacher)

T2 was not trained to teach Natural Science. She holds a Certificate in Primary Education which she obtained from the former college of education before independence. She said that at the time she had undergone teacher training, teachers were not trained in the specific subjects, they were trained as primary and secondary school teachers. Therefore, they could not specialise in any subject in the field. She has been teaching for about 20 years, and she also teaches at an urban public primary school in Windhoek that caters for learners from different ethnic groups.

5.7.2.1 Conception of standardised achievement tests

T2 said she understood the ideals of SATs very well and learners were performing very well in the standardised tests. She added that competencies were repeated from lower grades through to

grade 5 but when the learners come to grade 7 some new topics were introduced, like the scientific processes. She then uses the standardised tests reports to see how her learners were doing in those new competencies.

She said she received training on how to interpret the reports and she got the importance of standardised tests. She said:

> *If you find out let me say that it is in human development you have to compare your school with other schools in the region, you will find that no, this chapter I am very low, the regional is very high therefore you look at the basic competencies whether do you really have to make sure that the kids understand that basic competencies therefore when there was no standardised tests there was no way you can find that in this chapter you are not really cope very well with the learners with the standardised tests because some of the chapter you get 80% or 90% but you find some of the chapter you get so few.*

5.7.2.2 Use of SATs reports in teaching

T2's description of how she uses the standardised tests reports to inform teaching was not sufficient and there was no evidence of use whether in a lesson preparation form or year plan. She responded that: "*I use the report to identify the learners who are below basic average for learning support. ... for me I found out that standardised test is helping the teachers and the learners to understand because sometimes you are thinking as long as you think but that is not the case you have to focus with the syllabus so that you can make the kids understand the basic competency, otherwise the kids find standardised test difficult for them*". T2 seemed to have an idea about the potential benefits of SATs but her understanding needed consolidation.

5.7.2.3 Natural Science content knowledge

T2 had undergone teacher training during the time when teacher education programmes in Namibian former colleges of education did not have subject specialisations. However, she explained that she was confident in her Natural Science content although she was not trained to teach the subject.

She said that when she applied for the teaching post, she was given any subject that needed to be taught because she was trained to teach all subjects and Natural Science was one of them. She derives her confidence from her experience of teaching Natural Science for over a decade. She also indicated that her content knowledge helps her teach better, "*It will help, because it depend how you give the basic competency, I am confident in the basic competencies that I deal with in the syllabus*".

The basic competency that **T2** was teaching required learners to revise the characteristics of living organisms as learnt in grade 6, however, the teacher diverted to senses of living organisms for a longer period of the lesson, which was not specified as such in the grade 7 Natural Science syllabus.

As shown earlier in Section 5.6.2, **T2** was making inaccurate statements even when she was in line with what she was supposed to teach. Like **T1**, there was a gap between the description of their content confidence and what transpired in the classroom.

5.7.2.4 Teaching skills

T2 believed in using learning support materials and a good understanding of competencies to enhance the learning of her learners when teaching Natural Science. She was of the opinion that learners would not do well if the teacher did not understand the competencies that they were teaching very well. She remarked that learners' performance in tests such as SATs "*depend to the teacher how he understand also the basic competencies because the teacher has to make sure that he master to the basic competencies he prepare, if you are not master to the basic competencies you cannot give it well to the kids to understand*" [sic].

T2 further indicated that when she introduces a new topic she makes all the efforts to use posters or a Periodic Table, depending on the topic. She uses the internet also to get more information to supplement the textbooks. **T2** uses the question- and- answer method most of the time to introduce new topics and throughout her teaching, because she believes that it gives her the opportunity to find out what learners already know about what she is going to teach.

T2 said that she ascertained whether learners had understood what was taught by revising her lessons and asking whether the learners could recall what they learnt before they left the classroom. However, that doesn't come without challenges. She indicated that sometimes the lack of materials have made teaching a little challenging.

She cited an example of a topic like static electricity, where an electroscope is needed to demonstrate charges but it was not available in the school. As it was something that learners were not familiar with, this posed a serious challenge as explanations alone without the concrete object are not always enough. **T2** seemed knowledgeable about teaching methods.

5.7.2.5 Natural Science textbooks

T2 also indicated that all her learners had the prescribed textbook, namely Natural Science and Health in Context. As mentioned in Chapter 4, Section 4.2.2.2, this textbook has certain shortcomings when it comes to the way it represents information in the syllabus. However, like **T1** she described its content as fine, except for some topics, especially the Periodic Table and scientific processes. She explained that these topics used to be introduced in grade 8 and now they were brought to grade 7, and hence her learners find them difficult to understand.

5.8 Concluding remarks

Teachers' choice of teaching strategies to be used in the classrooms determines the extent to which learners acquire knowledge and skills. Both teachers in this study used a question- and-answer method during their teaching. The effectiveness of this method depends on the pacing of questions. In one instance the questioning was equivalent to an interrogation, due to lack of waiting time for learners to answer. However, the two teachers prepared different learning support materials to supplement their lessons.

Similarly, the exposition of the two teachers was characterised by unclear and at times incorrect information disseminated to learners, despite the fact that the topics taught were different. Exposing inaccurate information to learners can adversely affect their achievement in assessments such as the SATs. Furthermore, what the teachers had expressed is in line with the ideals of SATs, however, this was only evident at the descriptive level but not in practice, as there was no evidence of implementation in practice.

In the next chapter, I present an analysis, interpretation and discussion of the findings of my case study.

Chapter Six

Data analysis, interpretation and discussion of findings

6.1 Introduction

In this chapter, I present an analysis, interpretation and discussion of the findings of my case study. Schwandt (1997: 4) notes that:

> Data analysis is the activity of making sense of, interpreting, or theorising the data. It is both art and science, and is undertaken by means of a variety of procedures that facilitate working back and forth between the data and ideas. It includes the processes of organising, reducing and describing the data, and warranting those interpretations. If data could speak for themselves analysis would not be necessary.

This study sought to establish Natural Science teachers' perceptions of the SATs and the extent to which they were able to interpret and use the SATs reports to inform and improve their teaching and learning. It also envisaged investigating Natural Science teachers' classroom practices with a view to understanding the performance of learners in the SATs.

The study involved ten Natural Science teachers; however, a detailed investigation was conducted with only two participants. The performance of learners in certain competencies tested in the SATs varied significantly. This aroused the need to explore the extent to which teachers were able to interpret and use the SATs reports, as well as how their classroom practices impacted on learner achievement as reflected in the SATs reports.

In this chapter, a brief description is given of the setting in which the research took place, and of the participants. A description is also presented of the data that emerged from different data- gathering techniques. The data to be analysed were gathered through:

- document analysis, which focused on SATs reports and Natural Science textbooks;
- questionnaires to capture teachers' perceptions of SATs, interpretation of SATs reports and usage thereof;
- observations of teaching practices and an examination of their lesson plans and learners' written notes, and
- Semi-structured interviews focused on teachers' conception of SATs and pedagogical practices.

The analysis draws on all of these data- gathering techniques.

In light of the above, themes that emerged from the data are discussed with a view to answering the following four research questions, as presented in Chapter 1, Section 1.6:

- What are teachers' perceptions of the grade 7 Natural Science SATs?
- How do teachers interpret and use the Natural Science SATs reports to improve learners' performance in identified competencies?
- How were the three competencies in which learners performed poorly in the 2010 SATs taught in 2012?
- What influence does teachers' content knowledge development have on their learners' mastery of competencies in the syllabus?

6.2 Description of research setting

The study was conducted at two urban public primary schools in Windhoek. The two schools cater for learners of different ethnic groups from Namibia. The two schools are located in the former 'blacks only' suburbs of *Katutura*. The learners in the two schools come from different socio-economic backgrounds and from middle- to low- income households. The classrooms where observations took place were generally spacious and neat, with notice boards on the back wall. However, the number of learners in each class was quite high, ranging from 37 to 40. Nonetheless, there was sufficient furniture and writing boards in good condition to provide a reasonable teaching and learning environment.

6.3 Description of participants

One male (T1) and a female (T2) teacher participated in the detailed study. T1 is a trained Natural Science teacher in possession of a Basic Education Teacher Diploma (BETD) from a former college of education which had since become part of the University of Namibia's Faculty of Education. He has been teaching Natural Science in grade 7 for three years.

T2 received her teaching training qualification during the colonial dispensation; hence she was not trained to teach Natural Science as teachers then were trained to teach either at primary or secondary schools without specialising in specific subjects. However, she has been teaching Natural Science for over twenty years. Both teachers asserted that they were confident in their content knowledge of Natural Science.

6.4 Description of data from the different data- gathering techniques

6.4.1 Analysis of the SATs reports

The process began with the analysis of the SATs reports, which revealed that learners were not doing well in certain competencies in the Natural Science syllabus, particularly in competencies

such as “identify reflex arc from diagrams”, “describe the influence of drugs on the nervous system” and “classify elements into metals and non-metals” (see Chapter 4, Table 4.2.1(a).

The implication of these findings was that teachers were not teaching all the competencies in the syllabus sufficiently to enable learners to perform well in external assessments such as the SATs. Hence, an effort was made to establish the kind of information that learners were provided with.

6.4.2 Teachers’ perceptions of the SATs

Since the objectives of SATs entailed providing teachers with information on how learners were learning, it was deemed necessary to get their perceptions on the SATs as it was a new form of assessment, introduced into schools for the first time in 2010. This was achieved through the use of a questionnaire which contained three indicators, namely teachers’ perceptions of SATs, interpretation of SATs reports, and the use of such reports in informing teaching and learning. Teachers were expected to agree or disagree with the indicators (see Chapter 4, Table 4.3).

It emerged from the questionnaire that the majority of responding teachers agreed with the notion that SATs helped to inform the teaching and learning of Natural Science in the schools. They also felt that the test results helped teachers to address competencies that learners find difficult to learn. Similarly, they felt that the test results would be a good measure to monitor whether or not there was an improvement in the performance of learners over the years. Furthermore, most teachers indicated that they were able to interpret the SATs reports but only 50% (five participants out of ten) indicated that they were using the reports to inform their planning of teaching and learning of Natural Science in their schools.

6.4.3 Analysis of content of textbooks

Analysis of the content of textbooks in light of how they presented information on the three designated competencies revealed that despite their alignment to the Natural Science syllabus in terms of topics, there were gaps in certain specifics that learners ought to acquire in order to master the competencies of the syllabus. One of the textbooks (Chapter 4, Section 4.2.2.3) appeared to be richer in content knowledge than others, particularly in terms of detailed illustrations and layout. T1 uses this textbook in his teaching. Moreover, the two teachers T1 and T2 expressed satisfaction with the content of the textbooks available in their schools. However, this study could not establish the accessibility of those textbooks by grade 7 learners in terms of the language used. This is a possible area for further research.

6.4.4 Lesson plans and learners' written notes

Teachers were writing their lesson plans, although not for all lessons, as was evident in their preparation files. Teachers presented their lessons according to the lesson plans they had prepared. T1's lesson plan contained errors in terms of subject content, and these errors were explicit in his presentation (see Chapter 5, Section 5.3 & Figure 1). Exposing learners to incorrect information could affect their acquisition of intended knowledge and skills, which would affect their achievement in assessment tasks. T2's lesson was characterised by improper English language usage in terms of oral expression, which could be a point of detriment for learners' understanding, particularly those that were good listeners.

An analysis of the current grade 7 learners' written work on the three competencies, in which their counterparts did not perform well in the 2010 SATs, revealed that there were gaps in the teachers' exposition of necessary information to learners in order to address competencies in the syllabus. There was no evidence of sufficient coverage of technical aspects of the designated competencies, all of which could be reasons why the national average performance in SATs for those three competencies was quite low (see Chapter 4, Section 4.2.1, Table 4.2.1(a)). The situation could repeat itself in the follow-up SATs scheduled for November 2012. Similarly, this leaves lingering doubts whether teachers were capable of interpreting and reacting to the SATs results.

6.4.5 Teaching strategies

Teachers demonstrated some knowledge of teaching methods. This was evident in their efforts to link learners' prior knowledge to the new content matter and the use of learning and teaching support materials (LTSMs) (Czerniewicz, Murray & Probyn, 2000) featured in their explanation of their teaching approaches. Through the interviews teachers said that good understanding of the competencies and the interpretations thereof were key to enhancing the teaching and learning of Natural Science. They made the further point that learners were unlikely to do well when the teacher does not have sufficient understanding of the competencies they ought to teach.

6.4.6 Natural Science content knowledge

Teachers in this study expressed confidence in their Natural Science content knowledge, although this was only at a descriptive level. The observation of lessons and the analysis of learners' written work revealed some degree of disjuncture in this regard. The errors observed in

one of the lessons revealed significant flaws in the teacher's content knowledge, particularly on the content that was being taught.

Content knowledge is related to the discipline and includes subject matter knowledge and ways of working in the discipline (Appleton, 2008). When teachers' content knowledge is flawed, they are unlikely to teach such subject matter successfully and consequently their pedagogical content knowledge (PCK) will be underdeveloped. Shulman (1986) described PCK as knowledge of how to teach specific content in specific contexts, and claimed that teachers needed strong PCK to be the best they possibly can. I agree with Shulman.

6.5 Discussion of findings

6.5.1 Teachers' conceptions of SATs

Standardised achievement testing (SATs) is a new form of summative assessment at grades 5 and 7 in Namibian primary schools. It is aimed at complementing teachers' efforts in the assessment of learning in identified subject areas, in particular Natural Science, which was a focus of this study. SATs provide information about how learners are acquiring the competencies and skills in the syllabus at the end of primary education.

The SATs not only provides information about the performance of the education system, it is also intended to assist teachers in identifying areas of difficulty in the syllabus, where learners are not acquiring intended competencies and skills. This feedback is necessary for teachers to review their exposition strategies in those areas where learners are not acquiring the mastery of prescribed knowledge, skills and competencies in the syllabus.

In this study, teachers have shown positive perceptions towards SATs (Chapter 4, Table 4.3 & Graph 4.3) as evident in their responses (Chapter 4, Section 4.3.1.1). Teachers were of the opinion that SATs was helpful in informing their teaching and the learning of Natural Science. Also, they felt that the test results informed teachers where to provide assistance to learners in competencies they found difficult to learn. Moreover, they felt that the test results would be a good measure to monitor whether or not there was improvement in the performance of learners over different years.

A study to evaluate the implementation of SATs at grade 5 revealed that the majority of stakeholders, of whom some were English and Mathematics teachers who participated in the study, exhibited a positive opinion about SATs. Their positive perceptions led to the suggestions that the SATs be administered every year, as opposed to the current alternating practice between

grade 5 and 7. This should be done so that cohorts of learners could be tracked over the years (van der Merwe, 2011).

This study has also found that teachers were not using the SATs reports to inform teaching and learning for improvement. Van der Merwe (2011) reported that some teachers did not know how to go about using the SATs reports to improve the quality of their teaching. The assessment skills of many teachers seemed to be insufficient to determine whether learners had mastered the competencies, and teachers were not teaching the competencies where they lacked the teaching resources.

Notwithstanding, the introduction of the SATs was not accompanied by any policy imperatives to compel schools to use the SATs information, despite valuable diagnostic feedback available. Consequently, schools are not held accountable (although it is low-stake assessment) for non-utilisation of such information, and this renders the whole assessment effort fruitless.

The ideals of SATs envisaged that teachers would be able to interpret information in the reports in order to reflect on their own teaching and learning at their schools. Through the teachers' comments, it became evident that they were aware of the benefits of using the SATs reports to inform the planning of their lessons, although this was not without limitations, as none of the teachers made reference to the meaning of percentage scores as indicated in the reports. Thus, it could be argued that teachers did not receive adequate training on the interpretation of the SATs reports. Consequently, their use of the SATs reports in teaching could not be validated as they could only describe how they were using the reports but there was no evidence to substantiate their claims.

6.5.2 Science teaching practices

Roschelle (1995) argues that it is impossible to learn without prior knowledge and new knowledge is constructed from the old. This study found that an effort was made by teachers to relate learners' prior knowledge to what was presented in class, although this was limited to what was previously learnt in class and not necessarily prior everyday knowledge. Stears, Malcolm and Kowlas (2003:1) argued that "constructivist approaches to learning advocate for curricula that build on learners' experience, interests and prior knowledge"

The consideration of learners' prior knowledge would serve as a step in the right direction for the two teachers. To a certain extent the two teachers attempted to fulfil the requirements of the NCBE, which requires learning in school to constantly relate to, involve, and extend the learners'

prior knowledge and experiences, and this must be complemented and challenged by the knowledge that the school provides from beyond the immediate sphere of the learner (MoE, 2010).

The two participant teachers (T1 & T2) demonstrated an element of learner-centred pedagogy. According to the NCBE (2010), the point of departure in the learner-centred teaching and learning process should always be what the learners already know and can do, and then the acquisition of new knowledge follows. During the two lessons, both teachers attempted to solicit learners' knowledge throughout the lessons through questioning. Both teachers used question- and- answer methods throughout their lessons. However, their effective use of questions varied significantly.

T1's way of questioning was characterised by pausing that gave learners a bit more time to think and respond. In contrast, T2's questioning techniques could be equated to an interrogation due to lack of waiting time for learners to think and respond (Chapter 5, Section 5.4). Settlage and Southerland (2007) argue that the effectiveness of question- and- answer methods during teaching depends on the pacing of questions. Furthermore, what contributes to fruitful science teaching using question- and- answer methods is the teacher's willingness to give learners time to think and formulate their responses. Most importantly, learners should be given an opportunity to ask questions too, however, little opportunity was given for them to ask questions.

The most notable attempt to make science real to learners was illustrated by T1, by means of a demonstration. The demonstration intended to show learners how they could test whether or not there was moisture in the air. This is an aspect of practical work that science education advocates.

Wellington (1998) argues that practical work can improve learners' understanding of science and promote their conceptual development by allowing them to visualise the laws and theories of science. Practical work is motivating and exciting as it generates interest and enthusiasm and helps learners remember things. However, the notable shortcoming during the T1's demonstration was the misconception he had about the physical properties of copper sulfate. He believed that *copper sulfate* was blue in the absence of water and white when water was added to it.

The correct understanding should have been the other way round, that is, *copper sulfate* is blue in the presence of water and white in the absence of water. T1 did not realise this misconception until the end of the lesson. The concept of testing for the presence of water is part of the science

syllabus up to grade 12. With learners leaving primary education such a misconception may be difficult to rectify later.

The NCBE demands systematic planning of teaching and learning activities. Planning is essential for a clear identification of lesson objectives, thereby directing the teaching and learning towards achieving such objectives (Magano, 2009). It is the role of the teacher to identify what knowledge and skills/competencies learners should be able to acquire at the end of the lesson, hence the need to decide on appropriate instructional strategies to realise the intended outcome. This can be achieved by preparing the learning content through consultation of different sources such as textbooks, the internet *etcetera*. The relevance and accuracy of the information to be presented to learners would thus depend heavily on the teacher's competence in interpreting competencies.

According to Framery (2002), it is the responsibility of the teacher to ensure that all learners have access to the science curriculum by developing a good daily practice which facilitates effective teaching such as:

- clear, crisp start to each lesson;
- specific lesson objectives that are shared with learners;
- clear instructions and explanations;
- appropriate, sequenced questions leading towards learning objectives;
- use of recapping on previous knowledge; and
- feedback given to learners promptly.

This study revealed that there was no systematic coverage of the Natural Science syllabus competencies during teaching and learning, as was evident in the learners' written notes. Their written notes lacked certain specifics that were very important for their attainment of competencies. This was evident in both what was being presented at the time of this study and what had already been covered during the course of the year.

Teachers are responsible for interpreting the syllabus competencies and developing activities aimed at achieving such competencies. If teachers do not interpret syllabus competencies accurately, learners are at risk of being exposed to information (content) that is insufficient and would subsequently achieve limited attainment.

The two participant teachers in this study indicated that they were confident in their Natural Science content knowledge (Chapter 5, Sections 5.7.1.3 & 5.7.2.3), and that it was helping them

teach better. However, this study revealed that there were gaps in their Natural Science content knowledge, particularly T1. Not only did he not realise that the three competencies were not sufficiently covered, he misconstrued and subsequently misrepresented the use of copper sulfate in the test for the presence of moisture in air.

The SATs results serve as a lens through which to look at teachers' teaching practices, particularly with regard to the three competencies. As presented in Chapter 5, Section 5.5, Figures 2, 3 and 4) such information is insufficient for learners to achieve well in assessments such as the SATs.

The shortcoming alluded to above could be associated with teachers' content and pedagogical content knowledge. Teachers' content knowledge is related to learners' learning, and it influences how teachers engage their learners in the subject matter, as well as how they evaluate, choose and use instructional materials (Loucks-Horsley, et al., 2010).

For teachers to develop an understanding of what makes the learning of specific concepts easy or difficult, an awareness of what concepts are more fundamental than others, and the knowledge of ways of representing and formulating subject matter to make it more accessible to learners, teachers need to have sufficient subject matter knowledge (Shulman, 1986). With limited subject matter knowledge, their pedagogical content knowledge is restricted (Loucks-Horsley et al., 2010). This situation calls for teachers to engage in continuous professional development activities. Such activities could enable teachers to engage with other teachers in conversations to learn what works under what circumstances, examine examples of practice and reflect on their own practice and learners' learning to become 'connoisseurs' of effective practice (Loucks-Horsley et al., 2010) .

This argument resonates with what Shulman (1986) suggested: that teachers need to have pedagogical content knowledge - that is, the knowledge of how to facilitate the learning of the subject matter being taught to learners in a variety of classroom contexts. Teachers will be successful when they possess the form of content knowledge that embodies the aspects of content appropriate to its teachability, and that comprises the ways of representing and formulating the subject matter that make it accessible to others.

The findings also point to the assessment practices of the two teachers. In both lessons, learners were not given structured assessment tasks to ascertain how much learning had taken place, whether during or after the lessons. The assessment instructions that were informally given were verbal and were not based on what had been taught, but rather on what would be learned in the

following lesson. According to Woolnough (1994), formative assessment of learners in science is necessary and potentially beneficial as it provides feedback to teachers concerning learners' achievement necessary to diagnose and help develop succeeding learning experiences appropriately.

Teachers need to be reflective practitioners. Framery (2002) posits that reflecting critically on one's own practice in teaching is likely to increase the repertoire of effective teaching methods in science. Moreover, reflection enables the teacher to review the effectiveness of what has been taught and learnt.

Framery (2002:105) suggests that aspects of the lesson that teachers need to reflect on are:

- learning objectives – to what extent they were achieved;
- teaching methods – how appropriate the teaching methods and structure of the lesson were;
- lesson content – how appropriate was the content of a science lesson for the range of abilities in the class;
- organization – how effective was the organisation and timing of the session, including the effectiveness of groupings;
- resources – the quality and use of resources; and
- activities – were the activities used suitable for the delivery of the lesson objective?

It emerged in this study that the lesson plans that teachers had prepared did not show that they would be reflecting on the lessons, despite provision made in the lesson plan format. T1 indicated that he does reflect on his teaching (Chapter 5, Section 5.7.1.3), however, the extent to which reflection was done requires further investigation. Issues that could have been identified through reflection, such as the appropriateness of content delivered for the three competencies, were at the heart of this study.

Furthermore, through reflection and through the use of the SATs reports, teachers could have identified that there were certain competencies in which learners did not do well, and could have planned to address such competencies. The lack of sufficient coverage of syllabus competencies by the two teachers, and the limited use of the SATs reports, could be indicative of the absence of critical reflection after lessons.

6.5.3 Content presentation in textbooks

Teachers expressed satisfaction with the content of the textbooks regarding the three designated competencies, described it as just 'fine'. However, the study revealed that all textbooks did not use the word 'influence' as is the case with the second competency above; they either mentioned 'things' that are harmful to the nervous system or to a human body' or 'effects' of drugs on nervous system. In Namibia where English is often a second or third language to many learners, it could be difficult for learners in grade 7 to realise that words such as 'influence', 'effects' or 'causes' may be used interchangeably.

Two of the textbooks (Chapter 4, Sections 4.2.2.1 & 4.2.2.2) did not have any illustration for a reflex arc, neither did they present the classification of elements. Thus, learners could not be expected to identify a reflex arc from diagrams they had never seen. Teachers only gave learners a definition of a reflex arc (Chapter 5, Section 5.5, and Figure 2) as it appears in the textbooks. However, that was not sufficient to cover the competency which demands the identification of a reflex arc from diagrams. It appeared that the competency on identification of a reflex arc was omitted entirely, an indication that teachers did not use the previous SATs results to inform their teaching.

Moreover, the listing of elements (Chapter 5, Section 5.5, and Figure 4) without specifying whether they were metals or non-metals was not sufficient to allow learners to differentiate between elements. It seemed as if teachers had simply replicated the textbooks content into learners' notes. Consequently, the learners' notes reflected the textbooks and not the syllabus.

Teachers appeared to be too reliant on textbooks, to such an extent that if the textbook did not have sufficient information, learners would not get the information required, despite claiming that they used other sources such as the internet and other textbooks (Chapter 5, Sections 5.7.1.5 & 5.7.2.4)

This study could not scientifically test whether the absence of the word 'influence' in the textbooks and subsequently in learners' written notes contributed to the way learners performed in the SATs. It only presents the assumption that the use of other key words and not the one used in the syllabus could influence the learners' performance in the SATs since these tests are set strictly based on the syllabus.

It should therefore be the responsibility of the teachers to ensure that learners are exposed to information that is congruent to what the syllabus requires, even if it means changing the words

used in the textbooks to those used in the syllabus. Coleman, Graham-Jolly and Middlewood (2003) argue that the success of the learners remains solely the responsibility of the teacher, because all learners can learn and they can reach a high level of competency. Although learners have the responsibility for their own learning it remains the teachers' duty to guide learners on what to learn, for example by exposing learners to the syllabus and not keeping it as a teacher's top secret document.

It could be argued that textbooks are not necessarily written to replicate the syllabus word by word, however, the way the information is presented in the textbooks requires the teacher to relate it to the language that is used in the syllabus, otherwise any assessment task set using the syllabus language, learners may not be able to relate to relevant information particularly at primary level.

It is worth noting that no study has been done in Namibia to establish the readability of grade 7 Natural Science textbooks, nor was it done for this study. For these reasons, this study could not scientifically reveal whether the textbooks currently used in Namibian primary schools are appropriate for primary school learners. Hence, this study could only assume at face value that the textbooks are appropriate for grade 7 learners. This is an area for future research.

6.6 Concluding remarks

The SATs are intended to show teachers how well their learners have learnt at the end of primary education. The resultant SATs reports inform teachers' decision-making about teaching and learning. Teaching is viewed as a decision-making process based on categories of knowledge, skills, attitude and awareness (Magano, 2009).

To gain insight into teachers' perceptions of SATs and their pedagogical practices, questionnaires, lesson observations and interviews were used. The intention was primarily to find out what perceptions teachers held about the SATs as a new form of assessment, and how they were using the SATs reports to inform their teaching and learning. A secondary intention was to ascertain the influence of their teaching practices on learners' acquisition of skills in the Natural Science syllabus.

The study found that teachers had positive perceptions towards the ideals of SATs, however, their use of the SATs reports in their teaching was inconclusive. It was also found that teachers were not teaching the syllabus competencies fully, and their Natural Science content was inadequate. These could be some of the reasons why learners did not do well in certain

competencies in SATs. This study suggests that teachers should engage in continuous professional development to improve their Natural Science content knowledge and pedagogical content knowledge.

In the next chapter, I present the conclusion of the study by drawing from the discussions of findings in Chapter six.

Chapter Seven

Summary of findings, recommendations and conclusion

7.1 Introduction

This study primarily investigated the perceptions of selected Natural Science teachers about SATs, and secondarily looked at the teaching practices of teachers with a view to understanding the possible influence such practices have on learners' achievement as illustrated in the SATs.

This chapter concludes the study by drawing from the discussions of findings in Chapter six. The endeavours of SATs, as well as teachers' pedagogical practices in light of their possible influence on learners' achievements are alluded to in this chapter. Recommendations and suggestions for further research, and limitations of the study are also presented. Lastly, a brief account of my research journey is provided as well as the conclusion of the study.

7.2 Summary of the findings

7.2.1 Aims of the standardised achievement tests

The SATs envisaged addressing constraints in the assessment of learners at primary education level. The SATs are low stake assessment, meant to show teachers how learners were learning and achieving in schools relative to regional and national norms. It further envisaged complementing other assessment practices in primary schools such as SACMEQ, in diagnosing grey areas in the curriculum for targeted actions.

Similarly, the results of the SATs provide the basis for teachers to reflect on their teaching practices, as learner performance to a certain extent mirrors the extent of teaching and learning that has taken place. According to van der Merwe (2011), SATs serve as an incentive for teachers to identify the competencies where learners performed poorly, and thus intervene accordingly.

Despite the fact that SATs are a new form of assessment in Namibia, this study revealed that teachers have positive perceptions about the practice. Indications are that SATs indeed help to inform the teaching and learning of Natural Science in schools, and teachers were able to interpret the SATs reports to some extent. Further, the use of SATs in actual classroom practice to improve learners' competence was not evident.

7.2.2 Teachers' pedagogical practices

It is the responsibility of the teacher to ensure that all learners have access to the science curriculum by developing good daily practice which facilitates effective teaching (Framery, 2002). Similarly, the success of the learners remains the sole responsibility of the teacher (Coleman, Graham-Jolly & Middlewood, 2003), although learners themselves have a significant role to play in their own learning as advocated for in the learner-centred pedagogy. This study revealed that selected Natural Science teachers were not living up to their responsibility of ensuring that all competencies in the syllabus are taught fully. As illustrated in the SATs reports, the competencies in which learners did not perform well were not sufficiently taught, as was also evident in the learners' notebooks.

According to participant teachers, learners had access to the Natural Science textbooks; however, most of the textbooks do not present information in such a way that concepts are explicitly clarified as demanded by the syllabus. It was for this reason that Shulman (1986) suggested the need for teachers to repackage the information in the textbooks to make the subject matter more accessible to learners.

The SATs are strictly based on the syllabus, and when the syllabus is not sufficiently taught, learners are unlikely to perform well in the competencies. Learners' notes have exposed a gap in the extent to which selected Natural Science teachers have taught certain competencies, as designated in this study.

The study has established that insufficient coverage of the syllabus competencies was compounded by teachers' subject content knowledge that was at times inaccurate or insufficient, which could adversely affect the achievement of learners in national assessments such SATs.

7.3 Recommendations for practice

- Teachers need to use the SATs reports more diligently in their planning of teaching and learning activities.
- Teachers need to engage in continuous professional development activities
- Teachers need to teach all competencies in the syllabus fully to enable learners to perform well in external assessments.

- Textbooks need to be reviewed to ensure that the information they contain addresses the syllabus competencies more explicitly.
- There is a need to develop policy imperatives for the utilisation of the SATs information by teachers in schools.

7.4 Suggestions for further research

This study was done on a small scale, as it focused mainly on two schools in Khomas region. A large- scale study could provide a more generalisable picture of Natural Science teaching and learning practices in Namibian primary schools.

During the course of this study, it could not be established whether any study was done on the readability of Natural Science textbooks in Namibian primary schools, or on learners' access to these textbooks in terms of language. A study in this regard could yield more insight into the appropriateness of these textbooks for learners in Namibian primary schools, as well as on the impact of teaching science in a second language.

7.5 Limitations of the study

Given the small and localized sample of teachers, viz., a total of ten teachers for the questionnaires, and the small size of the sub-sample of two teachers for the interviews and observations, the findings of this may not be generalized across the Khomas region or the whole of Namibia. Furthermore, due to work schedule congestions it was not possible to observe the teachers teaching the three identified competencies where learners performed poorly. Had this been possible, the findings might have had greater weight. However, the study has provided an indelible opportunity for me to understand learners' performance in certain competencies tested in the SATs, through teachers' pedagogical practices. If I were to do this study again, I would make a concerted effort to observe teachers teaching the competencies in which learners performed poorly in the SATs.

7.6 Reflections on the research journey

At the beginning of the MEd programme in 2011, I intended to research a problematic topic in Chemistry: stoichiometry. However, during the course of my studies, I had to change jobs and it became unfavorable to pursue my idea of stoichiometry. I had to think fast and identify another area of focus more in line with my current job, which deals with assessment and research.

Responsibilities of my new job entail developing and administering standardized achievement tests, analysing learners' results and providing schools with feedback. I therefore decided to undertake a study to investigate the perceptions of selected Natural Science teachers about standardized tests in my quest to understand the performance of learners in these tests.

The research started with the analysis of the SATs reports to establish the baseline data that informed the direction of focus of my research. Thereafter the research tools such as the questionnaires and interviews schedules were developed and piloted. The response from the piloting was awesome and I got an impression that all would eventually go well with the real study, but that was not to be. My research was characterised by certain predicaments. I sent out thirty-five questionnaires to schools in Khomas region and only ten returned. Efforts to follow up on them did not yield any results. Moreover, when I requested teachers to participate in my case study, only two teachers responded favorably, although it was also not without relentless persuasion.

I have learnt that the rate of return of questionnaires could be disappointing for a researcher, but I have also realized that asking questions in an interview requires certain skills and experience for a fruitful interview. Furthermore, I have realized that it is of utmost importance to establish a good rapport with research participants, particularly when the study is of a qualitative nature.

In the midst of all the quandaries, I have always fallen back on Dr. Ngcoza's trademark encouragement phrase "*Do not panic and do not lose momentum*". I persevered until I had collected reasonable data for analysis. I must admit that data analysis was the most tedious and at times difficult skill to master. However, with abundant guidance from the supervisors, I managed to grasp some data analysis ideas and apply them to my data. I am confident that I have done my best in Chapter six.

7.7 Conclusion

The implementation of SATs in Namibia's primary schools comes a long way in addressing constraints with regard to assessment. The need for teachers to fully utilise the feedback that this form of assessment provides cannot be overemphasised. The positive perception that teachers hold of this assessment needs to be translated into tangible actions related to the use of the feedback to bring about improvement in teaching and learning. The over- reliance by teachers on textbooks as the sole source of information needs to be done away with, and content knowledge should be developed continuously. Since SATs is a new practice, a study like this could lay the ground for further study into its impact in classrooms and the development of policy imperatives

necessary to ensure that all teachers use the SATs information in their daily practice. This study could also serve to address the tensions that exist between policy formulation and implementation in Namibia.

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Appendices

APPENDIX A1: Permission letter

P O Box 70098
Khomasdal
Windhoek
Cell: 0811271427

10 February 2012

The Director
Khomas Education Directorate
P/Bag 13236
Windhoek

Dear Ms Seefeldt

PERMISSION TO CONDUCT RESEARCH FOR A MASTERS DEGREE IN EDUCATION

I am a registered student for the Masters of Education (Science Education) with Rhodes University. As a part fulfilment of the Masters programme, I am required to conduct a research.

Against this background, I am requesting for permission to conduct a research in upper primary schools in Khomas region. The research envisaged to explore grade 7 teachers' views, perceptions and experiences about the National SATs with a view to illuminate whether or not it influences their instructional practices in Natural Science and the subsequent implications if any.

This is done with a view that grade 7 NSATs were implemented for the first time in 2010 and the follow-up tests will be administered at the end of 2012. The research is envisaged to take place between May and August 2012. Questionnaires and interviews will be used to collect data.

It is envisaged that the study will apply ethical procedures as no personal information regarding those who will participate will be publicised. Furthermore, participation will be voluntary, school academic programmes will in no way be disrupted and the researcher undertakes to share the outcome of the study with the regional education directorate on request.

I am looking forward to a favourable response in this regard.

Yours Faithfully,

_____
Simson N. Shaakumeni

Education Officer
DNEA: Research & Development

APPPENDIX A2: Permission to research

REPUBLIC OF NAMIBIA

KHOMAS REGIONAL COUNCIL

DIRECTORATE OF EDUCATION

Tel: [09 264 61] 293 4364
Fax: [09 264 61] 248251
Enquiries: Ms T Seefeldt

Private Bag 13236
WINDHOEK

17 February 2012

Mr Simson N.Shaakumeni
Education Officer
DNEA: Research & Development

Dear Mr Shaakumeni

RE: PERMISSION TO CONDUCT RESEARCH FOR A MASTERS DEGREE IN EDUCATION.

Your letter on the above subject bears reference.

Permission is hereby granted for you to conduct a research for a Master Degree in Education on conditions that:

- That prior arrangements need to be made with the school principals before the day of intended research..
- The normal school academic programme will **NOT** be disrupted.
- Teachers/learners who will take part in this exercise will do so voluntarily.

Wishing you all the success.

Yours sincerely,

MINISTRY OF EDUCATION
PRIVATE BAG 13236 WINDHOEK
2012 -02- 20
DIRECTOR OF EDUCATION
KHOMAS REGION

.....

Ms. T Seefeldt
Director of Education
Khomas Region

APPENDIX B: Consent Form for Teachers

CONSENT FORM

An exploration of Natural Science teachers' experiences and perceptions of the National Standardized Achievement Tests: A Namibian case study.

Researcher: Simson N. Shaakumeni

Education Officer: Research and Development

Directorate of National Examination and Assessment
Ministry of Education
Mobile: +264811 27 1427

- The purpose of the research study has been explained to me. I understand and agree to take part.
- I understand that while information gained during the study may be **audio/video taped and published**, I will not be identified and my personal responses will remain confidential.
- I understand that I can withdraw from the study at any stage and this will not affect my status now or in the future.
- I have had an opportunity to discuss taking part in this study with the researcher.

Signature of Participant:_____

Dated: _____

I certify that I have explained the study to the participant and consider that he/she understands what is involved.

Signed: _____

APPENDIX C: Questionnaire letter

QUESTIONNAIRE COVER LETTER

An exploration of Natural Science teachers' experiences and perceptions of the National Standardized Achievement Tests: A Namibian case study.

Researcher: Simson N. Shaakumeni

Education Officer: Research and Development

Directorate of National Examination and Assessment
Ministry of Education
Tel: +26461 2933402
Mobile: +264811 27 1427

20 February 2012

Dear Grade 7 Natural Science Teacher

In the wake of the implementation of National SATs in Grade 7 for the first time in the year 2010 and in anticipation of the follow-up SATs in 2012, arose the hunch to solicit views of Natural Science teachers about this intervention aimed at diagnosing the education system for improvement purposes. The enclosed questionnaire is designed to obtain information about your experience, views and perceptions about grade 7 Natural Science NSATs. Your responses will be anonymous and will be valued. The result of this study will be shared with you on request.

Your input could help with the evaluation of this programme for possible improvement in teacher development if needs be.The researcher acknowledges your busy schedule and values your time. It is therefore hoped that the 15 minutes of your **spare** time it will take you to complete the questionnaire will provide useful information for this study.

Kindly forward the completed questionnaire to the researcher (see above) at DNEA, GRN Office Park, Luther Street, Windhoek or to Private Bag 12026, Windhoek, before the **30th of March 2012. Alternatively, notify the researcher to collect the questionnaire physically.**

Thank you in advance for your participation. If you have any questions about the study, do not hesitate to call the telephone number given above.

Yours truly,

_____
Simson N. Shaakumeni

Education Officer: Research and Development
Directorate of National Examinations and Assessment

APPENDIX D: Questionnaire

QUESTIONNAIRE FOR GRADE 7 NATURAL SCIENCE TEACHERS

Kindly make time to answer this questionnaire

Region:_____School:_____

Code:_____ Male: ☐ Female: ☐

Teaching Experience in Natural Science: _____

INSTRUCTION: Make a cross through your choice

INDICATORS ON TEACHERS' PERCEPTIONS ABOUT STANDARDIZED ACHIEVEMENT TESTS (SATs)

1. **The Grade 7 Standardized Achievement Tests (SATs) will help to inform the teaching and learning of science in the school.**

AGREE	NOT SURE	DISAGREE

1.1 If you **agree**, how do you think that the test results would help to inform the teaching and learning of science in your school?

_____

_____

_____

1.2 If you **disagree**, why do you think that the test results would not help to inform the teaching and learning of science in your school?

_____

_____

_____

2. **The Grade 7 Natural Science test results will help teachers to provide assistance to learners with the competencies they find difficult to learn.**

AGREE	NOT SURE	DISAGREE

2.1 If you **agree**, how would the test results help teachers to provide assistance to learners with the competencies they find difficult to learn?

_____

_____

_____

3. **The Natural Science tests results would be a good measure to monitor whether there is an improvement or not in the performance of the Grade 7 learners over the years.**

AGREE	NOT SURE	DISAGRE

3.1 If you **agree**, how would the tests results serve as a good measure to monitor improvement of learners' performance over the years?

_____

_____

_____

3.2 If you **disagree**, is there in your opinion a better measure to monitor whether there is an improvement or not in the performance of learners over the years?

_____

_____

_____

_____

_____

4. **The arrangement of information in the SATs school report (format) makes the document easy to use (user friendly).**

AGREE	NOT SURE	DISAGREE

4.1 If you **agree**, do you have a copy of the Grade 7 Natural Science SATs school report for use in your planning of lessons or in your teaching?

_____

_____

_____

4.2 If you **disagree**, what changes need to be made to improve the format of the SATs school report to make it user friendly?

_____

_____

_____

5. **The information (content) in the Grade 7 Natural Science SATs school report is clear and understandable.**

AGREE	NOT SURE	DISAGRE

5.1 If you **agree**, what have you learnt from this report?

_____

_____

_____

5.2 If you **disagree**, what changes need to be made to future SATs school reports to make the information clear and understandable?

_____

_____

_____

6. **The Grade 7 Natural Science SATs school report is comprehensive and contains sufficient information about the test needed by the Natural Science teachers.**

AGREE	NOT SURE	DISAGRE

6.1 If you **agree**, is there information which is unnecessary and which could be taken out of the SATs school report?

_____

_____

_____

6.2 If you **disagree**, what information needs to be added to the SATs school report?

_____

_____

_____

7. All the competencies tested as shown in the SATs reports are in the Grade 7 Natural Science syllabus.

AGREE	NOT SURE	DISAGREE

If you **agree**:

7.1 Have you compared the competencies tested in the SATs school report with the competencies in the syllabus?

_____

_____

_____

7.2 Have you taught all the competencies in the report to your 2010 Grade 7 learners?

_____

_____

_____

7.3 If you **disagree**, could you point out in the report the competencies which do not appear in the syllabus?

_____

_____

_____

8. Grade 7 Natural Science teachers are able to interpret (make out the meaning; understand; explain) the information in the school report of November 2010.

AGREE	NOT SURE	DISAGREE

If you **agree:**

8.1 Have you received any guidance on how to use the information in the school report in your teaching? (at a workshop or from a visiting Advisory Teacher)

_____

_____

_____

8.2 Has your school performed better or poorer in Natural Science test than the schools in the region? Why?

_____

_____

_____

8.3 Is there a competency, or competencies, in the report where the percentage correct scores were below 20 % in the Natural Science test?

_____

_____

_____

8.4 What percentage of the Grade 7 learners in the school demonstrated insufficient knowledge and skills across all themes in the Grade 7 Natural Science syllabus?

_____

_____

_____

8.5 Explain how you could use the report and state how your school has performed in the Natural Science test.

_____

_____

_____

8.6 If you **disagree**, why do you find it difficult to interpret the information in the school report?

_____

_____

_____

9. Grade 7 Natural Science teachers are using the information in the SATs school report in their teaching.

AGREE	NOT SURE	DISAGREE

If you **agree:**

9.1 What information in the report do you find most useful in your teaching?

_____

_____

_____

9.2 How are you using the information in the report in your teaching?

_____

_____

_____

9.3 How many times did you use the information in the school report in your teaching?

_____

_____

_____

9.4 Did you use the information in the November 2010 SATs school report in your teaching in 2011/2012?

_____

_____

_____

9.5 Do you feel it has improved the quality of your teaching or not? (E.g.an improvement in the performance of learners).

_____

_____

_____

If you **disagree**:

9.6 What are the main reasons for not using the information in the report?

_____

_____

_____

9.7 If you have not used the information in the report up to now, how do you plan to use the information in future?

_____

_____

_____

10. Any other comment regarding all three indicators A, B and C?

_____

_____

_____

_____

The end – Thank you

APPENDIX E: Interview Schedule

INTERVIEW SCHEDULE

"Thank you for making time to speak with me"

1. In your opinion, what would you say are the ideals of SATs?

2. Did you receive the SATs reports for 2010? If yes would you confidently say you are able to interpret it? Use a copy of the report to explain how you can interpret the reports.

3. Did you receive training on how to interpret the SATs reports?

4. How do you use the SATs report in your teaching?

5. What in your view contributed to learners not doing well in some competencies as illustrated in the SATs reports?

6. What in your view contributed to learners not doing well in some competencies such *identify reflex arc from diagrams, describe the influence of drugs on nervous system* and *classify elements into metals and non-metals* as illustrated in the SATs reports?

7. In what way do you think the Natural Science content knowledge you have learned during your teacher training programme influences your teaching today?

8. How do you describe your content knowledge of Natural Science?

9. What challenges do you experience when teaching Natural Science?

10. How do you introduce new topics?

11. How do you ensure that learners understand what is being taught in class?

"Thank you for your time. Much appreciated"

APPENDIX F: T1 interview transcripts

INTERVIEW TRANSCRIPTIONS: **RSR** = Researcher (myself) **T1** = Teacher 1

RSR	**For how long have you been teaching Natural Science in grade 7?**
T1	*I have been teaching the subject for three years now.*
RSR	**Have you been trained to teach Natural Science?**
T1	*Yes, yes I was, I was trained to teach Natural Science, Mathematics and Social Science through the Basic Education Teacher Diploma (BETD).*
RSR	**In your view, what are SATs trying to achieve?**
T1	*SATs ne?*
RSR	**Yes, in short.**
T1	*Ya! Is actually is to... to find if learners are meeting their basic competencies and they are try to find out they can just uhm...! may be like teaching environment, if teachers well trained in teaching their subjects and what the other negative factors that may be affecting the learning.*
RSR	**Did you receive the SATs reports?**
T1	*Yes I did receive for 2009.*
RSR	**For 2009 only?**
T1	*Yees*!
RSR	**What about for 2010 grade 7 Natural Science? (Took out the report and show it to the teacher).**
T1	*Yah, that's the one, yes, yah, I have this one, I forgot.*
RSR	**Did you receive any training on how to interpret it or use it?**
T1	*Yes, I received. I went for training somewhere at Harmony Centre for grade 5.*
RSR	**But for grade 7, you did not receive any training?**
T1	*Ah ah! For grade 7 I did not receive any training.*
RSR	**These reports are of the same format anyway, given the training you have received although on the grade 5 reports, would you say you are confident in interpreting and using the reports for teaching?**
T1	*Yes, yes I am confident; it was just one month ago when I went for this training.*
RSR	**Can you give an example?**
T1	*Example here I can look at the first one science test, theme 1- Healthy Education whatever healthy body ah! Human body and development. Looking at this one we have nation, region and school, now we are comparing the two, for example the nation which is 51% ouh! first with cognitive level, this is the thing that is required the learner. We look at national which is 51%, regional 61% and school 62%, ok. This show that the school is doing well which is better compare to other regional and national. When it come to the second here, the school, the national is 54%, the regional 66% and the school 64%, this show that the school were dropping there, they did not do well on that one.*
RSR	**How do you use the report in your teaching, do you use it at all?**

T1	*Eeeeh! Last time we had a workshop on this one, we talk about few themes, we compare schools, we found that certain topics that learners were not getting well, then we tried to identify factors why learners not doing well because we find that learners were not doing well in a certain topic in many schools. What was the problem? We try to write down the possible problems that learners were facing, for example the one on digestive system; when it comes to stating the end product of digestion of starch, fat and protein. You find that most of these topics were just introduced to the learners for the first time in grade 7. We also looked at how we can now go about helping learners understand better the topic yah! According to my own practice, whenever I am teaching I look at the topic, like ok, this is when I taught it the previous year and what the standardised achievement tests results, so this gives an indication on what to improve compare to what I did the previous year.*
RSR	**This is the second component of the report (showing the qualitative description of performance level categories) do you consult it also? Do you understand what it is telling you?**
T1	*Yah! I understand this one, just like the one I explained before, you find that if a learner, a learner did not do well, .. ok, we have below basic, basic, above basic and excellent. Now if a learner did not do well, did not do well in a topic that means that learner fall under below basic and some learners who show some knowledge fall under basic, those that score about 60% there fall under above basic and the others with more knowledge will be in excellent. This actually the level how learners are being judged according to the knowledge they know when they sat for those tests.*
RSR	**In your view, what do you think contributed to learners not doing well in some competencies that appear quite easy to master such as identify reflect arc from diagrams, describe the influence of drugs and classify elements as metals or non-metal?**
T1	*Yah yah! There are several factors that contribute to that one, the first one I can mention is the teachers' presentation. The teaching itself that takes place in class, may be the teacher was not putting enough effort to help the learners understand the topic. That is the one. Because when you teach at least you need to have to have some teaching aid. You need to have teaching aid that shows where the nervous system is and also some certain chemical that affect the nervous system. The other factor is that even like the teacher has delivered the lesson well, it depend to the work of the learner, because some learners still go there with their books and revising what they have learn and still investigate further. But some learners just go there and forget. But if they keep on reading and reading we will be able to remember. This is the thing that is causing some learners to fall under below basic, because you cannot just point to the teacher that I did not do well because the teacher did not do this, a well trained teacher teaches according to basic competencies in the syllabus.*

RSR	**In what way do you think the Natural Science content knowledge that you have developed during teacher training influences your teaching today?**
T1	*Yah!, ok, I ... I had a well trained Lecturer, who was ... uum who taught us well and I am thankful for that. Because she really demonstrated to us what we suppose to know and all things we have done, research here and we demonstrated in the classroom. We were well trained.*
RSR	**Would you say that Natural Science content you have developed helps you teach better or constrain your teaching skills?**
T1	*No...it help me teach better, it also helping me teach .. teach better so helping me to reflect myself the way I taught, reflect myself how I conduct the lesson. I don't just teach today and realise that ah–ah something went wrong and tomorrow I don't rectify the mistake before continue with something else. I don't do that.*
RSR	**Would you say you are confident enough to teach Natural Science at grade 7?**
T1	*Yees! I am confident, so despite the unavailability of resources in our schools, for example no laboratory or library for learners to use.*
RSR	**How do you introduce a new subject matter to your learners?**
T1	*Uum, introducing a topic depend, but for instance what I was teaching today, I ask learners what they learn the previous day as a reminder. If there was homework, we rectify the homework before we go the next topic. And then eh.., first of all to like.., to understand you write the topic on the chalkboard, to understand if the learners dealt with the topic before, you see in form like questioning, how do you understand this term and try to assess mentally, mental activity development of the learners if they have some basic knowledge of what of what is about to be introduced to them.*
RSR	**In other words you solicit learners' prior knowledge before you get into the topic you are going to teach.**
T1	*Recall yes, yes.*
RSR	**How do you ensure that learners understand what is being taught in class?**
T1	*Uum, to see if learners understand is in two ways, like in a question in a method asking questions while teaching and like a small assessment in form of writing that involve the content that you taught and mark it and that is when you see whether they understand. I also give tests, topic tasks and investigations.*
RSR	**Is English language a problem in your Natural Science class?**
T1	*Learners understand English but putting down on paper is a problem. Writing is a problem. As a Natural Science teacher you have to look at the learner's thinking like what was the learner trying to say or write.*
RSR	**What are the challenges you experience when teaching Natural Science in your school?**

T1	*Yaah! I or we experience the challenges like the first thing is the lack of commitment among the learners today. They are not committed to their school work. But also the parents' involvement in their learner's learning is very poor. For instance when we call up a meeting or may be to come and make observations how their learners are learning, they don't turn up. The other thing is the lack of resources at our school. Although teachers are supposed to prepare their own teaching aid, some things need to be in the class. The challenges are many but those are the few that I can mention for now.*
RSR	**Do all learners have access to textbooks?**
T1	*Yes, all of them have textbooks. What I normally do every Friday, I write down the monitoring of the textbooks and sometimes you find that one learner is sharing a textbook with others and when you ask you will be told that the book is lost. So have textbooks but learners are careless, they throw the textbooks away.*
RSR	**Which titles are available for learners?**
T1	*I have this one (showing the book) Natural Science and Health Education, I have this other one Natural Science and Health Education in Context and then I have the other one ... uum, Natural Science .....uum, I can't recall the title but currently I am using three.*
RSR	**How do you describe the content of the textbooks?**
T1	*The content of the textbook, uum, it's like this Natural Science and Health Education in Context, uum, the content is not that deep in this one, eeeh, not really that deep.*
RSR	**But does it address the basic competencies in the syllabus?**
T1	*Yeah, obviously addressing the basic competencies and I also for teaching I also use this one (showing the other book). According to me, the books are ....the books are fine. I like one book that I personally bought, it is a South African-based book, it highlights more on the knowledge learners suppose to acquire, to acquire for certain basic competencies, it helps me with teaching.*

APPENDIX G: T2 interview transcriptions

INTERVIEW TRANSCRIPTIONS: **RSR** = Researcher (myself) **T2** = Teacher 2

RSR	**For how long have you been teaching Natural Science in grade 7?**
T2	*Grade 7 I have taught now for 26 years.*
RSR	**Where you trained to teach Natural Science?**
T2	*No sir, I am not because when I go to college we were not trained in the specific subjects, we were trained as primary and secondary teachers, therefore we were not specialised in any subject in the field, we were just teaching without specialised subjects.*
RSR	**What gives you confidence to teach Natural Science when you were not trained the subject?**
T2	*What gives me confidence is that I am very comfortable with it although I didn't go through that because of the fact that when I got the syllabus, because when you apply you are given just .... from 1991 when I started, we were not asked to teach a specific subject it was teaching all the subject because you were trained for that purpose, therefore that time you were just given any subject you can teach ok, although when we started it is not nice.*
RSR	**How much do you know about SATs?**
T2	*I know very well and my kids are performing very well in the standardised tests uum normally when the kids come out of lower primary are just repeating the basic competencies but when coming to grade 7 some topics are new like the scientific processes now I use to get from the standardised test report that my kids are doing quite well even in these competencies.*
RSR	**So you do receive the SATs reports?**
T2	*Yes I do receive the reports.*
RSR	**Did you receive training on how to interpret and use the report the SATs reports?**
T2	*Yeah, we did. We go through there. We were really getting information how is the important of standardised tests therefore for me I found out that standardised test is helping the teachers and the learners to understand because sometimes you are thinking as long as you think but that is not the case you have to focus with the syllabus so that you can make the kids understand the basic competency, otherwise the kids find standardised test difficult for them.*
RSR	**Can you explain how you use the standardised report in your teaching?**
T2	*The report when is given the level, if you find out let me say that it is in human*

	development you have to compare your school with other schools in the region, you will that no, this chapter I am very low, the regional is very high therefore you look at the basic competencies whether do you really have to make sure that the kids understand that basic competencies therefore when there was no standardised tests there was no way you can find that in this chapter you are not really cope very well with the learners with the standardised tests because some of the chapter you get eighty something or ninety but you find some of the chapter you get so few.
RSR	**In your view, what do you think contribute to learners not doing well in some competencies as illustrated by the standardised tests reports?**
T2	T2: It depend to the teacher how he understand also the basic competencies because the teacher has to make sure that he master to the basic competencies he prepare, if you are not master to the basic competencies you cannot give it well to the kids to understand.
RSR	**How do you introduce a new subject matter to the learners?**
T2	*Depend what topic it is, if a topic is about the animals, you can get the poster of animals, if is a scientific let me say is a periodic table, you have to go to the internet also to get some of the information although the standardised tests does not really go far it goes only up to somewhere you stick to what you suppose to do, but you get the concrete materials that can make the kids to understand. Therefore if it is a poster you or any concrete material is water you bring it therefore you have to bring something that kids can see what you are talking about.*
RSR	**What is your take on learners' prior knowledge when introducing a new topic?**
T2	*Ok, sometimes you start with asking questions when you are introducing the topic, introduce by asking questions then they are giving their views some of them individually some of them are answering on the chalkboard before you introducing the topic that they give before the information then that then to say ok, our topic for today is this, you can see that you can bring the information coming from them then that is basing on the introduction of the topic.*
RSR	**How do you ensure that learners understand what has been taught?**
T2	*After the lesson you should make sure you revise your lesson what you taught asking whether they can recall few minutes after you presented something before they leave make sure you can ask what the main basic competency whether they can able to*

	remember all the points which they suppose to know about that basic competency.
RSR	**What challenges do you experience when teaching Natural Science in your school?**
T2	*Challenges are sometimes materials which the school does not have you might introduce the topic let me say the electroscope when the school doesn't have it, it something that kids do not know therefore it is really challenging to make sure that you should try to explain something that kids cannot see. So you are just giving information because it was agreed upon but you don't have material to show learners.*
RSR	**Would you say your content knowledge is helping you teach better or is it hampering?**
T2	*It will help, because it depend how you give the basic competency, I am confident in the basic competencies that I deal with in the syllabus.*
RSR	**Do all your learners have textbooks?**
T2	*Yes, they have Natural Science and Health in Context.*
RSR	**How do you describe the content of the textbooks?**
T2	*No, they are fine except some topic especially the topic of the ... which I observe that is not ok a little, normally in the past the topic of Periodic Table and scientific processes used to be introduced in grade 8, maybe it is good to introduce but not to go into details.*
RSR	**When learners write note from the chalkboard do you check whether they copied correctly?**
T2	*We have to do it but sometimes is going to be difficult because learners are too many. We do it sometimes not always because are having topic tasks, homework and investigations to mark, to tell you the truth is too much.*
RSR	**Thank you so much for agreeing to this interview and good luck with your teaching.**
T2	*Thank you too and all the best with your Masters.*

APPENDIX H: Stimulated recall discussion

STIMULATED RECALL DISCUSSION (Post lesson discussion)

RSR: There are a few things that I would like to point out, for instance when you gave the composition of air, you indicated that one of the gases in air is hydrogen, which is not correct.
T1: *Ok.*
RSR: Hydrogen does not exist in air as a gas but it exist as part of other gases such as water vapour which is made up of water and surely is made up of hydrogen and oxygen.
T1: *But it is here in the textbooks other gases in air include hydrogen, carbon dioxide.....*(pointing it out in the textbook).
RSR: Ouh, ok, so it is in the textbook? It have been a mistake by authors of the textbooks, they shouldn't have included hydrogen as a gas found in the air. Always cross check information among textbooks you have at your disposal. You see like in this book, it does not indicate that hydrogen is on of the gases that make up air. Surely this need to be rectified. However, in the mean time you need to go back to your learners the next day and rectify this misunderstanding. As you indicated earlier in our conversation that you don't just leave something that is wrong unattended or rectified.
T1: *Ok, I will do so*.
RSR: Ok, that is settled.
RSR: The next thing that I picked up was about the testing for the presence of water in the air. I am not sure if it was because of the camera that you got a little confused. The issue of the copper sulfate, you were telling your learners that anhydrous copper sulfate is blue and when is left in the air it will turn white. That was very wrong. If it is blue then it is hydrated, that is when it is called hydrous copper sulfate, meaning there is water of crystallization. When it is heated, it becomes white and that is when it is called anhydrous copper sulfate meaning there is no water.
T1: *But are they not two, there is this blue and the white?*
RSR: No, it is one substance that changes colour when the amount of water in changes. When it is blue it contains water, when it is white, it does not contain water. I don't know what caused the confusion but you just need to go back to your learners and rectify this mishap.
RSR: When you asked your learners what they have learned, they were answering with their books open. What purpose did that serve? When learners copy notes from the chalk board the teacher need to check whether learners have copied correctly.
T1: *It was probably just one of those days.*
RSR: The study I am conducting was triggered by the fact that when I studied the SATs report, I realised that many schools did not do well some competencies such identifying reflex arc from

diagrams. When I check in your learners books, I could not find any diagram illustrating reflex arc. How did you address that competency?

T1: *I know I understand that one. I made copies of the reflex arc for learners but I didn't check where they kept it.*

APPENDIX I: Transcript for Lesson one

TRANSCRIPTION OF LESSON ONE (LRS = Learners)

T1: What are we here for?

LRS: Science!!!

T1: Who can remember what we learn yesterday

LRS: Water pollution.

T1: water pollution. Alright what pollutes water?

LRS: Human activities.

T1: Yes human activities, for example?

LRS: Releasing.

T1: Releasing in water yes! Very good.

T1: What else?

LRS: Putting sand.

T1: Putting?

LRS: Sand!

T1: Putting sand? Yes putting sand in the water.

T1: How do we clean this water? How can we clean polluted or dirty water?

LRS: Boiling.

T1: Boiling for how many minutes?

LRS: Thirty minutes.

T1: Thirty minutes?

LRS: Nooo!

T1: How long?

LRS: Twenty minutes

T1: Twenty minutes, very good.

T1: Ok, another way of cleaning our water is by ...?

LRS: Filtering

T1: Filtering, eee? So we have to filter it this way. Ok.

LRS: Yees!

T1: Ok, today we are looking at eee ... I think we concluded with this lesson yesterday. Ok, today we are going to look at AIR. Right, the date ... (writing the date on the chalkboard). The theme is air, air around us (writing the topic on the chalkboard). Yees, some of us we don't know what air is, what is air?

LRS: Is a ... is a gases that are surrounding us.

T1: oou! Gases that are surrounding us, very good I like the term gases. So, gases that is surrounding us, where do we find these gases?

LRS: Everywhere.

T1: Everywhere, ok, since somehow in grade five or grade six we learned about air as a mixture of gases, alright what is a mixture? Anyone?

LRS: A combination of substances.

T1: Yes, it is a combination of substances. So we say air (writing on the chalkboard) is a mixture of gases. Right, now we are going to identify these gases. I want you to close your textbooks. I want to see if people can remember what they learn in grade six. Alright, what are these gases? Air is a mixture of gases.

LRS: Hydrogen,

T1: Hydrogen, we have hydrogen, what else?

LRS: Nitrogen.

T1: Hydrogen, Nitrogen, what else?

LRS: Oxygen.

T1: Oxygen, very good, what else?

LRS: Carbon dioxide.

T1: Carbon dioxide, what else? Ok, we mentioned, nitrogen, hydrogen, oxygen, somebody mentioned oxygen .... carbon dioxide,

LRS: Hydrogen, Chlorine ...

T1: Hydrogen?

LRS: Yes!

T1: Alright, before we jump to hydrogen, let us found the composition, in other words we are saying the percentage of nitrogen in the air. Air is mixture of other gases, there must be a certain percentage for each gas, ok.

LRS: 21 percent.

T1: 21 percent?

LRS: Yes!

T1: Is that correct?

LRS: Noo! 78 percent.

T1: Very good. Ok, if it is 78 percent what is the remaining percentage? How much is the remaining percentage?
LRS: 22 percent.
T1: 22. Ok, so if we are left with 22. Oxygen?
LRS: 21 percent.
T1: Oxygen 21. How much is the remaining?
LRS: 1 percent.
T1: Carbon dioxide?
LRS: 1 percent
T1: Is it 1 percent?
LRS: Some yes, some no. One learner: there are other gases also in that one.
T1: Ok, so let us say carbon dioxide is 0.03 percent. Now how much is the remaining percentage?
LRS: 0.07 percent.
T1: Are you sure?
LRS: Yes.
T1: 0.07 plus 0.03 equals one? Let us see, addition. 0.03 plus 0.07 is equal to 0.10. is this 1?
LRS: No.
T1: Now tell me the remaining percentage?
LRS: 0.97 percent.
T1: Ok let us add 0.97 plus 0.03 equals 1. So the other gases give us that one, which covers what is left of the 100 percent. Ok, now what are these other gases?
LRS: Helium.
T1: Helium, ok, we are looking at other gases, these are helium, the other one?
LRS: Hydrogen.
T1: Hydrogen, uhu?
LRS: Chlorine.
T1: Chlorine?
LRS: Calcium.
T1: Calcium? Uum, ok , the other gases are hydrogen, helium, hydrogen, argon and water vapour.
LRS: But chlorine is also a gas.
T1: Chlorine is also a gas but uum, let us find out if it is also part of other gases, how do we find out? Read where? Read other books, internet, cyclopedia and give the answer tomorrow.
LRS: Yes sir!

T1: Ok, that is air around us. Now what is the use of nitrogen in the environment? To ... to ..., you don't know? (No response) So as part of your homework find out the uses of nitrogen, so that we share this knowledge with others.

LRS: Yes sir.

T1: But my interest for today I want to find out the uses of oxygen. Where is oxygen used?

LRS: In our bodies.

T1: In our bodies, for breathing right?

LRS: Yes.

T1: Animals uses oxygen for ... breathing.

LRS: (one learner said loudly) Plants releases carbon dioxide.

T1: Plants release carbon dioxide?

LRS: (other learners) Noooo!

LRS: Plants releases oxygen.

T1: Ok, and carbon dioxide?

LRS: We release it out.

T1: Released by the animals and human when they breathe out. Remember the reaction that takes between carbon and oxygen in our body and that compound that is released is carbon dioxide, we talked about compound already.

T1: Ok, we want to prove that we have water vapour in the atmosphere. Can we prove that? How do we prove it?

LRS: By breathing on the mirror and also when it is cold the window gets wet.

T1: Yes, ok, you have got the idea, ok, that is what we are going to do now. We are going to carry out a scientific... scientific what?

LRS: Scientific experiment!

T1: Scientific processes, ok. In this practical investigation we want to find if out if we really have water vapour in the air and we also want to find out if we have oxygen around us. Ok. We will start with water vapour. Alright so you are in different groups, I want you to choose one person to come quickly forward here and take something. Be careful; do not smell the substance you got, put it where others can see it. Alright, where do we start when we have to do a scientific process?

LRS: (One learner answered) We classify (another learner answered) we start with the aim.

T1: We start with the aim. What is our aim in this case?

LRS: To find out whether there is water vapour in air.

T1: Ok, what is next after the aim?

LRS: Apparatus.

T1: Before the apparatus we look at the prediction or hypothesis. What do you predict? What do you know?

LRS: There is water vapour in the air.

T1: Ok, we believe there is water in the air. Ok, let us find out. And then what is next?

LRS: The apparatus or materials.

T1: Ok, materials or apparatus. What is the apparatus that we are going to use in this case?

LRS: Blue sugar (referring to hydrated copper sulfate powder which is blue in colour).

T1: Blue sugar? Ok, what else?

LRS: Blue soap.

T1: Where is the blue soap?

LRS: In the saucer.

T1: Ok, it is not blue sugar or soap. We call it blue 'unhydrous copper sulphate powder' (as written on the chalkboard, although the correct science should have been to mention 'copper sulfate' alone without blue and 'unhydrous'). Ok now, what is happening here? What is the next procedure?

LRS: The method, how to do it.

T1: What are we going to do now the method? ok, the steps of how to do it. Ok, some of you have two, a flask and this one (pointing to the little dish where copper sulfate powder is placed) whatever you call it. What is happening here is that you see it is blue, eeem, blue anhydrous copper sulfate is in the flask, one flask is blue the other one look a bit blue but white. What I did was a study, I also didn't know there is water vapour, what i did was to put this one yesterday on my window there now we are going to compare this one and this one (holding up two containers with copper sulfate powder but with slightly different colours) this one looks... blue, right?

LRS: Dark blue

T1: Blue, dark blue, very good, and this one...?

LRS: Sky line.

T1: But it was the same way, I got it from the same flask, it is supposed to be dark blue also. What does that tells you?

LRS: That there is water vapour.

T1: That there is water vapour. What happened is that the blue anhydrous copper sulfate is blue, but in the presence of water vapour, the blue anhydrous copper sulfate turns white (repeated this three times). That is what you see now this one in this plate here is turning white. That means there is water vapour in the air. Ok, what did I say? We are testing if there is water vapour in the air.

LRS: The blue anhydrous copper sulfate powder in the presence of water vapour it turns white.

T1: In the presence of water vapour it turns to white.
LRS: Will it not turn to white hydrous copper sulfate because it is white now?
T1: Ouh, ok, what is anhydrous? Very good, I like the question, what is anhydrous copper sulfate? (Waiting for learners response) Yes....dictionaries! Did you find anything in the dictionaries? If there is nothing in the dictionaries we don't have science dictionaries. Ok, what is happening, anhydrous is something dry, do you see is wet?
LRS: No

T1: Is not wet is dry but in fact it captures the moisture. Eeh? Are we together?
LRS: Yes.
T1: I want us to find a clear definition of the word that is in there, I explained something that is dry is not wet. Eeh? Even if it captures moisture or water vapour but is still dry.
T1: That is how we find out if there is water vapour. Now, I don't have the white, I don't have the white copper sulfate, but we had the white copper sulfate, it can change back to blue.
LRS: How?
T1: How again? Because of the presence of water vapour in the air. This is blue.
LRS: Teacher, if you take the white copper sulfate, what do you do to change it back to blue?
T1: (Repeating the question), what do we do for us to change the white copper sulfate to blue?
LRS: I think we should put it in a dry place.
T1: Put in a dry place, I love that, I like that, very good, that is a scientific thinking. Eeh? You put it at a...?
LRS: Dry place (chorus).
T1: Dry place where there is no water vapour, eeh, the process is reversible, ne?
LRS: Yes (chorus)
T1: Who can tell me the other method they should demonstrate if there is water vapour in the air?
LRS: When it is too cold the window start .....
T1: When it is too cold the windows start doing what?
LRS: Freezing (chorus)
T1: Freezing? What appears on the window?
LRS: Water vapour.
T1: Do I have something cold here?
LRS: Yes, there are those bottles there.

T1: Give me those bottles there. Alright what happen here is that when you look at that bottle you see the surrounding the outside looks like is having water drops. What happens? Remember the process of condensations? What is condensation?
LRS: when water rises.
T1: When water rises?
LRS: No (chorus), when substances change from gas to liquid.
T1: From gas to liquid, what happen? When the air is cooled it changes to liquid (water vapour).
BELL RINGS!!!!!

T1: Ok, I am going to give you a home work quickly before you go, I want you to write the procedures of scientific processes in groups and in this case is to find out if oxygen is present in the atmosphere. Discuss in groups tomorrow. We are going to share ideas tomorrow.

APPENDIX J: Transcript for Lesson two

TRANSCRIPTION OF LESSON 2

T2: We are done with Electricity, isn't it?

LRS: Yes!

T2: Ok, today we are going to start with a new topic, and this topic is the last topic before we start with our exams. Now this topic is an old topic, we did it in grade 5, we did it in grade 6, we are just doing as a revision. I am going to check whether you can still remember what you did in grade 6. What are the living organisms?

LRS: No response.

T2: What are they? Pause...What are ....? Who are the living organisms?

LRS: The mammals.

T2: The ...?

LRS: Mammals

T2: Ouh, then we won't finish, put them in the groups where do you classify them.

LRS: People.

T2: Can we say the people then are we going to finish then, can you classify and put them according to the where they belong?

LRS: Is the abiotic factors.

T2: What are the abiotic factors?

LRS: (No response).

T2: When you are talking about factors, what are we talking about? What is the other word for abiotic factors?

LRS: (Still no response)

T2: Uh uh! What are the abiotic? When you are talking abiotic, what are you talking about?

LRS: Living organisms.

T2: You want to say abiotic is a living organism? I don't believe you, I will put that here (writing on the chalkboard), but there is something that is a living organism and something which are abiotic factors.

LRS: Abiotics are non-living organisms.

T2: Ok these are the non-, non-living (writing on the chalkboard).Ok, is that true?

LRS: Yes.

T2: Ok, then what about living organisms?

LRS: Biotic factors.

T2: Biotic factors, living and non-living organisms, it means that we are going .. our topic is a living organisms, isn't it?

LRS: Yes.

T2: Living organisms (writing on the chalkboard) that is the main heading to our topic. Who are the living organisms? The abiotic and biotic isn't it?

LRS: Yes.

T2: Livings and non-living. Now we are going to concentrate on both living and non-living but let us concentrate with living organisms today. Now, when we are talking about living organisms

we group them according to their characteristics, we say this they are doing this they are doing that they are doing this, alright?

LRS: Yes

T2: Now I am going to give you a piece of paper with something to remember, to give me the characteristics of the living organisms, you look at the picture, you study the picture, can you remember the six characteristics of the living organisms? You must take your summary, not the textbook, don't open the textbooks.

LRS: Learners take their summary books and start jotting downs a few things.

T2: Ok, let us look at the picture together, study the picture below very carefully that outline the characteristics of a living organism and give the characteristics to their name if you look at the picture alright, now I give you two three four minutes, hurry up. Look at the A, what type of characteristics is described on that picture? Look at the picture and indentify what are the characteristics of that one, is showing what?

LRS: (Learners get on with task).

T2: You can share, is not a test, ok, you can share, but I wanted to check whether you can still remember once again, can you remember? People are not remember any, any characteristics. (Walking around checking learners' work) Do you want to say that this is a respire? Learner: No mem. Ok, go on. (at another learner's table) Do you want to say that eat is a characteristic? Another learner: no. (Checking another learner) Don't cover anything, nothing to cover, nothing to hinde but you cannot remember? After a while: What do you think the first characteristics of living organism in your paper? (Writing the heading on the chalkboard). What is the first one?

LRS: Grow.

T2: Can you agree?

LRS: No

T2: Is one of the characteristics but when you are looking that is not grow. Look at the picture, you must know how to look at the picture and get really what the picture is telling you.

LRS: Reproduce.

T2: The first one is reproduce. Why are we saying that is reproduce? Why is tellings you that is a reproduction?

LRS: Because is having a baby.

T2: Because is carrying a baby. You can identify that this is repro... two people three people and they are all holding their babies that is reproduction. All the living organisms they reproduced. Ok, let us look number B, what is the other characteristics?

LRS: Breathing.

T2: She say breathing , is that correct?

LRS: Yes.

T2: The second one is breathing (One learner: or respire), all the living things, remember that living things then we say abiotic and biotic, alright, now here all living things they are breathing, they are reproducing, what is the next characteristic?

LRS: Walking.

T2: Is walking a characteristic? Non-living things they can also... living things...is that one showing that is walking? The second one can see even the pot ...excrete! Excretion isn't it? Number is excrete or excretion. Do you know what is excrete?

LRS: Yes

T2: What does it mean?

LRS: Releasing waste (choir)

T2: Excretion is to release the waste. Can you see now?

LRS: Yes.

T2: What is the last... the next one D?

LRS: Grow.

T2: Grow, yes, grow, they grow, can't you see, a person is having another leg, the third leg. All the living organism they grow. What is the next?

LRS: They feed.

T2: They feed. All the organism they feed. Who got all of them?

LRS: Many learners put their hands up.

T2: Isn't it, I say we are repeating. Alright, we know now the living organism the characteristics of the living organisms those are the five characteristics of the living organisms. Now, because we are trying to find out how the living organisms are .... living, we cannot leave ... when we are talking about living organisms without talking about the senses. Isn't it?

LRS: Yes

T2: Now, living organism they are having sense, remember when you are talking about living organism you must not forget you are talking about the plants and animals that is the most important things. Now, the plants and animal they are also have sense, they are also having the characteristics. Let us look about the sense, what are the sense? Can you indentify the sense? I give you three or two minute in your paper. I will check what you are putting there.

LRS: (One learner) I am done.

T2: You are done?

LRS: Yes.

T2: Why should you done? Ok, you must give others people chance. Please I want more than five. What are the sense of a living organism? What are your sense? List them, name them.

(Walking around while waiting for learners to list the senses)

Ok, let us look about the sense, what are they? Living organism have got sense, what are those?

LRS: I think they can smell.

T2: They can smell. Why do they smell? Why do you smell? What is helping you to smell something?

LRS: The nose

T2: I didn't ask what do they use, I say why...what is the need for us to smell?

LRS: To know their surrounding.

T2: To know their surrounding, remember that plants and animals, like now let us take an example of the other animals, the wild animals. Why do they use a smell to them, why the smell important to them? The wild animals... even to you. Why do we think that we have to smell?

LRS: For the animals to hunt. (Other learners giggle in amusement).

T2: Shhhhhhhhhhh!!!! Yes, is correct. Just make your sentence correct nicely.

LRS: When they smell for the other animals to hunt.

T2: Is correct, can you make it better?

LRS: For the predators to see where their what..... uum is gone. Another learner: When the animals are smelling for their tracks, like may be if you are sleeping and there is a lion there.

T2: What else? Even they can smell us, for the hunters, when you want to hunt they smell may be the wind is blowing to them. Even to us we can also smell something. Check what is happening. All of us the smell are helping us to smell so that we can react to that situation. What other sense do you know?

LRS: Movement.

T2: Move? Is that true?

LRS: Some yes some no (choir).

T2: The move is only on the characteristics, the sense don't have move as a characteristic.

LRS: They can eat.

T2: That is a sense? How is it going to respond? Remember the sense are there to help us respond, to react, but that is not a sense.

LRS: Tasting

T2: Tatse, wow, tatse. All the living organism they can taste. What do you mean by taste? We taste, why do we taste? What do we taste? What is the important for us to taste as a living organism? We are all taste, isn't it?

LRS: Yes

T2: Why do we taste?

LRS: To look how something is sour or sweet.

T2: Yes, we taste whether the food which you are eating is it sour or sweet or is... what else? What is the most important thing? What do you think you can taste? Do other animals taste also?

LRS: Yes.

T2: Yes, when animal are grazing, they don't graze even the poisonous plant, they don't, they just graze the grass which they can eatable to them, otherwise they will die. Therefore, plants and animal we taste and we smell... what else?

LRS: They can hear.

T2: They can hear, all of them they can hear. Isn't it?

LRS: Yes

T2: You can hear, you respond when you hear, you react, we are reacting to the sense. What else, number four? What is number four?

LRS: they can see.

T2: Yeah, they can see. We can see, is not correct? All the living organism they can see.

LRS: Nooo!!!! No teacher (choir) One learner: do you mean that even the plants can see?

T2: That's why they are moving, they can also may be see, they can use the sense to search for the sunlight, is correct!!! some plants they can even close at night, some plants they can ...

LRS: What about the snake? It does not close their eyes.

T2: They are closing their eyes. Do you want to say to see is not our sense?

LRS: It is .

T2: It is because when you saw something .... you.....(suddenly closing her eyes to demonstrate) you respond, we are talking about sense can react to our responding, isn't it? We respond according to our sense. What else?

LRS: Feel.

T2: Yes, feel, we feel, what do you mean by feeling? How do we respond by feeling?

LRS: We feel if something is smooth or rough or soft.

T2: That is the stimuli, that is responding to your body, no don't touch, even a small baby can feel. You can react according to your sense is helping us. Are we lefting something there?

LRS: No, yes.

T2: What do we left? Look in your textbook. We are on page 109, the characteristics of the living organisms. Are you there?

LRS: Yes.

T2: Living things include all the plants and all animals. Living things are different to the non-living things because they have the following characteristics. Those characteristics they are the one who make us different from the non-living things. Non-living things they don't t reproduce, they don't breathing, they don't excrete, they don't grow and they don't feed. The characteristics are the one which differentiate the difference between living and non-living things. Give me an example of a non-living thing. What is a no-living thing?

LRS: A stone

T2: A stone, they never have that characteristics that makes us to differentiate the difference between living and non-living things. Alright, then they continue that all of them those are the five .... six characteristics of living thing. It continue with the sense.. I want someone to read the next paragraph.

LRS: Animals and plants have sense. Animals are able to respond or react to their environment because of their sense. People and other animals have five senses. They are sight, touch, hearing, taste and smell. You use these senses to take in stimuli or information about the environment and react to the information in an appropriate way. Our senses can help to protect us from dangerous situation.

T2: What is stimuli? We are using the sense to take in stimuli. What is stimuli?

LRS: Information.

T2: Information, can we say it is information? Can it make you understand to say that stimuli is the information?

LRS: Teacher, I think is the act in people or plants and animal.

T2: Ok, is the reaction, to react, to realise to something to tells you that *nie man*... let me give you one example: I was just sitting there while you are busy then I take orange, I started to peel my orange then my orange it was very sour, then I start shhhhhhh... what is going to be on you? I am eating my orange, you can feel the smell. There is something that is going to react in you Where?

LRS: In the gum first.

T2: Saliva will start to come, stimuli, you are stimulating according to the situation what you observe and your body will start to react but if you are nervous also, where is your stimuli going to start?

LRS: In your heart.

T2: To your heart, you start (demonstrating fast heart beats) ... and even the whole body it don't know even to do what you are going to do. Your reaction whether you run away it depend to your stimuli. Now they say, why do we have senses? Is a sense important to us?

LRS: (No response)

T2: Do we need to have sense?

LRS: Yes

T2: Why?

LRS: To respond and react to the environment.

T2: Yes, to respond and to react to the environment, is also helping us to protect us from danger. Like if you hear the voice of the lion, you react, and what is giving you is the sense.

Now, what did we say today? We talked about the characteristics of the living organisms and we said that the characteristics are the one which a difference between living and non-living things. We talked about the sense, they are five and you must know what is the work of the sense to us, what is the importance and what are they.

Please that paper you must put it in your book, have a nice day.

APPENDIX K: Extract from SATs quantitative report

APPENDIX K

Republic of Namibia

MINISTRY OF EDUCATION

DIRECTORATE OF NATIONAL EXAMINATIONS AND ASSESSMENTS

Report on the National Standardized Achievement Test (NSAT), 2010

Grade 7 Science

School Demographic Information:

School Code:	[redacted]	School Name:	[redacted]
Rural/Urban:	[redacted]	Region:	[redacted]
No. of Learners Taking the Test:	[redacted]		

	Cognitive Level	National	Regional	School
Describe the mixing of substances to make solutions as a physical process	Knowledge	56	57	60
Explain that the components of mixtures can be separated by methods	Application	46	41	46
Topic: Building blocks of matter: air around us	[redacted]	51	44	42
State the composition of air in the atmosphere	Knowledge	64	64	67
State that one fifth of the air around us consist of oxygen and the four fifths consists of nitrogen	Knowledge	49	40	43
Name two substances which are essential for combustion	Knowledge	37	27	22
Topic: Nature and effects of forces		66	64	77
Describe pushing and pulling (repulsion and attraction)	[redacted]	71	66	79
Classify forces in contact and non-contact forces	Application	63	62	33
State that forces are measured in newtons	Knowledge	67	66	89
Topic: Weight and mass		61	63	80
Explain the difference between weight and mass	[redacted]	61	63	80
Topic: Energy in everyday examples		65	72	84
Describe energy as the ability to do work	[redacted]	65	72	84
Topic: Sources of energy		39	35	46
List the most important energy sources for Namibia	[redacted]	37	38	56

NSAT